RIO CONNECTION:

Jackson Focus on Mathematics and Science Teaching

YEAR TWO EVALUATION

OHIO UNIVERSITY

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Prepared By The Voinovich School of Leadership and Public Affairs

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EXECUTIVE SUMMARY

This Executive Summary addresses Ohio University's Voinovich School of Leadership and Public Affairs' Year 2 evaluation findings on the Rio Connection: Jackson Focus on Mathematics and Science Teaching project. The project is a three-year Math-Science Partnership among the University of Rio Grande (URG), The Gallia Vinton Educational Service Center (GV-ESC) and Jackson City School District (JCSD). The purpose of the partnership is to connect K-12 teachers with mathematics and science faculty at nearby colleges and universities in order to facilitate ongoing, high-quality professional development in the mathematics and science content areas required by Ohio's Academic Core Curriculum. Collaborating with faculty at URG and the Gallia-Vinton ESC and utilizing a coaching professional development model, Jackson City School District mathematics teachers in grades 3-8 were provided an average of 65 hours of professional development and individual coaching in probability and statistics and review of Ohio's new Core Curriculum during the second year of the project. Additionally, science teachers were provided with four day-long sessions on physical science, and review of Ohio's new Core Curriculum. Lastly, mathematics teachers also had contact with coaches in grade- and/or subject-level teams as well as contact during the professional development sessions.

The evaluation of Year 2 of the project finds:

- Science teachers in grades 3-8 showed a statistically significant increase in physical science content knowledge after one year of targeted professional development in physical science. Further, a number of the teachers' scores increased substantially from pre- to posttest.

- Mathematics teachers in grades 3-8 showed a statistically significant increase in content knowledge from pre- to posttest. There is no significant difference in mathematics content knowledge between JCSD and comparison district teachers.

- Fourth grade students in the JCSD showed significantly greater gains in science content knowledge from pre- to posttest than students in a similar district. Fifth grade students in the JCSD showed significantly greater gains in mathematics content knowledge from pre-to posttest than students in a similar district. There were no significant gains in sixth grade mathematics or in seventh grade science content knowledge from pre- to posttest as compared to students in a similar district. However, JCSD students had

higher scores at both pre- and post-test in both sixth grade mathematics and seventh grade science than students in the comparison district.

- Overall, the science teachers (elementary and middle school levels) who participated in Year 2 of the project were pleased with the professional development. They believe their content knowledge has improved and perceive themselves as more prepared to deliver science content and improve student achievement in science.

- Mathematics teachers were less satisfied with the professional development. They provided average ratings in regards to content knowledge gains and appropriateness of the professional development. Elementary teachers were slightly more positive about the professional development than were middle school teachers.

- There is evidence of change in teacher instructional practices among science teachers and to some degree mathematics teachers who received the professional development. Teachers reported using more hands-on and inquiry-based activities and confidence in conducting the experiments in class that were demonstrated during the professional development sessions.

Recommendations for Year 3 and beyond include:

- Ensure that the professional development workshops meet the needs of teachers at both the elementary and middle school levels by targeting content and activities based on grade bands.

- As in Year 2, university faculty should continue to lead the professional development workshops and participate in follow-up activities throughout the academic year as much as possible. This direct collaboration between 3-8 teachers and faculty improved the project in Year 2 and has the potential to lead to longer-term collaborations between public school teachers and university faculty located in the same region.

Rio Connection: Jackson Focus on Mathematics and Science Teaching

YEAR 2 EVALUATION

Introduction

As part of 2001 reauthorization of the Elementary and Secondary Education Act, the U.S. Department of Education created the Mathematics and Science Partnership (MSP) program with the stated goal of increasing the academic achievement of students in mathematics and science by enhancing the content knowledge and teaching skills of classroom teachers (U.S. Department of Education, 2010). The Ohio Department of Education administers the Ohio program. The program requires partnerships between high-need school districts and the Science, Technology, Engineering and Mathematics (STEM) faculty in institutions of higher education. The intent of the partnership requirement is to link K-12 teachers with mathematics and science faculty at nearby colleges and universities in order to facilitate ongoing, high-quality professional development in the mathematics and science content areas required by Ohio's Academic Core Curriculum.

In the winter of 2010, in preparation to apply for a MSP grant from the Ohio Department of Education, the University of Rio Grande and the Gallia-Vinton Educational Service Center (ESC) collaborated with the Jackson City School District (JCSD) to conduct a teacher needs assessment focused on the professional development needs of science and mathematics teachers in grades 3 through 8. In the spring of 2010, they convened a planning team made up of JCSD teachers, administrators, and representatives from the University of Rio Grande and the Gallia-Vinton ESC. The planning team developed a proposal for a MSP project that would provide targeted, content-focused professional development for Jackson City School District science and mathematics teachers in grades 3-8. As a result of the successful planning efforts, the collaborative received a Math-Science Partnership grant from the Ohio Department of Education, with the Gallia-Vinton ESC to serve as the fiscal agent and Dr. Jacob White from the University of Rio Grande to serve as the principal investigator. The project planners developed the mission and vision of the Rio Connection: Jackson Focus on Mathematics and Science Teaching MSP project as:

> *to increase teacher content knowledge and student achievement by providing relative, rigorous, and continuing professional development opportunities to teachers of science and mathematics using an academic coaching model.*

The five identified outcomes, as submitted to the Ohio Department of Education are as follows:

- There will be a statistically significant increase in teacher content knowledge in mathematics and physical science from pre- to posttesting and participating mathematics teachers' posttest scores will be significantly higher than a similar group of teachers in a similar district who are not participating in the program.
- Students of participating teachers will show a significantly greater increase in physical science and mathematics content knowledge as compared to a similar group of students, in a similar district whose teachers did not participate.
- Economically disadvantaged students of participating teachers will show significantly greater gains in physical science and mathematics content knowledge as compared to similar students in the comparison district.
- Science teachers will perceive themselves as more prepared to deliver science and mathematics content/improve student achievement.
- The project, including the high-quality, targeted professional development based on identified needs, will be sustained beyond the life of the grant.

This report evaluates the project's progress toward these five goals and provides an evaluation of Year 2 implementation and outcomes.

Project Description

The implementation plan for Year 2 included professional development for mathematics and science teachers in grades 3-8 with a focus on probability and statistics and physical science (2011-2012). In the fall and winter of 2011/2012, Jackson City School Districts' grades 3-8 mathematics teachers were provided eight day-long mathematics professional development sessions which were held at Jackson High School. In the winter of 2012, Jackson City School Districts' grades 3-8 science teachers were provided eight day-long mathematics professional development sessions which were held at Jackson High School. Tables 1 and 2 list the topics covered during the day-long professional development sessions.

Table 1. Physical Science Teacher Professional Development Sessions
(Each sessions was presented twice to accommodate all teachers)

Day 1 (Dec. 8th & 9th)	Day 2 (Jan 20th & 27th)	Day 3 (Feb 10th & 17th)	Day 4 (Mar 2th & 9th)
✓ *Overview of* Common Core Standards *and "Big Ideas" in Physical Science* ✓ *The Particle Model and Classifications of Matter*	✓ *Physical States and Physical Changes of Matter* ✓ *Chemical Changes of Matter*	✓ *Heat, Temperature, and the Particle Model* ✓ *Density and the Particle Model*	✓ *Properties of Light and Interactions with Matter* ✓ *Group Discussion/Assessment Activities*

Table 2. Mathematics Teacher Professional Development Session
(Each session was presented twice to accommodate all teachers)

Day 1 (Sept 13th & 14th)	Day 2 (Sept 27th & 28th)	Day 3 (Oct 11th & 12th)	Day 4 (Oct 25th & 26th)
✓ *Common Core Standards*	✓ *Statistics* ✓ *Measurement Errors and Random Sampling*	✓ *Data Organization and Representation*	✓ *Describing Distributions and Statistics in Everyday Life*
Day 4 (Nov 1st & 2nd)	**Day 5 (Nov 13th & 14th)**	**Day 7 (Dec 6th & 7th)**	**Day 8 (Jan 10th & 11th)**
✓ *Number Summary*	✓ *Variation About the Mean*	✓ *Probability*	✓ *Random Sampling and Estimation*

In addition to day-long professional development sessions, five mathematics coaches were engaged. During Year 2, science teachers did not receive coaching. The role of the coaches is to offer professional support to the teachers. Four of the coaches were assigned to groups of teachers in the various buildings while the fifth had the primary task of planning, organizing, and hosting science nights at each of the three elementary schools and the middle school. The coaches assigned to the buildings assisted with the design of workshop days that integrated modeling activities and experiments, science content lessons, instructional practices, and assessment strategies that align with Ohio Science Core Curriculum and that meet the specific needs of the district. They also worked one-on-one and on-site with the participating teachers during the academic year, providing additional professional development contact hours with each participating teacher via individual coaching sessions. As laid out by the project, responsibilities of a science coach include:

- Work with teachers to analyze areas of need
- Provide regular one-on-one and collective support to teachers
- Assist in improving the abilities of participating teachers
- Offer activities that help the teachers improve their ability to teach
- Provide resources to teachers (expertise, materials, etc.) and gather professional information to support them
- Offer feedback about classroom observations
- Model lessons and activities in a classroom setting allowing the teacher to observe
- Ensure that teaching adheres to district and state standards

Year 2 Evaluation Overview

Ohio University's Voinovich School of Leadership and Public Affairs serves as the external evaluator for the project. This report focuses on implementation and outcome evaluation findings for the second year of the project. In addition to this report, throughout the year, the evaluators provided the Primary Investigator, Mr. Jacob White, Ph. D., with summaries of various evaluation activities, including teacher survey results and teacher group interview findings. The ongoing feedback from the evaluation activities facilitated continuous improvement throughout the first year of implementation.

Methodology

During the second year, the evaluators used a variety of methods to assess implementation and outcomes of the project including:

- Selection of a similar, comparison district that is not participating in targeted professional development in mathematics and science and that agreed to allow evaluators to assess teachers in mathematics content and students in mathematics and science content. The comparison district was identified via propensity score matching based on district-level demographic indicators including socioeconomic status and average daily membership;
- Analysis of pre- and posttests of participating JCSD teachers' mathematics and physical science content knowledge, and comparison of JCSD mathematics teacher content knowledge to teachers in a similar, comparison district;
- Analysis of pre- and posttests assessing physical science content knowledge of students in grades 4 and 7 in the JCSD, and comparison to pre- and posttests of students in the same grades in the comparison district;
- Analysis of pre- and posttests assessing mathematics content knowledge of students in grades 5 and 6 in the JCSD, and comparison to pre- and posttests of students in the same grades in the comparison district;
- Analysis of teacher professional development satisfaction and preparedness surveys;
- Analysis of participating teachers' group interview responses;
- Review of documents such as attendance sheets from all professional development sessions and corresponding agendas;
- Summary of administrator interview responses;
- Observation of selected professional development sessions;
- Document review of coaching logs;
- Classroom observations of selected teachers with the Reformed Teaching Observation Protocol (RTOP);
- Observation of partnership meetings;
- Online survey results from participating teachers during Year 2;

Outcome Evaluation Findings

Evaluation Question 1: Does the professional development lead to a statistically-significant increase in teacher content knowledge in mathematics from pre- to posttesting, and as compared to a similar group of teachers in a similar district who are not participating in the program?

Teacher Mathematics Content Knowledge

The mathematics teachers in the JCSD and comparison district essentially took two mathematics content knowledge tests. One was developed by the evaluators from items selected from the National Assessment of Educational Progress (NAEP) for Mathematics and the Trends in International Mathematics and Science Study (TIMSS). The second mathematics test was comprised of six questions selected from the Learning Mathematics for Teaching assessment (Regents of the University of Michigan, 2007). The scores from the two instruments are analyzed separately.

The JCSD teachers' pre- to posttests were developed by the evaluators. When all of the JCSD teachers' scores are compared there is no significant difference in scores from pre- to posttest but, when the three teachers whose scores were 100 percent on the pre-test are removed from the analysis, there is a significant difference ($t(21)=2.143$, $p<.05$) from pre- to posttest. Removal of the three cases of capped scores is justified because the ceiling effect would otherwise suppress the amount of gain.

Table 3: Jackson Mathematics Teachers' Pre- and Posttest Mean Scores on Assessments

Test	n	Pretest *M (SD)*	Posttest *M (SD)*
Mathematics Assessment (17 possible points)	22	12.9 *(2.98)*	13.6 *(2.63)*

In addition to analyzing the data for statistical significance, or the likelihood that the difference in means from pre-test to posttest was by chance, it is valuable in applied research to know the magnitude of the difference from pre-test to posttest as well as between the treatment and comparison groups. Statistical significance, while important, does not give a complete picture of the relationship between the treatment and the outcomes. A very small difference in practical terms can be statistically significant if the groups are large enough; conversely, a difference that may be considered important in practical terms may not be statistically significant because of sample size issues, the reliability of the test, or other confounding

factors. The effect size statistic η^2 (eta squared) is one of several statistics that can be used for measuring how much or what proportion of the outcome can be attributed to the treatment or intervention. For the Jackson teachers' mathematics gains from pre- to posttest, there was a large effect ($\eta^2 = .18$), indicating a large change in test scores from pre-test to posttest.

Teachers in the same grade bands in the comparison district were administered the same posttest as the JCSD teachers. A posttest only design was deemed appropriate for the comparison district, as those teachers were not receiving professional development focused on science content, so relative stability in the science content knowledge from fall to spring for the group as a whole can be assumed.

As noted above, at posttest the JCSD and the comparison district mathematics teachers also completed a second instrument comprised of selected items from the Learning Mathematics for Teaching instrument that was designed to assess competencies on real mathematics tasks teachers face in the classroom(Regents of the University of Michigan, 2007). This assessment was developed by the University of Michigan for the National Science Foundation's Math-Science Partnership program. When the posttest scores from this test are compared, we see no significant difference between the JCSD teachers and the comparison district teachers though the JCSD teachers' averaged scores are slightly higher (Table 4). There was a small effect ($\eta^2 = .008$), indicating a very small difference between JCSD and comparison district teachers' posttests.

Table 4: Jackson and Comparison District Teachers' Pre- and Posttest Mean Scores on *Learning Mathematics for Teaching* Items

	n	Posttest *M (SD)*
Jackson Teachers	27	5.3 *(1.86)*
Comparison District Teachers	25	4.96 *(1.93)*

(10 possible points)

Evaluation Question 2: Does the professional development lead to a statistically significant increase in teacher content knowledge in physical science from pre- to posttesting?

Teacher Science Content Knowledge

All participating science teachers in the JCSD were administered a pre- and posttest of physical science content knowledge. The pretest was administered at the beginning of the first professional development workshop, and the posttest was administered at the end of the academic year.

The instrument chosen for the teacher science content knowledge assessment was the MOSART or Misconceptions-Oriented Standards-Based Assessment Resources for Teachers Physical Science (President and Fellows of Harvard College, 2011). The MOSART tests were developed by researchers in the Science Education Department of the Harvard-Smithsonian Center for Astrophysics. They were developed specifically for National Science Foundation-funded Math-Science Partnership projects, field tested, and made publicly available.

The analysis of science teachers, grades 3-8, participating in the professional development, shows a statistically significant ($t(17)=-2.361$, $p<.03$) increase in JCSD teacher content knowledge from pre- to posttest in physical science (Table 5). There was a large effect ($\eta^2 = .25$), indicating a large difference between pre- and posttest scores.

Table 5. Jackson Science Teachers Physical Science Pre- to Posttest Scores

	n	Pre-test *M (SD)*	n	Posttest *M (SD)*
(out of 20 possible points)	18	11.22 *(3.51)*	18	12.33 *(3.12)*

Evaluation Question 3: Do students of participating teachers show a significantly greater increase in physical science and mathematics achievement and scientific inquiry skills development as compared to a similar group of students, in a similar district whose teachers did not participate?

Information about the project and the testing was sent home with fourth, fifth, sixth, and seventh grade students in both JCS and the comparison district, and parents/guardians were given the opportunity to decline their son or daughter's participation in the test. Test packets for each student were prepared according to project protocols approved by Ohio University's Office of Research. Science and mathematics teachers in both districts received individual test packets with student names printed on an envelope that contained a test form with only the student ID number printed on it. The student information was supplied to Ohio University by the EMIS coordinators in both districts and stored on a secure server. Once the teachers administered the test, the teachers collected and returned the tests without the envelopes in order to ensure confidentiality of test results. The test results were entered into a database using only the student's ID number as an identifier. The ID number was necessary in order to link an individual student's pre- and posttest as well as to identify economically disadvantaged students.

Student Science Content Knowledge

Fourth and seventh grade science students in JCSD and the comparison district were administered a pre- and posttest of science content knowledge in physical science. For the fourth grade students, the evaluators utilized a content test comprised of physical science items (20 total items) from previous Ohio Achievement Assessments, released items from the National Assessment of Educational Progress (NAEP), and the Trends in International Mathematics and Science (TIMMS). For the seventh grade students, the evaluators used the MOSART or Misconceptions-Oriented Standards-Based Assessment Resources for Teachers (President and Fellows of Harvard College, 2011) Physical Science.

A total of 241 fourth grade science students completed both pre- and posttests of physical science content knowledge during Year 2 of the project. This includes 141 students across the three JCSD elementary buildings and 100 students, all housed in one elementary building, in the comparison district.

Both the JCSD fourth graders and the comparison district fourth graders made gains in science from pre- to posttest (Table 6). The JCSD fourth graders overall showed a statistically significant ($p<.005$, $t(239)=3.838$) greater gain from pre- to posttesting than the comparison group. The effect size was moderate ($\eta^2 = .06$).

Table 6: Jackson and Comparison School District Fourth Grade Students' Pre- and Posttest Mean Scores on Science Assessments

Group	n	Pretest *M (SD)*	Posttest *M (SD)*
Jackson	141	10.72 *(2.46)*	15.95 *(3.12)*
Comparison	100	10.63 *(2.60)*	14.43 *(3.64)*

Seventh grade students in Jackson City and the comparison school district completed a physical science pre- and posttest. A total of 218 seventh graders completed the pre- and posttests, including 142 from JCSD and 76 from the comparison district. There were no significant differences for Jackson City or comparison district seventh graders' pre- to posttest scores and no significant difference between the two groups' in regards to gain scores. It is also important to note that teachers report that physical science has not been emphasized in the seventh grade standards though this is changing in the current year. Additionally, seventh grade students in JCSD received physical science prior to the teacher's participation in the professional development. Therefore, the students had not received the benefit of the teacher's participation in the professional development.

Student Mathematics Content Knowledge

To assess the impact of the professional development on student mathematics content knowledge, both fifth and sixth grade student groups were assessed using instruments developed by the evaluators from released items from the National Assessment of Educational Progress (NAEP), and the Trends in International Mathematics and Science (TIMMS).

First the fifth grade students' results are discussed. In all, 204 fifth graders including 131 from JCSD and 73 from the comparison district, completed the pre- and posttest (Table 7). Paired samples t-tests were conducted to compare the differences in students' pre- and post-content knowledge test scores for mathematics. The JCSD fifth graders had a statistically significant ($p<.0005$, $t(130)=-6.823$) gain and the comparison district fifth graders did not show statistically significant gains. There was a large effect for the JCSD fifth grade scores ($\eta^2 = .26$), indicating a relatively large difference in test scores from pre- to posttesting.

Table 7: Jackson and Comparison District Fifth Grade Pre- and Posttest Mean Scores on Mathematics Assessments

Group	n	Pretest *M (SD)*	Posttest *M (SD)*
Jackson	131	15.09 *(3.21)*	16.625 *(2.96)*
Comparison	73	14.86 *(3.34)*	15.26 *(3.39)*

An independent-samples t-test was conducted to compare the Jackson City and comparison district gain scores on mathematics pre- to posttests. There was a significant difference between Jackson students' (M = 1.5, SD = 2.6) and comparison district students' (M = 0.40, SD = 2.8), gain scores ($p<.005$, $t(202)=2.9$). There was a small effect ($\eta^2 = .04$), indicating a small difference in gain scores.

Sixth grade students also made gains in mathematics. Paired samples t-tests were conducted to compare the differences from pre- and post-content knowledge test scores in mathematics for both the JCSD and comparison district sixth graders (Table 8). Both groups of sixth graders (Jackson City and comparison school district) made statistically significant (JCSD = $p<.0005$, $t(176)=-5.894$) (comparison = $p<.0005$, $t(68)=-5.741$) gains from pre- to posttest.

Table 8: Jackson and Comparison School District Sixth Grade Pre- and Posttest Mean Scores on Mathematics Assessments

Group	n	Pretest *M (SD)*	Posttest *M (SD)*
Jackson	177	12.49 *(3.967)*	13.76 *(4.329)*
Comparison	69	11.67 *(3.571)*	13.62 *(4.131)*

An independent-samples t-test was also conducted to compare the Jackson City and comparison district gain scores on mathematics pre- and posttests. There was a slight difference in mean gain for the JCSD (M = 1.271, SD = 2.869) and comparison district (M = 1.957, SD = 2.83), but it was not statistically significant. There was a small effect ($\eta^2 = .012$), indicating a small difference in gain scores.

Evaluation Question 4: Do economically disadvantaged students of participating teachers also show significantly greater gains in physical science and mathematics knowledge as compared to similar students in the comparison district?

Economically Disadvantaged Student Science Content Knowledge

Another objective of the Rio Connections project is to increase the science content knowledge of economically disadvantaged students. Evaluators isolated the test results of economically disadvantaged students for this portion of the analysis. Economically disadvantaged status of the comparison district students was not obtained for Year 2, so the analysis instead focuses on JCSD economically disadvantaged students' pre- to posttest gains. A paired sample t-test was conducted to compare the differences in JCSD fourth grade students who are economically disadvantaged, pre- and post-content knowledge test scores for science. There was an increase in the test scores from pre-test (M=10.97, SD=2.251, N=59) to post-test (M=15.93, SD=3.253, N=59) and it was statistically significant (p<.0005, t(58)=-12.549). There was a large effect ($\eta^2 = .73$) indicating a large difference in test scores obtained before and after the intervention. As was evident with the entire group of seventh graders, economically disadvantaged seventh graders did not make statistically significant gains from pre- to posttest.

Economically Disadvantaged Student Mathematics Content Knowledge

A paired sample t-test was also conducted to compare the differences in fifth grade JCSD students who are economically disadvantaged pre- and post-content knowledge test scores for mathematics. There was an increase in the test scores from pre-test (M=14.62, SD=3.021, N=53) to post-test (M=16.23, SD=2.913, N=53) and it was statistically significant (p<.0005, t(52)=-4.095). There was a large effect ($\eta^2 = .24$) indicating there was a large difference in test scores obtained before and after the intervention.

A paired sample t-test was conducted to compare the differences in JCSD sixth grade students who are economically disadvantaged pre- and post-content knowledge test scores for mathematics. There was an increase in the test scores from pre-test (M=11.32, SD=3.872, N=76) to posttest (M=12.62, SD=4.069, N=76) and it was significant (p<.0005, t(75)=-3.605). There was a large effect ($\eta^2 = .20$) indicating there was a large difference in test scores obtained before and after the intervention.

After-School Mathematics and Science Nights

The district also provided after school mathematics/science nights at each elementary and the middle school. Once the event concluded, parents and family members were asked to complete a satisfactory survey for the event. The surveys were utilized to assess the relevance and usefulness of the event to see if the parents saw their children benefiting and learning from these demonstrations.

Seventy satisfaction surveys were completed assessing the effectiveness of the *Family Fun Math/Science Nights*. Of the 70 completed, 31 were received from the Jackson Middle School's event, 20 were received from the Southview Elementary School's event, 6 were received from the Northview Elementary School's event, and 13 were received from the Westview Elementary School's event. The survey itself included two rating scale questions, one yes or no response, and three open-ended questions.

The overall ratings and reviews of the *Family Fun Nights* were very positive across the board. Question number one asked respondents to rate the event as a learning experience for the child/children on a scale of 1 to 10. Among all four schools, the average response was 9.4. Question two provided an opportunity to rate the event overall using the same 1 to 10 scale and received an average rating of 9.5. Additionally, 62 of the 70 respondents indicated they too learned something by attending the event. Lastly, parents also provided comments on what they liked best about the mathematics/science nights and here are a few examples of their comments:

> *"I thought he was very good with the kids, he got their attention and kept it during the whole show. I loved his sense of humor and his outfit was great, too. This was fun, learning and math!!"*
> *"Kids enjoyed it, kept their attention and lots of fun with math."*
> *"The event was a fun way to incorporate math"*
> *"Child interaction, the ability of the host to keep the attention of the kids"*
> *"I liked that family was invited, and that it was humorous"*
> *"Kids learning and laughing"*
> *"Max and using magic and enthusiasm to teach math concepts"*

Evaluation Question 5: Do science and mathematics teachers who participate in the professional development perceive themselves as more prepared to deliver science and mathematics content/improve student achievement in science and mathematics?

Teacher Perception of Preparedness

Teacher surveys, group, and individual interviews are the data sources used to address this evaluation question. Many science and mathematics teachers who participated in the professional development found improvement in their abilities to deliver a positive teaching experience. The following points are drawn from the evaluation data sources:

- Participants overall found value in the collaboration with teachers from other buildings and grade levels.
- The teachers felt that their absence from the classroom for the professional development was unfavorable.
- Responses from discussion groups indicate that even if they did not use the material in the classroom at the time of the discussion, teachers did learn new science content which improved their overall understanding of concepts.
- The mathematics teachers agree that there are areas besides probability and statistics that they need extra help with.
- Teachers appreciate that the content presented was connected with what the students would need to know in later grades and the changing common core standards.
- All science teachers agree that the material they received for the classroom will be useful and that their physical science content knowledge increased.
- Teachers were able to learn not only content, but also teaching styles from the STEM faculty which better prepares them to teach in the field.

Evaluation Question 6: Does the professional development include methods/approaches for incorporating the awareness of the new standards and model curriculum?

Inclusion of New Standards in the Professional Development

Evaluators observed professional development sessions during which the new standards and model curriculum were covered. The sessions included teachers working in small groups by grade level to determine which standards were changing or being transferred to a different grade level and which standards were remaining at the same grade level. The format allowed teachers to thoroughly examine the existing and new standards for their current grade level.

Based upon survey and group discussion responses, the science teachers' knowledge of the new science content standard increased substantially. Among 24 teachers, the average response to this question was a 6.5 on a one to seven scale with seven being the highest possible score. All science teachers selected a five or higher. They also spoke positively about

this component during discussion groups held at the end of the day-long professional development sessions. In the focus groups, science teachers agreed that the session was "enlightening" and covered the new science content standards thoroughly. They indicated they have a better idea of what they need to do to prepare for the new standards and understand that they will need to change teaching practices now so that students will have the background they need. One teacher commented that the needs of middle and elementary teachers were better met this year than last, and another teacher said that Dr. White did a good job of picking the bands that run through all grade levels and explaining how they are used in all grades.

Responses from the mathematics teachers were somewhat less positive in regards to how much they thought their knowledge of the new core curriculum had increased. Among 34 teachers, the average response to this question was a 4.4 on a one to seven scale with seven being the highest possible score. Elementary teachers have a slightly higher average response (4.7) than do middle school teachers (3.8).

In one of the two mathematics teacher focus groups, participants reported that they only covered core curriculum during the first session and only for about an hour and a half. They noted that they got on a computer and looked on their own. They agree that spending more time on the core curriculum and looking at the standards more specifically would have been beneficial. Mathematics teachers from the other focus group noted that it was somewhat helpful in some areas but that the emphasis was on probability and statistics as opposed to areas they need more help with, like measurement. Some teachers did report that it was useful to see what standards were being eliminated and introduced as well as to see the changes at each grade level. Overall, input suggests that the mathematics teachers would have benefitted from more coverage of the new core curriculum.

Evaluation Question 7: Is the project, including the high-quality, targeted professional development based on identified needs, sustainable beyond the life of the grant?

Sustainability

During telephone interviews in fall 2012, evaluators asked three of the four JCSD building administrators their views on the sustainability of the project beyond the grant period. The administrators interviewed were from two elementary schools and the middle school. The third elementary building had a change in administration in the summer of 2012 so the new administrator was not interviewed. All three administrators interviewed were optimistic that the district commitment to science instruction would be sustained beyond the grant period. One administrator cited as a specific example of longer-term sustainability the current discussion and planning for dedicated time specific to science instruction in grades 1 and 2 across the district. Until now, science content has been delivered through the language arts curriculum in grades 1 and 2. One administrator noted that the delivery of any future

professional development may need to occur when school is not in session in order to avoid teachers being out of the classroom for multiple days during the year. Teachers would need to be compensated, but substitute teachers would not need to be hired to cover classes.

The building administrators interviewed were asked to respond to three items adapted from Mancini and Marek's Program Sustainability Index (Mancini & Marek, 2004). All three administrators provided affirmative responses to the items (Table 9).

Table 9: JCSD Building Administrator Responses to Sustainability Questions

	Not at All	Somewhat	Very Much
There is a shared vision among all of the collaborators	0	1	2
Leaders in the district and buildings are committed to long-term project goals	0	0	3
Teachers who participated in the project are committed to long-term project goals	0	1	2

*Items adapted from Mancini & Marek, 2004

The Principal Investigator organized a meeting with JCSD district- and building level administrators to discuss the sustainability of the project. The meeting was held on November 14, 2011 at the district office. Participants included five JCSD administrators, three JCSD science teachers, representatives from the partner organizations (URG and Gallia-Vinton ESC), the local evaluator and a statewide evaluator. JCSD personnel and partners discussed existing factors that may support or impede sustainability. Those factors supporting sustainability included a clear commitment on the part of JCSD district- and building-level administrators, elementary and middle school teachers requesting cross-grade collaboration time to plan science instruction, and a successful collaboration with URG. Factors that may impede sustainability included shrinking resources at the district level (have lost 17 teaching positions at the elementary level in previous two years) and the difficulty of finding quality science teachers when positions open. Some suggestions from the group for future work that could sustain the partnership, the high-quality professional development, and the district focus on science included structuring department meetings across grade levels in science (including across buildings throughout the district using web conferencing), periodic online, interactive lectures from STEM faculty at URG in order maintain teacher enthusiasm with additional material and ideas, and seeking additional financial support through existing projects such as the after-school program.

Implementation Evaluation Findings

Evaluation Question 8: Is the project able to maintain teacher participation in planned science and mathematics professional development sessions?

Teacher Participation

There were two groups of science teachers who participated in four days of professional development, with each session offered twice in order to accommodate all teachers' schedules. Throughout the four-day professional development process, science teacher participants were required to sign in at the beginning of each day of professional development activities. Overall, science teacher participation was very high. While the sign-in sheets for day one of the process were not returned to the evaluation team, an assessment of the sign-in sheets for days two through four can be done. The participants were separated into group "A" (n=12) and group "B" (n=14) with a total number of 26 science teachers participating in the professional development. The teachers ranged in specialization, and many identified as teaching third, fourth, fifth, special needs or science. For group "A", all participants attended the development days two through four. Similarly, group "B" had a steadily high rate of attendance with 14 attendees for days two and four and 13 attendees on day 3. Attendance sheets were not available for the first professional development day but most teachers attended.

There were also two groups of mathematics teachers who participated in eight days of professional development, with each of the eight days offered twice in order to accommodate all teachers' schedules. Throughout the eight-day professional development process, mathematics teacher participants were required to sign in at the beginning of each day. Overall, mathematics teacher participation was very high. All sign-in sheets for the mathematics professional development meetings were returned to the evaluation team. The participants were separated into group "A" (n=18) and group "B" (n=18) with a total of 36 mathematics teachers participating in the professional development. The teachers ranged in specialization, and many identified as teaching third, fourth, fifth, sixth, seventh, eighth or special needs. For group "A", all participants attended all of the professional development activities. Similarly, group "B" had a steadily high rate of attendance with an average of 17 attendees out of 18 participating each day.

Evaluation Question 9: How are the STEM faculty engaged in the project and what are teacher perceptions of STEM faculty involvement?

STEM Faculty Engagement

Professional development observations, teacher group discussions, and surveys are the data sources used to address this evaluation question. The STEM faculty members engaged teachers

in the development of their professional teaching methods as well as in their content knowledge of mathematics and science. For the science component, the STEM faculty member was the primary professional development facilitator. For the mathematics component, the STEM faculty member provided specific content lectures, while a coach served as the primary facilitator.

Many of the teachers who participated in the professional development activities found the STEM faculty members to be extremely helpful and knowledgeable. On one survey, teachers were asked to write in what they liked best about the professional development. Eight of the 24 respondents of that survey offered praise for the instructor. Throughout the survey and interviews, it was revealed that teachers were able to learn about content and teaching styles from the STEM faculty members. Additionally, it was found that many teachers gained a more holistic understanding of teaching in the STEM fields. Some commented that the instructors helped to explain the bigger picture of how scientific concepts fit together and how they are taught to students over the duration of their time in elementary and middle school. Teachers commented that this new understanding of what comes before and after their grade, in terms of the progression of the teaching of scientific and mathematic concepts, is an essential aspect that has improved their understanding of teaching methods.

Evaluation Question 10: How are the coaches engaged in the project and what are teacher perceptions of coach involvement?

Science Coach Engagement

Group discussion responses from teachers, interviews with coaches and building administrators, and review of coaching logs that document coaching activities are the sources used to address this evaluation question. During this second year of the JCSD professional development project, the mathematics teachers received coaching, whereas the science teachers did not. Within the professional development process, the coaches aided in essential growth aspects of the program. The coaches served as general resource and support persons, providing teaching materials and professional development with an emphasis on the increase of hands-on activities in the classroom. Teachers were able to have access to ongoing teaching resources through the help of the coaches.

The coaches also observed the effectiveness of teachers' implementation of newly learned content or strategies in the classroom. Many coaches noted that the level of hands-on activities and their content knowledge improved greatly. The coaches also assessed the needs of the teachers on a wider scale. One coach developed an innovative idea of implementing an improved intra-district communication system among all participating teachers to facilitate resource sharing. Additionally, coaches helped to improve inquiry-based content levels, which has in turn increased the amount of student inquiry. Many teachers found the coaches to be an

asset to their professional development. However, some issues that arose for the coaches included the ability of the coaches to gain teacher trust and support in the program. Some coaches noted that this was a difficult aspect of the project and that there needed to be more time to develop the coach-teacher relationship. Some teachers commented that the role of the coaches in the program needs to be more clearly defined.

All three building administrators who were interviewed spoke highly of the math coaches working in their buildings during Year 2 of the project. They commented that coaches had good ideas for instructional practices and supported teachers in implementing new practices. One administrator noted that, although the district had hired math coaches in previous years, the coaches provided through this project focused more on instructional practices and less on materials development and other supportive functions.

Evaluation Question 11: How well does the implemented teacher professional development match the teacher- and administrator- identified needs of the science and mathematics teachers?

Congruence of Professional Development with Identified Needs

During the needs assessment phase, the six administrators interviewed and surveyed (four building principals and two district-level administrators) agreed that increasing teachers' science content knowledge and use of hands-on, inquiry-based instructional practice was a critical need throughout the district, especially in grades 3-5. They also noted teachers have few materials for science and are less experienced and confident about hands-on, inquiry-based science instruction. Teachers also identified scientific inquiry as a need. They rated "Help students develop an understanding of…the abilities needed to do scientific inquiry" as a moderate or high priority more frequently than any other need among the potential needs listed. Additionally, in Year 1, teachers requested professional development that focused on physical and life sciences. Physical science as previously noted, was the focus of the professional development for science teachers during the 2011/2012 academic year and life science is the focus during the 2012/2013 academic year. The implemented professional development was very much in line with the administrator- and teacher-identified needs. This evaluation finds that the professional development clearly addressed teacher content knowledge in physical science, and mathematics.

Evaluation Question 12: What is the average number of professional development (including coaching) hours that participating science teachers receive?

Average Number of Professional Development Hours

In Year 2 of the project, only mathematics teachers received coaching. The coaches were asked to track their activities with the teachers in binders dubbed "coaching logs." Each of the

four mathematics coaches kept track of the activities they provided in their role as a coach. They coached 27 mathematics teachers, ranging from six to nine teachers assigned to each coach. A total of 108.2 crosscutting hours were logged by the coaches, ranging from 0.0 to 94.5 hours with an average of 27.1 hours. Only six teachers were not logged as benefitting from any crosscutting hours, but this was due to the fact that one of the coaching logs did not contain a crosscutting timesheet. The coaches also kept track of how many hours they spent coaching each teacher. Individually, an average of 16.9 hours was spent coaching each teacher, with a range from 1.0 to 73.2 hours and a total of 455.6 hours combined. The majority of time spent with each teacher consisted of instruction (323.8 hours total with an average of 14.1 hours per teacher) or content support (74.6 hours total with an average of 3.6 per teacher). Activities in the categories of preconference (23.7 hours total), feedback (20.5 hours total), and other (12.9 hours total) were not as prominent in the coaching logs.

Evaluation Question 13: Do teachers in all of the targeted grades perceive that the professional development was appropriately targeted to improve their content knowledge and instructional practice in science and mathematics?

Teacher Perceptions of Appropriateness of Science and Mathematics Professional Development

Surveys and focus groups were used to address this evaluation question. First the mathematics teachers responses are addressed. Mathematics teachers were asked to assess how much their overall content knowledge of probability and statistics increased as a result of their participation in this professional development. On a one to seven scale in which one stands for "Not at all" and seven stands for "Very much", the average combined response was 4.7. The average combined response to the question of how much science teachers believe their physical science content knowledge has increased was a 6.8 on the same scale. The responses regarding appropriateness of the professional development for their current needs as teachers varied. Mathematics teachers were less positive than science teachers, and elementary mathematics teachers were more positive about the appropriateness of the professional development than middle school mathematics teachers.

For mathematics teachers, the survey question that asked if the facilitators or presenters provided information that will be useful for the teachers' current grade levels showed a split response, with 17 indicating yes, 15 indicating no, and one teacher responding "not sure" (Table 10). Elementary teachers were nearly evenly split, with ten responding no and nine responding yes in regards to usefulness. Eight of the middle school teachers said yes, five said no, one wrote in "somewhat" and another chose "not sure." Further, the elementary mathematics teachers provided higher satisfaction survey ratings in regards to increased

knowledge in probability and statistics, increased knowledge of Core Curriculum, relevance of the material in instructional methods, and confidence in transferring their learning to the classroom.

There were also differences in responses between the two groups of mathematics teachers who participated in the professional development on different days: 13 mathematics teachers from one group and only 2 mathematics teachers from the second group said no to the question regarding useful information for their grade level.

Table 10: Overall Mathematics Teachers' Response to the Professional Development

Question	Response Scale							
	1 Not at all	2	3	4	5	6	7 Very	Average
Overall, how appropriate do you feel this professional development was for your current needs as a teacher?	2	8	8	1	8	6	1	3.8
Has the professional development increased your knowledge in probability/statistics?	2	2	2	8	6	12	2	4.7
How much has your knowledge increased in regards to the new Core Curriculum?	0	8	6	2	8	4	6	4.4
How confident are you in your ability to implement what you've learned in this series in the classroom?*	0	3	5	3	7	10	5	4.9
How relevant was the material in regards to instructional methods?	4	7	5	5	6	4	3	3.8
Have you incorporated pacing charts into your classroom?	31 (Yes)		1 (No)			2 (Not yet but intend to)		
Are you using comprehensive quarterly assessments?	34 (Yes)		0 (No)			0 (Not yet but intend to)		
Did the facilitators/presenters provide information that will be useful to you in teaching at your current grade level?**	17 (Yes)		15 (No)			1 (Not Sure)		
*One teacher did not respond to this question.								
**One teacher wrote in "somewhat."								

Additional discussion and survey responses from mathematics teachers include:

- Participants overall liked the time that they had to collaborate with teachers from other buildings and grade levels.
- The teachers do not like taking eight full days away from their students.
- Responses from focus groups indicate that even if they did not use the material in the classroom at the time of the discussion, teachers did learn new math content.

- Teachers agree that there are areas besides probability and statistics with which they need extra help.
- Most teachers felt that Dr. Rhodes was helpful and provided answers to their questions.

Science teachers weighed in on the professional development experience as well. The majority of participants, 19 of 24, gave the highest possible response to the survey question of whether the professional development was appropriate for their current needs as teachers (Table 11).

The following table shows how teachers responded to each question, and the average response to each. There were 24 total respondents, with 16 elementary school teachers and 8 middle school teachers. The next paragraphs will discuss these results along with input from teacher focus groups and write-in responses from the survey.

Table 11: Overall Science Teachers' Response to the Professional Development

Question	Response Scale							
	1 Not at all	2	3	4	5	6	7 Very	Average
Overall, how appropriate do you feel this professional development was for your current needs as a teacher?	1	0	0	0	2	2	19	6.5
Has the professional development increased your knowledge in physical science?	0	0	0	0	0	5	19	6.8
How much has your knowledge of the new science Core Curriculum increased?	0	0	0	0	2	7	15	6.5
How confident are you in your ability to implement what you've learned in this series in the classroom?	0	1	0	0	2	7	14	6.3
How relevant was the material in regards to instructional methods?	1	0	0	0	1	4	18	6.5
Have you incorporated pacing charts into your classroom?*	18 (Yes)		0 (No)			5 (Not yet but intend to)		
Are you using comprehensive quarterly assessments?	18 (Yes)		4 (No)			2 (Not yet but intend to)		
Did the facilitators/presenters provide information that will be useful to you in teaching at your current grade level?	24 (Yes)		0 (No)			0 (Not Sure)		
*One teacher wrote in "Don't teach science."								

Teachers liked that the content was connected to what the students would need to know later and what was coming up in the new science content standards. The professional development prepared teachers for what they will have to teach in the future. Teachers agreed that they received important and useful resources, as well as activities they could use in the classroom.

- Overall, responses from both elementary and middle school teachers about the professional development were very positive on the satisfaction survey as well as in the focus group responses.
- All teachers agree that the material they received for the classroom will be useful and that their physical science content knowledge increased.
- Teachers were able to learn not only content, but teaching styles from the STEM faculty.

The majority of the teachers (18 of 24) also gave the highest possible response to the survey question about the relevance of the material in regards to instructional methods. All teachers in the focus groups were in agreement that they have incorporated components they have learned from the professional development. Participants responded that they are now able to use more hands-on activities or go more in depth with the activities, that they do not have to spend as much time after school looking for activities, and that they have more confidence about doing the exercises and understanding where they fit in with the curriculum. One teacher discussed, and others concurred, that she was able to use Dr. White's teaching style of reviewing and asking students what they know before beginning the lessons. A teacher who does not teach science was able to incorporate this style into her classroom.

Teachers all agree that the material they received will be very useful in the classroom: "*The equipment we're able to take back is without a doubt a great help because a lot of it is beyond our capabilities to purchase and just anything we can take back and show the kids without just talking about it; 3D is always better than 2D."* Teachers were able to name many activities they have done in their rooms:

- Atoms and compounds activity
- Solid, liquid and gasses activity
- Sink or flow activity
- Density lab
- Conversion and mass exercises

The teachers in both science teacher discussion groups answered unanimously that their knowledge in physical science increased. Many teachers commented on the fact that it was a great review of college courses or an opportunity to understand subjects they never took in college. One teacher said, "*I've taught science for almost 20 years now, and physical science at this grade level, but yet I finally understood how all the radiant energy fit in…I really understood how it all fit together. Now I can explain it to my 12 year olds and they will get it.* Another said, "*It raised my content knowledge, and I thought I knew a lot about science. In certain areas, I had misconceptions so it increased my content knowledge, and I'm able to teach K-12 so it doesn't matter if I teach it right now or not because I will use it sometime.*

Evaluation Question 14: Is there a change in teacher instructional practices among science and mathematics teachers receiving the professional development?

Change in Teacher Instructional Practices

The data sources used to address this evaluation question include classroom observations (RTOP Protocol) of selected teachers, interviews with the observed teachers, administrator interviews, an online teacher survey, teacher satisfaction surveys and teacher group discussions.

When all of the data sources are considered, it appears that JCSD teachers have made changes in their instructional practices. There is more evidence of change among science teachers however, than among mathematics teachers. As noted above regarding the teacher discussions and survey, the science teachers report the information presented to them was useful, and they are confident that they can incorporate it into their classrooms. Mathematics teachers were less confident about the usefulness of what was presented.

Building administrators who were interviewed at the end of Year 2 indicated a change in teacher instructional practices as a result of the professional development and coaching components of the project. They indicated observing teachers using more hands-on, activity-based lessons and being more confident in the content.

Teacher observations and individual interviews also suggest changes particularly among the science teachers. The observations of science teachers revealed use of hands-on classroom experiments and inquiry. The science lessons included more questioning and guidance by the teachers, whereas, in general the math lessons included more solitary problem solving among the students. While the math students participated actively, their participation was mostly solitary except for small amounts of time or occasional instances. One of the math teachers used math rap, which the students were really eager to do and seemed to help them remember procedures or steps in solving math problems. Many of the observed math classes were doing review or practice for the Ohio Achievement Assessment (OAA). This was stated by most of the teachers. Additionally, there was substantial use of worksheets comprised of math problems, but the argument could be made that mathematics requires substantial practice of specific steps in problem solving.

The science students in one class did hands-on experiments the previous day and were reviewing what they learned during the current lesson. Another science class used hands-on materials to do experiments. The third science class completed poster projects and were discussing related material. Students used journals to articulate what they learned. There were many instances of the teachers asking such things as “What do you think will happen?” Thus, students often made predictions or estimations. Further, teachers sometimes asked for

alternative results by utilizing prompts such as, “Did anyone get a different answer?” The math lessons included fewer predictions, hypotheses and estimations as well as fewer means of representing phenomena.

Evaluators also asked each observed teacher a few questions about their teaching and the professional development they had received. A number of the science teachers stated that they are using the information gained from the professional development. After the observations, each teacher was asked a few questions regarding how much the professional development affected the lesson just observed. There is a clear difference between the mathematics and science teachers’ responses. Two of the science teachers indicated the professional development made a big difference in how they taught the observed lesson, while one reported it made a small difference. Two of the mathematics teachers noted the professional development made a moderate difference and two noted it made a small difference in how they taught the lesson observed.

Though not specific evidence of teacher change in instructional practices, self-reporting of teacher practices at a point in time are important to consider. An online survey was conducted querying teachers about how much time they spend on various activities in a typical week, perceptions of preparedness, importance of particular teaching strategies, and expertise. Although their responses provide additional insights, the response rate was very low among science teachers (N=5) and low among mathematics teachers (N= 10) (Tables 12 and 13). Thus, the responses are not necessarily reflective of the science and mathematics teachers across the district.

In general, the responses from mathematics and science teachers who completed the online questionnaire are positive. For example, among mathematics teachers, nearly all of the items that teachers rated (in terms of importance) received a “Fairly Important” or higher rating. Additionally, in regards to the frequency that teachers employ various activities during a given week, the item that got the average closest to “All or Almost All of the Time”, was *“Require students to supply evidence to support their claims.”* The average ratings about their perceived level of expertise on various items indicate that the respondents consider themselves “Intermediate to Advanced” in many areas including, *“Aligning instruction and assessment to Ohio’s standards.”* The item that in this section that had the lowest average rating was “*Presenting the content from the professional development.”*

The five science teachers’ responses to the online questionnaire indicate that they employ a variety of teaching strategies in a typical week. The item that averaged the highest or most frequent use was, *“Differentiate classroom instruction to meet students learning needs in science”,* which teachers indicated they do “Often.” Further, the science teachers feel “Fairly Well” prepared to do all of the activities presented. The item in this section that received the

highest average was *"Use informal questioning to assess student understanding."* Lastly, the science teachers also rated themselves on average as "Intermediate" to "Advanced" on level of expertise, including *"Aligning instruction and assessment to Ohio's standards."* The item in this section that received the lowest average rating was *"Understanding national standards for science", but still it was at the "Intermediate"* level.

Table: 12 Mathematics Teachers' Response to Spring 2012 Online MSP Survey *(N=10)*		
In a typical week, about how often do you do each of the following in your mathematics instruction?	Mean Response	*(SD)*
a. Pose open-ended questions in mathematics to access prior knowledge or to promote inquiry.	4.1	0.88
b. Require students to supply evidence to support their claims or explain their reasoning when giving an answer.	4.7	0.48
c. Engage the whole class in discussions based on the mathematics academic content standards.	4.2	1.03
d. Ask students to explain concepts to one another.	3.9	0.74
e. Use student written reflections to guide instruction.	3.2	1.03
f. Differentiate classroom instruction to meet students learning needs in mathematics.	4.3	0.82
g. Allow students to work at their own pace.	3.8	0.92
Response Scale: 1=Never; 2=Rarely; 3=Sometimes; 4=Often; 5=All or Almost All the Time; 99=NA		
Please rate each of the following in terms of its importance for mathematics instruction in the grades you teach.	Mean Response	*(SD)*
a. Provide students with concrete experience before abstract concepts.	3.9	0.32
b. Develop students' conceptual understanding of mathematics.	3.6	0.70
c. Take students' prior understanding into account when planning lessons.	3.6	0.70
d. Use appropriate modes to communicate mathematically in my instruction.	3.8	0.42
e. Have students work in cooperative learning groups.	2.9	0.74
f. Have students use appropriate educational technology (e.g. calculator, computers, Internet-based applets) to learn mathematics.	3.5	0.71
g. Use performance-based assessment.	3.4	0.52
h. Use informal questioning to assess student understanding.	3.6	0.52
i. Have students use feedback to revise their work.	3.5	0.71
Response Scale: 1=Not Important; 2=Somewhat Important; 3=Fairly Important; 4=Very Important		
Please indicate how prepared you feel to do each of the following for mathematics instruction in the grades you teach.	Mean Response	*(SD)*
a. Provide students with concrete experience before abstract concepts.	3.40	0.70
b. Develop students' conceptual understanding of mathematics.	3.50	0.71
c. Take students' prior understanding into account when planning lessons.	3.50	0.71
d. Use appropriate modes to communicate mathematically in my instruction.	3.30	0.67
e. Have students work in cooperative learning groups.	3.44	0.73
f. Have students use appropriate educational technology (e.g. calculator, computers, Internet-based applets) to learn mathematics.	3.40	0.70
g. Use performance-based assessment.	3.50	0.71
h. Use informal questioning to assess student understanding.	3.50	0.53
i. Have students use feedback to revise their work.	3.20	0.79
Response Scale: 1=Not Adequately Prepared; 2=Somewhat Prepared; 3=Fairly Well Prepared; 4=Very Well Prepared		
Which of the following best describes your level of expertise for each statement?	Mean Response	*(SD)*
a. Understanding the Common Core standards for mathematics.	2.40	0.84
b. Understanding the Ohio Academic Content Standards for Mathematics.	2.60	0.84
c. Understanding the specific content addressed by the OMSP professional development.	2.70	0.82
d. Aligning classroom instruction to the Ohio Academic Content Standards for Mathematics.	3.00	0.67
e. Aligning classroom assessment to the Ohio Academic Content Standards for Mathematics.	2.80	0.79
f. Presenting the specific content addressed by the OMSP professional development to students in engaging, meaningful ways.	2.30	0.82
g. Preparing students for Ohio statewide assessments (i.e., OGT, OAA).	2.80	0.79
Response Scale: 1=Beginner; 2= Intermediate; 3=Advanced; 4=Expert		

Table 13: Jackson Science Teachers' Response to Spring 2012 Online MSP Survey *(N= 5)*		
In a typical week, about how often do you do each of the following in your science instruction?	Mean Response	*(SD)*
a. Pose open-ended questions in science to access prior knowledge or to promote inquiry.	3.80	0.84
b. Require students to supply evidence to support their claims or explain their reasoning when giving an answer.	4.20	0.84
c. Engage the whole class in discussions based on the science academic content standards.	4.40	0.89
d. Ask students to explain concepts to one another.	3.20	0.84
e. Use student written reflections to guide instruction.	3.00	0.71
f. Differentiate classroom instruction to meet students learning needs in science.	4.20	1.30
g. Allow students to work at their own pace.	3.60	0.55
Response Scale: 1=Never; 2=Rarely; 3=Sometimes; 4=Often; 5=All or Almost All the Time; 99=NA		
Please rate each of the following in terms of its importance for science instruction in the grades you teach.	Mean Response	*(SD)*
a. Provide students with concrete experience before abstract concepts.	3.20	0.84
b. Develop students' conceptual understanding of science.	3.20	0.84
c. Take students' prior understanding into account when planning lessons.	3.60	0.89
d. Use appropriate modes to communicate scientifically in my instruction.	3.20	0.84
e. Have students work in cooperative learning groups.	3.00	1.00
f. Have students use appropriate educational technology (e.g. calculator, computers, electronic probes, Internet-based applets) to learn science.	3.20	0.84
g. Use performance-based assessment.	3.20	0.84
h. Use informal questioning to assess student understanding.	3.60	0.55
i. Have students use feedback to revise their work.	2.80	0.84
Response Scale: 1=Not Important; 2=Somewhat Important; 3=Fairly Important; 4=Very Important		
Please indicate how prepared you feel to do each of the following for science instruction in the grades you teach.	Mean Response	*(SD)*
a. Provide students with concrete experience before abstract concepts.	2.80	0.84
b. Develop students' conceptual understanding of science.	2.80	0.84
c. Take students' prior understanding into account when planning lessons.	3.20	0.45
d. Use appropriate modes to communicate scientifically in my instruction.	3.00	0.71
e. Have students work in cooperative learning groups.	3.20	0.84
f. Have students use appropriate educational technology (e.g. calculator, computers, electronic probes, Internet-based applets) to learn science.	2.80	0.45
g. Use performance-based assessment.	3.00	1.00
h. Use informal questioning to assess student understanding.	3.40	0.55
i. Have students use feedback to revise their work.	3.20	0.84
Response Scale: 1=Not Adequately Prepared; 2=Somewhat Prepared; 3=Fairly Well Prepared; 4=Very Well Prepared		
Which of the following best describes your level of expertise for each statement?	Mean Response	*(SD)*
a. Understanding national standards for science.	2.20	0.84
b. Understanding the Ohio Academic Content Standards for Science.	2.60	0.89
c. Understanding the specific content addressed by the OMSP professional development.	2.40	0.89
d. Aligning classroom instruction to the Ohio Academic Content Standards for Science.	2.80	0.84
e. Aligning classroom assessment to the Ohio Academic Content Standards for Science.	2.80	0.84
f. Presenting the specific content addressed by the OMSP professional development to students in engaging, meaningful ways.	2.80	0.84
g. Preparing students for Ohio statewide assessments (i.e., OGT, OAA).	2.80	0.84
Response Scale: 1=Beginner; 2= Intermediate; 3=Advanced; 4=Expert		

Evaluation Question 15: Does the partnership result in a functioning collaboration, as evidenced by an evident process and structure, participation by teachers and administrators, and open, purposeful communication?

Collaboration Among Partner Organizations

One of the required components of the Mathematics and Science Partnership model is the development of an ongoing *partnership* that includes STEM faculty from nearby higher education institutions, ESC personnel, as well as teachers and administrators from the participating district. This requirement is intended to lay the groundwork for a functioning collaborative partnership that results in ongoing professional development in mathematics and science beyond the funding period of the MSP grant. Hence, the project evaluation includes methods intended to gauge the health and sustainability of the partnership. Specifically, data were collected on teacher and administrator participation in professional development sessions and administrator interviews.

During telephone interviews in the fall of 2012, building administrators were asked about long-term sustainability and shared vision of the partnership. All three building administrators were positive about the partnership between the JCSD and the University of Rio Grande. They spoke highly of the engagement of the URG faculty with their teachers, and the middle school administrator talked about the successful field trip during Year 1 where middle school students got to explore the various science labs and work with URG faculty. When asked if they perceived a shared vision among all of the collaborators in the project, two building administrators responded "very much" and one responded "somewhat." All three administrators spoke positively about the math coaches in their buildings during Year 2. The math coaches are ESC personnel.

Teacher and administrator participation rates in professional development remained very high in Year 2 of the project. Virtually all teachers attended every professional development session and there was an administrator present at almost every professional development session. This high level of participation and willingness to arrange schedules and hire multiple substitute teachers is indicative of the commitment to the collaborative partnership.

CONCLUSION

Most components of the Rio Connection: Jackson Focus on Mathematics and Science Teaching project were implemented successfully during Year 2. Science teachers in grades 3-8 in the Jackson City School District were provided with four day-long content-specific professional development sessions, including review of Ohio's new Model Curriculum, which resulted in increased science content knowledge, and incorporation of hands-on strategies. The

participating teachers' physical science content scores improved from pre- to posttest. Additionally, the science teachers report very positively about the professional development and rate it very highly on surveys. Mathematics teachers in grades 3-8 were provided with eight day-long content specific professional development sessions including review of Ohio's new Core Curriculum, and an average of 17 individual coaching hours. The mathematics teachers showed significant gains from pre- to posttest on one mathematics instrument but a second instrument indicated no significant difference between JCSD mathematics teachers and a comparison districts' mathematics teachers. The mathematics teachers report less positively about the professional development and rate it somewhat lower than do the science teachers.

The increased teacher content knowledge and changes in instructional practices appear to have transferred to students in the district as evidenced by a statistically significant difference among Jackson fourth grade students' science scores compared to similar fourth grade students in a similar district. Additionally, fifth grade students in Jackson also made significantly greater gains in mathematics than did fifth grade students in a similar district. There was not a significant overall difference between JCSD sixth grade math or seventh grade science gain scores compared to students in the same grades in the comparison district. However, JCSD students' scores were higher than the comparison district students at both pre-and posttest. Economically disadvantaged fourth grade students also appear to have made statistically significant gains in science and fifth and sixth grade economically disadvantaged students made statistically significant gains in math.

Lastly, the "Family Fun Science and Math Nights" provided at each of the schools are clearly beneficial to the district, the students, and their families. The presenters used substantial amounts of humor to engage the students and their parents in mathematics and science activities. The events provided engaging science and mathematics activities that parents and students enjoyed together, thereby helping to emphasize the importance of science for these young students.

The project does appear to be sustainable beyond the life of the grant. The high level of administrator involvement and commitment to science and mathematics is a good indication of sustainability and there has certainly been increased enthusiasm and focus on science and mathematics in the district. Based on teacher self-reports and administrator feedback, many teachers have changed their instructional practices as a result of the professional development. Additionally, if the district continues to emphasize the need for teachers to know what content is covered across different grade levels, that is another sustained impact of the project. If the commitments last, and the connection between the URG faculty and the JCSD teachers is maintained, then the work accomplished by the project will be sustained.

Recommendations:

Recommendations for Year 3 and beyond include:

- Ensure that the professional development workshops meet the needs of teachers at both the elementary and middle school levels by targeting content and activities based on grade bands.

- As in Year 2, university faculty should continue to lead the professional development workshops and participate in follow-up activities throughout the academic year as much as possible. This direct collaboration between 3-8 grade teachers and faculty improved the project in Year 2 and has the potential to lead to longer-term collaborations between public school teachers and university faculty located in the same region.

References

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Appendix A: Science Teacher Professional Development Workshop Satisfaction Survey

Rio Connections: Jackson Focus on Mathematics and Science Teaching
Teacher Professional Development Satisfaction Survey

Instructions: Please take a few moments to tell us your opinions on the three-day *Learning Science Through Inquiry* professional development session.

Today's Date: ____/____/____

Mon/Day/Year

Do you currently teach elementary or middle school? _____Elementary _____Middle School

How many years have you been teaching? _____

1. Overall, how appropriate do you feel this professional development was for your current needs as a teacher?	**1** **2** **3** **4** **5** **6** **7** Not At All — Very
2. Did the facilitators/presenters provide information that will be useful to you in teaching at your current grade level?	**Yes** **No** **Not Sure**
3. How relevant was the material provided in this professional development in regards to science content?	**1** **2** **3** **4** **5** **6** **7** Not At All — Very
4. Was the science content covered in this professional development mostly a review or was it new material?	**Review** **New Material**
5. How relevant was the material in regards to instructional methods?	**1** **2** **3** **4** **5** **6** **7** Not At All — Very
6. What did you like best about this three-day professional development session?	
7. What did you like least about this three-day professional development session?	
8. For future professional development, what would you like to see added or changed?	
9. What final comments do you have?	

Thanks!

Appendix B: Mathematics Teacher Professional Development Workshop Satisfaction Survey

Rio Connections: Jackson Focus on Mathematics and Science Teaching
Teacher Professional Development Satisfaction Survey

Instructions: Please take a few moments to tell us your opinions on the Mathematics Workshops.

Today's Date: ____/____/____
Mon/Day/Year

Do you currently teach elementary or middle school? _____Elementary _____Middle School

How many years have you been teaching? _____

1. Overall, how appropriate do you feel this professional development was for your current needs as a teacher?	**1** Not At All **2 3 4 5 6 7** Very Much
2. Did the facilitators/presenters provide information that will be useful to you in teaching at your current grade level?	**Yes No Not Sure**
3. Has the professional development increased your knowledge in probability/statistics?	**1** Not At All **2 3 4 5 6 7** Very Much
4. How much has your knowledge increased in regards to the new Core Curriculum?	**1** Not At All **2 3 4 5 6 7** Very Much
5. How relevant was the material in regards to instructional methods?	**1** Not At All **2 3 4 5 6 7** Very Much
6. Have you incorporated pacing charts into your classroom?	**Yes No Not Yet but intend to**
7. Are you using comprehensive quarterly assessments?	**Yes No Not Yet but intend to**
8. How confident are you in your ability to implement what you've learned in this series in the classroom?	**1** Not At All **2 3 4 5 6 7** Very Much
9. What did you like best about this professional development series?	
10. What did you like least about this professional development series?	
11. For future professional development, what would you like to see added or changed?	
12. Do you have any final comments?	

Thanks!

Appendix B: 2012 Teacher Group Interview Questions

Rio Connections: Teacher Interview Questions (Physical Science)

Good afternoon and thank you for allowing us to use part your professional development day. My name is _____ and I am from the Voinovich School at Ohio University.

The Voinovich School of Leadership and Public Affairs at Ohio University is conducting an evaluation of the Rio Connection: Jackson focus on Mathematics and Science project. We are here to facilitate a discussion as a part of this evaluation. The discussion is an opportunity for you to provide us with your thoughts about this professional development project.

I am going to ask a few guiding questions to direct the conversation. There are no right or wrong answers and I welcome a variety of perceptions and input. Please feel comfortable to express your thoughts and opinions about your experiences.

Because this is intended to be a conversation, please feel free to respond to me and others without waiting to be called on. I would ask that only one person talk at a time. In order to cover everything we need to today, I may need to move the conversation on if we go too long on a given topic.

Renee Lewis will be taking notes and making a digital audio recording of the discussion so we don't miss anything. The recording will be used for our reference only and will be erased once the research report is complete. The report will not include your names, though we may use a quote or two from the group without identifying who said it. Should you feel uncomfortable at any time during the discussion, remember that your participation in today's discussion is strictly voluntary. Does anyone have any questions about this procedure?

Are there any other questions before we begin?

1. You have now participated in four physical science workshop days.
    a. Describe how appropriate this professional development was for you.
    b. Has this professional development increased specific physical science knowledge and if so can you provide examples?
    c. How, if at all, have your teaching practices changed?
2. What, if anything, have you incorporated from the professional development into your classroom?

    Describe the session that covered the new Core Curriculum.

        i. Was that session helpful and if so why?
3. Do you see any benefits to your students from the professional development you received so far? If so could you please describe?
4. Describe how the STEM faculty (Dr. White) has been involved so far.
5. In regard to the professional development overall:

    What has been the **most helpful** to you?

    What has been the **least helpful** to you?

6. What recommendations would you make for future professional development?
7. Is there anything else that you would like to mention that we have not already discussed?

Thank you!!

Appendix C: Teacher Group Interview Questions

Rio Connections: Teacher Interview Questions (Mathematics)

Good afternoon and thank you for allowing us to use part your professional development day. My name is _____ and I am from the Voinovich School at Ohio University.

The Voinovich School of Leadership and Public Affairs at Ohio University is conducting an evaluation of the Rio Connection: Jackson focus on Mathematics and Science project. We are here to facilitate a discussion as a part of this evaluation. The discussion is an opportunity for you to provide us with your thoughts about this professional development project.

I am going to ask a few guiding questions to direct the conversation. There are no right or wrong answers and I welcome a variety of perceptions and input. Please feel comfortable to express your thoughts and opinions about your experiences.

Because this is intended to be a conversation, please feel free to respond to me and others without waiting to be called on. I would ask that only one person talk at a time. In order to cover everything we need to today, I may need to move the conversation on if we go too long on a given topic.

Renee Lewis will be taking notes and making a digital audio recording of the discussion so we don't miss anything. The recording will be used for our reference only and will be erased once the research report is complete. The report will not include your names, though we may use a quote or two from the group without identifying who said it. Should you feel uncomfortable at any time during the discussion, remember that your participation in today's discussion is strictly voluntary. Does anyone have any questions about this procedure?

Are there any other questions before we begin?

1. You have now participated in seven workshop days and may have received individual coaching.

    a. Describe how appropriate this professional development was for you.

    b. Has this professional development increased specific math knowledge and if so can you provide examples?

    c. How, if at all, have your teaching practices changed, such as use of quarterly assessments and pacing charts?

    d. How helpful was it to cover the new Core Curriculum?

2. What, if anything, have you incorporated from the professional development into your classroom?

3. Do you see any benefits to your students from the professional development you received so far? If so could you please describe?

4. Describe what the coaching sessions have included and tell us your thoughts about the coaching.

5. Describe how the STEM faculty (Dr. Rhodes?) has been involved so far.

6. In regard to the professional development overall including the day long sessions and coaching:

    What has been the **most helpful** to you?

    What has been the **least helpful** to you?

7. What recommendations would you make for future professional development?

8. Is there anything else that you would like to mention that we have not already discussed?

Thank you!!

Appendix D: Fall 2012 Administrator Interview Questions

Administrator Name_____
Administrator Role or Title_____
Building_____
Interviewer_____
Date_____

Introduction: Jackson City Schools, The University of Rio Grande, and the Gallia-Vinton ESC have completed the second year of a Math Science Partnership professional development project for third through eighth grade teachers in the district. Ohio University's Voinovich School of Leadership and Public Affairs is evaluating the project. Your input after Year 2 of the project is an important component of the ongoing evaluation.

I will be taking notes during today's interview and making a digital audio recording of the discussion, just so I don't miss anything. The recording will be used for my reference only and will be erased once the report is complete.

Your responses are confidential. I won't identify to anyone who said what, although I may use a quote or two without identifying who said it.

Your participation in today's discussion is strictly voluntary and you may choose not to answer any question. Do you have any questions before we begin?

1. What are your thoughts about last year's professional development in SCIENCE through the Rio Connection MSP project?

2. What are your thoughts about last year's professional development in MATH through the Rio Connection MSP project?

3. What was your impression of last year's MATH **coaching** component of the project?

4. How prepared do you think the teachers in this building/district are to meet the needs of students in MATH?

    a) Compared to last year at this time, do you think the MATH teachers are (i) more prepared, (ii) less prepared, (iii) about the same?

5. Did you observe any specific changes in the instructional practices of any of your MATH teachers this past academic year? If so, please describe.

6. In regard to the project overall (both math and science components):

   How would you describe the long-term goals of Jackson's participation in the project?

   What has been the most helpful?

   What would you change?

7. At this point, do you think the increased commitment to science education in the district will continue even after the grant is over? Why or why not?

8. Please respond to the following items:

   a) There is a shared vision among all of the collaborators (JCS, URG, GV-ESC).
   not at all somewhat very much

   b) Leaders in the district and buildings are committed to long-term project goals.
   not at all somewhat very much

   c) Teachers who participated in the project are committed to long-term project goals.
   not at all somewhat very much

9. Is there anything else that you would like to mention that we have not already discussed?

Thank you!

Appendix E: Instructional Coach Interview Questions- Year 2

Rio Connections: Jackson Focus on Science and Math

Coach Liaison Interview Questions

Date:
Interviewer:
Interviewee:

Introduction

Good morning, my name is_____ and I am with the evaluation team at the Voinovich School. The purpose of this call is to interview you as a coach liaison for the Rio Connections: Jackson Focus on Science and Math project. The focus of the 2011 interviews were on the science portion of the project and the current year's questions are focused on the math portion of the project. The conversation is confidential in that no specific respondent will be identified. Rather, the group of coaches' responses will be summarized together. Although, we may use a quote or two, no coach will be identifiable.

Your participation in this interview is completely voluntary. You may choose not to answer any of the questions or stop the interview at any time.

Because it is difficult to capture everything that is said via note-taking, I would like to audio-record the interview. Is that okay with you?

1. Describe the coaching component of The Rio Connection: Jackson Focus on Science and Math Project. (If I were a teacher in this project, what would I experience?)

2. What evidence have you observed that indicates the teachers have implemented newly learned content/activities?

3. What support or other needs do you see among the teachers with whom you have worked this year that would help them effectively implement inquiry-based instruction?

4. What has been challenging for you as a coach liaison?

5. How successful do you think the program was overall?

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Leadership and Public Affairs