Rio Connection:

Gallipolis Focus on Science Education

EVALUATION

OHIO UNIVERSITY

AUGUST 2012

Prepared By The Voinovich School of Leadership and Public Affairs

ACKNOWLEDGEMENTS

The Voinovich School of Leadership and Public Affairs conducted this evaluation of the Rio Connection: Gallipolis Focus on Science Education. Assistant Professor Marsha Lewis and Senior Project Manager Margaret Hutzel are the project managers and are responsible for all evaluation design, data collection, analysis, and reporting. Student Research Associates Samantha Bergstein and Renee Lewis assisted with data entry and analysis. Renee Lewis and Student Research Associate Ginger Schmalenberg assisted with interviews, analysis, and summary. Student research Associate Tessa Barman assisted with data entry and coaching log review. The Voinovich School wishes to thank the University of Rio Grande, Gallia-Vinton Educational Service Center, Gallipolis City School District and the Ohio Board of Regents for their participation in and support of the external evaluation activities.

CONTENTS

LIST OF TABLES

Rio Connection: Gallipolis Focus on Science Education Evaluation Report

EXECUTIVE SUMMARY

This Executive Summary addresses Ohio University's Voinovich School of Leadership and Public Affairs' evaluation findings on the Rio Connection: Gallipolis Focus on Science Instruction project. The project was a one-year collaborative endeavor among the University of Rio Grande (URG), The Gallia Vinton Educational Service Center (GV-ESC) and Gallipolis City School District (GCSD). The purpose of the project was to provide high quality professional development for science teachers in grades 3-8. Collaborating with faculty at URG and the Gallia-Vinton ESC and utilizing a coaching professional development model, GCSD science teachers were provided five days of professional development (approximately 35 hours) and an average of 19 hours of individual coaching in scientific inquiry, earth science, and space science during the project. In addition, the coaches attended grade level meetings, participated in the professional development sessions, assisted with readying supplies, and obtained instructional resources for the teachers.

Primary Evaluation Findings

- There was a slight increase in mean scores on the earth science test among GCSD teachers but there was also a slight decrease in their astronomy scores. Neither change was statistically significant, nor was there a significant difference between GCSD teacher posttest scores and scores of teachers in a similar district.

- Seventh grade students in the GCSD showed significantly greater gains in astronomy knowledge from pre- to posttest than students in a similar district. They also had an increase in mean score on the earth science test, whereas the comparison district had a decrease in mean score on the same test. For earth science, neither change was statistically significant nor was there a significant difference between the treatment and comparison group.

- Both the GCSD fourth grade students and the comparison district fourth graders made significant gains from pre- to posttest. There was not a significant difference in the amount of change from pre- to posttest between the two groups.

- There is substantial evidence of change in teacher instructional practices among science teachers who received the professional development. Teachers reported using more hands-on and inquiry-based activities.

- Overall, the GCSD science teachers were pleased with the professional development and perceive themselves as more prepared to deliver science content and improve student achievement in science.

- GCSD teachers expressed varying levels of satisfaction and value regarding the coaching component of the project. Some teachers felt the coaching component was extremely helpful while others felt it was minimally helpful.

Recommendations

- It is imperative that the coaches engaged are instilled with the authority and confidence to fully execute the coaching model as it is intended. It is therefore recommended that additional preparation, monitoring, and where necessary, mid-project modifications be implemented for this component.

- Ensure that all stakeholders are fully informed of programmatic changes such as replacing after-school science activities with school day activities.

Methodology

Staff members at Ohio University's Voinovich School of Leadership and Public Affairs serve as the external evaluators for the project. This report focuses on implementation and outcome evaluation findings for the project. 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 science and that agreed to allow evaluators to assess teachers and

students in science content. The comparison district was identified via the similar districts grouping on the Ohio Department of Education website.

- Analysis of pre- and posttests of participating GCSD teachers' earth and space science content knowledge, and comparison of GCSD teacher content knowledge to teachers in a similar, comparison district;
- Analysis of pre- and posttests assessing science content knowledge of all students in grades 4 and 7 in the GCSD, 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;
- Observation of selected professional development sessions;
- Document review of coaching logs.

RIO CONNECTION: GALLIPOLIS FOCUS ON SCIENCE EDUCATION EVALUATION DETAILS

Introduction

Rio Connection: Focus on Science Education is an Improving Teacher Quality project funded by the Ohio Board of Regents for the 2011/2012 academic year. The project intent was to provide professional development to science teachers in the Gallipolis City School District. The University of Rio Grande submitted the proposal and the Gallia-Vinton Educational Service Center (ESC) served as the fiscal agent. The Rio Connection: Focus on Science Education project's goals are to provide high-quality, earth and space science-focused professional development for teachers in grades three through eight in the participating school district and ultimately increase Gallipolis City School District student achievement in science.
Staff members at the Voinovich School of Leadership and Public Affairs at Ohio University served as the evaluators for the project and provide this report of evaluation findings.

In the Fall of 2011, in preparation to apply for a grant, the University of Rio Grande and the Gallia-Vinton Educational Service Center (ESC) collaborated with the Gallipolis City School District (GCSD) to conduct a teacher needs assessment focused on the professional development needs of science and math teachers in grades 3 through 8. Separate surveys were developed for science staff and building principals to identify a composite snapshot of the 3-8 science department within the district. Only 27 percent of respondents indicated they had received science-focused professional development within the last five years, and only half indicated they completed college coursework in geology or astronomy. Respondents also rated assessment strategies and scientific inquiry as preferred areas for professional development.

Face-to-face planning meetings were held on October 8th between the Principle Investigator, Program Director and all science staff grades 3-8, with follow-up focus group meetings and administrator interviews. When asked what focus the teachers would value most, a majority of the staff responded that scientific inquiry and strategies for promoting higher level student thinking were a priority. During these planning meetings, it was also disclosed that no science

assessment strategies were being implemented within any of the three elementary schools. Although end-of-chapter assessments are utilized by some teachers, the 8th grade was the only intermediate grade level with earth and space sciences textbooks due to financial challenges faced by the district. The district had committed to developing short cycle assessments in science during the next academic year. Focused professional development in assessment strategies was articulated by the partners as an opportunity for directly improving the district's 3-8 science curriculum.

URG then applied for and received an Improving Teacher Quality grant from The Ohio Board of Regents to provide professional development for GCSD teachers in grades 3-8, with 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: Gallipolis Focus on Science Education project as: to improve the district's Earth & Space Sciences 3-8 curriculum through professional development opportunities that will focus on increasing teachers' content knowledge, usage of inquiry-based instruction and usage of effective assessment strategies.According to the Gallipolis City School District 2009-2010 School Year Report Card, the district meets "high need" status via 35.1% of students being classified as economically disadvantaged. In addition, the district did not meet adequate yearly progress, is below the value-added measure, and nearly 68 percent of students from this district scored either "limited" or "basic" in science.

Project Description

The project provided teachers with five daylong professional development sessions (Table 1). Four days were devoted to primarily earth and space science and one day was devoted to inquiry-based science instruction and Ohio's revised academic content standards and model curriculum.

Table 1. Teacher Professional Development Sessions

(Each session was presented twice to accommodate all teachers)

Day One: Revised Ohio Science Standards (Grades 3-8) & Inquiry-Based Science Instruction	Day Two: Space Science Workshop	Day Three: Earth Science 1 – Plate Tectonics, Continental Drift
✓ *Introduction to the Revised Ohio Science Standards and Model Curriculum* ✓ *Inquiry-Based Science Instruction*	✓ *Introduction, The Copernican Revolution* ✓ *"Essential Science for Teachers": Order Out of Chaos* ✓ *Earth's Rotation and Revolution* ✓ *Lunar Phases, Eclipses, and Tides* ✓ *"Joy of Science": The Life Cycle of a Star*	✓ *Introduction; Plate Tectonics* ✓ *Volcanoes, Earthquakes* ✓ *Mountain Building* ✓ *Restless Landscape and Erosion Activity*

Table 1. Continued. Teacher Professional Development Sessions

(Each session was presented twice to accommodate all teachers)

Day 4: Earth Science 2 – Rock Cycle, Minerals, and Soil Formation	Day 5: Earth Science 2 – Weather and Climate
✓ *Introduction; Rock Cycle* ✓ *Minerals* ✓ *Soil Formation* ✓ *Soil Activity, Weathering Activity, and Small Group Discussions* ✓ *Earth Science*	✓ *Introduction; Workshop Overview; OAA Discussion* ✓ *Water Cycle* ✓ *Water Cycle Activity* ✓ *Atmospheric Cycle* ✓ *Weather Mini-Lecture* ✓ *Weather Mapping Activity*

In addition to five daylong professional development sessions, four science coaches were engaged to offer professional support to the teachers. The four coaches were assigned to groups of teachers in the various buildings. They 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

OUTCOME EVALUATION

Evaluation Question 1: Does the professional development lead to a statistically-significant increase in teacher content knowledge in earth and space science 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 Science Content Knowledge

Teachers participating in the GCSD were administered a pre- and posttest of 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. Three teachers tested in the fall did not complete the posttest in the spring. Eighteen teachers' pre and post instruments were matched. Teachers in the same grade bands in the comparison district were administered the same posttest as the GCSD 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.

The instrument chosen for the teacher science content knowledge assessment was the MOSART or Misconceptions-Oriented Standards-Based Assessment Resources for Teachers (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 teachers in the *Rio Connection* project took both the earth science and astronomy/space science assessments because those were the

specific science content areas covered in the professional development. Parallel forms of the tests are available, so one form was used at pretest and the second form was used at posttest by both the GCSD teachers and comparison district teachers.

Among the Gallipolis teachers, there was a small increase in the test scores from pretest (M = 18.39, SD = 2.279, N = 18) to posttest (M = 19.00, SD = 2.521, N = 18) on the earth science test (Table 2). There was a slight decrease in test score means from pretest (M = 7.72, SD = 2.396) to posttest (M = 7.67, SD = 2.544) on the astronomy test. Neither the earth science nor the astronomy science test comparisons resulted in statistically significant change from pre-to posttest (earth science $p < .878$ and $t(17) = .156$, astronomy $p < .335$ and $t(17) = -.991$).

Table 2. Gallipolis Teachers' Pre- and Posttest Mean Scores on MOSART Science Assessments

Test	n	Pretest *M (SD)*	Posttest *M (SD)*
Earth Science (25 Points)	18	18.39 (2.279)	19 (2.521)
Astronomy/Space Science (15 Points)	18	7.72 (2.396)	7.67 (2.544)

An independent-samples t-test was conducted to compare the Gallipolis City and comparison district results on the teacher content knowledge earth science posttests. There was a slight difference in means for the intervention (M = 19, SD = 2.521) and comparison district posttest (M = 18.50, SD = 2.236), but it was not statistically significant (Table 3).

An independent-samples t-test was conducted on the teacher content knowledge astronomy posttest scores for the comparison and GCSD district. There was not a statistically significant difference in scores for the Gallipolis (M = 7.67, SD = 2.544) and comparison districts (M = 8.08, SD = 3.370).

Table 3. Gallipolis and Comparison District Teachers' Pre- and Posttest Means Scores on MOSART Science Assessments

	Gallipolis Teachers		Comparison District Teachers	
TEST	n	Posttest *M (SD)*	n	Posttest *M (SD)*
Earth Science (25 Points)	18	19 (2.521)	12	18.5 (2.236)
Astronomy/Space Science (15 Points)	18	7.67 (2.544)	12	8.08 (3.37)

Though there was not a statistically significant change in teacher content knowledge as measured by the MOSART instrument, the teachers did perceive that their knowledge increased. Twenty-one teachers completed a professional development satisfaction survey (Appendix A) addressing the five-day *Earth and Space Science Professional Development* series. Fourteen of the teachers completed the professional development prior to the start of the academic year during the summer, and seven of the teachers completed the series during the academic year. On a scale of one to seven, with one being not at all and seven being very much, the average response to the question of whether the professional development increased the teachers' knowledge in earth and space science was 6.4. Twelve teachers responded with a seven, the highest score on the scale, and seven responded with the second highest score of six. When asked how confident they were that they could implement in the classroom what they learned through the professional development, the average response was a 5.9 on the same scale. Three participants responded with the highest scale score of seven, and twelve responded with the second highest score of six.

Not only did the teachers report these sentiments on the survey but they also spoke positively in the discussion groups. Overall, the teachers felt that their knowledge of earth and space science increased via the professional development workshops, and they felt energized by the experience and excited to share the knowledge in their classrooms. Some teachers felt that the information was transferrable to the classroom but might not be utilized due to timing issues since the information wasn't necessary for standards being taught.

Evaluation Question 2: Do students of participating teachers show a significantly greater increase in earth and space science achievement and scientific inquiry skills development as compared to a similar group of students, in a similar district whose teachers did not participate?

Student Science Content Knowledge

Fourth and seventh grade science students in GCSD and the comparison district were administered a pre- and posttest of science content knowledge in earth and space science. For the fourth grade students, the evaluators utilized a content test made up of scientific inquiry and earth and space 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). The MOSART earth science and astronomy/space science instruments were both used (28 total items) in order to cover the science content addressed in the MSP project.

Information about the project and the testing was sent home with all fourth and seventh grade students in both GCSD City Schools and the comparison district, and parents/guardians were given the opportunity to decline their son or daughter's participation in the test. If they declined consent, they were not tested. Additionally, data for students who participated in only the pre- or only the posttest were not included in the analysis. For the seventh grade group, the sample size was reduced from 161 to 117 in the Gallipolis City Schools because not all classes completed the posttest. These factors reduced the sample size of the study.

Fourth Grade Student Test Data

The following analysis is based on fourth grade student content test data acquired with science knowledge tests in the GCSD and comparison district. The GCSD sample size is 117 and the comparison sample size is 106.

An independent-samples t-test was conducted to compare the fourth grade pre-test scores for GCSD and comparison school district. The pre- and posttest instruments included 22 questions for a total of 22 possible points. At pretest, there was a significant difference, ($p < .015$) and $t(116) = -14.889$, in means for the GCSD (M = 10.57, SD = 2.16, N = 117) and comparison

district (M = 11.51, SD = 2.16, N = 106) (Table 4). Therefore, it appears that the comparison district and the GCSD are significantly different in fourth grade student pretest scores with the comparison district fourth grade students having a slightly higher mean score at pretest.

Table 4. Fourth Grade Pre- and Posttest Average Scores on Science Assessment

Gallipolis 4th Graders			Match 4th Graders		
n	Pretest *M (SD)*	Posttest *M (SD)*	n	Pretests *M (SD)*	Posttest *M (SD)*
117	10.57 (2.16)	14.27 (2.98)	106	11.51 (2.16)	15.28 (3.18)

An independent-samples t-test was also conducted to compare the difference in scores for the fourth grade pre- and posttests for the GCSD and comparison school district. There was not a significant difference in means in the difference in scores for the GCSD (M = 3.70, SD = 2.69, N = 117) and comparison (M = 3.77, SD=2.87, N = 106). Therefore, it appears that the comparison district and the GCSD district are not significantly different in fourth grade student pre- to posttest difference scores.

Both districts' fourth grade groups showed statistically significant increases, (P = .0005) and $t(116) = -14.889$, pre- to posttests (GCSD pre M = 10.57, SD = 2.16, N = 117 to post M = 14.24, SD = 2.98, N = 117) (comparison school district pre M = 11.51, SD = 2.166, N = 106 to post M=15.28, SD=3.177, N = 106). The effect size for both groups is large ($\eta^2 = .656$ (GCSD) and .636 (Comparison). Therefore, there was a substantial difference in test scores for both groups from the beginning to the end of the academic year.

Seventh Grade Student Test Data

The following analysis is based on seventh grade student content data acquired through the use of science knowledge tests in two separate districts, GCSD and comparison. For both the GCSD and comparison school district, pre- and posttests were collected. Any data for students who participated in only the pre- or only the posttest were not included in the analysis. These factors reduced the sample size of the study. The GCSD sample size is 117 and the comparison sample size is 132.

For GCSD earth science there was an increase in test scores from pretest (M = 9.44, SD = 3.150, N =117) to posttest (M = 9.73, SD = 3.370, N = 117) but it was not statistically significant (Table 5). There is a small effect size ($\eta^2 = .01$). For the comparison district, there was a decrease in test scores on the earth science test from pretest (M = 9.88, SD = 3.203) to posttest (M = 9.84, SD = 3.195) but it was not statistically significant. There is a small effect size value ($\eta^2 = .000137$). Therefore, there was a small effect, with a small difference in test scores obtained before and after the intervention.

A paired-samples t-test was conducted to compare the GCSD and comparison district astronomy and earth science pre- and posttests. For GCSD, there was an increase in test scores from pretest (M = 4.04, SD = 1.967, N = 117) to posttest (M = 4.48, SD = 2.246, N = 117) on the astronomy tests but it was not statistically significant ($p = .054$) and $t(116) = -1.943$. There is also a small effect size ($\eta^2 = .032$). Therefore, it appears that the GCSD pre- and post-astronomy test scores are not significantly different at the .05 level though the scores are quite close to meeting the significance level. For the comparison district, there was a decrease in test scores from pretest (M = 4.63, SD = 2.270, N = 132) to posttest (M = 4.34, SD = 2.498, N = 132) on the astronomy tests but it was not statistically significant. Therefore, it appears that the comparison district pre- and post-astronomy test scores are not significantly different at the .05 level.

Table 5. Seventh Grade Pre- and Posttest Mean Percentage Correct on Science Assessment

	Gallipolis 4th Graders			Match 4th Graders		
	n	Pretest *M (SD)*	Posttest *M (SD)*	n	Pretest *M (SD)*	Posttest *M (SD)*
Earth Science (20 Points)	117	9.44 (3.15)	9.73 (3.37)	131	9.88 (3.20)	9.84 (3.19)
Astronomy/Space (15 Points)	117	4.04 (1.967)	4.48 (2.24)	131	4.63 (2.27)	4.34 (2.49)

An independent-samples t-test was conducted to compare the difference between the seventh grade astronomy pre- to posttest gains for the GCSD and comparison school districts. That is, the pretest scores were subtracted from the posttest scores and the differences were analyzed for both groups. There was a difference in means for GCSD (M=.44, SD=2.426, N = 117) and comparison (M = -.29, SD = 2.680, N = 132) and it was statistically significant (p=.027) and

$t(247) = 2.223$. There was also a small effect size ($\eta^2 = .02$). Therefore,2 percent of variability in the dependent variable of test scores can be explained by the independent variable, GCSD or comparison group. The Gallipolis seventh graders made significantly greater gains in astronomy from pretest to posttest than the comparison district.

An independent-samples t-test was conducted to compare the difference between the seventh grade Earth Science pre-to posttest gains for the GCSD and comparison school districts. There was not a large difference in means for GCSD (M = .29, SD = 2.968, N = 117) and comparison (M = -.04, SD = 3.282, N = 132) and it was not significant. Therefore, it appears that earth science pre-to posttest gain scores are not significantly different at the .05 level in the GCSD and comparison school districts. .

Evaluation Question 3: Do science teachers perceive themselves as more prepared to deliver science content/improve student achievement in science?

Science Teachers' Perceived Preparedness

Several evaluation methodologies are used to address this evaluation question including teacher discussions, coach interviews and teacher surveys.

An end of year survey indicates that in general, the teachers believe they are more prepared to deliver science content/improve student achievement in science (Table 6). There is fairly strong agreement about learning new concepts, learning inquiry-based activities, perception of improved teaching, and increased enthusiasm for teaching.

Table 6. Teacher Post Intervention Responses to the Professional Development

Extent to which respondents agree with statements:	**Strongly agree 1**	**2**	**Neither agree or disagree 3**	**4**	**Strongly disagree 5**	Mean:
I learned new content (concepts, facts and definitions)	8	7	2	1	0	1.78
I learned multiple ways to assess student learning	2	6	8	2	0	2.56
I learned effective questioning techniques…	2	7	6	3	0	2.56

I learned new instructional approaches, methods and teaching strategies…	4	10	3	1	0	2.06
I learned inquiry-based, hands-on activities to use in my classroom..	6	9	3	0	0	1.83
Participation in this professional development *improved* my teaching…	4	8	5	1	0	2.17
Participation in this professional development *increased* my enthusiasm for teaching…	8	5	4	1	0	1.89

Evaluation Question 4: Is there an increased usage of assessment strategies by participating teachers?

To address this evaluation question, teachers' understanding and learning about assessment strategies was explored. Teachers responded to two questions regarding use of assessment strategies. One question was asked post intervention only, while the second question was asked at pre and post intervention. The first question that was post intervention asked teachers how much they agree with the statement, "I learned multiple ways to assess student learning" (Table 6, above). Among the eighteen teachers who completed the questionnaire, eight agreed or strongly agreed, eight were neutral and two disagreed with the statement. The mean response was 2.56 which is somewhat closer to the agree end versus the disagree end of the scale. The question that was asked pre and post intervention was analyzed to determine the number of teachers who changed their level of agreement with the statement, "I have a good understanding of how to assess student learning in multiple ways." Responses were compared at the individual level and nine teachers' responses did not change, six teachers' responses moved toward the disagreement end of the scale and three teachers' responses moved toward the agreement end of the scale. Thus, overall the results regarding increased usage of assessment strategies are somewhat mixed.

IMPLEMENTATION EVALUATION FINDINGS

Evaluation Question 5: Is the project able to maintain teacher participation in planned science professional development sessions?

Teacher Participation

In general, teacher participation (attendance) in the daylong professional development sessions was very good. The primary investigator reports that two of the teachers who attended the summer training sessions needed to miss one of the days during the summer, yet they did attend those follow-up days later in the fall when the sessions were offered again. Four of the teachers who attended the fall sessions missed the first day of the training, yet attended the remaining four days. Therefore, the only absences were these four teachers for one of the daylong sessions.

Evaluation Question 6: How are the STEM faculty engaged in the project and what are teacher perceptions of STEM faculty involvement?

STEM Faculty Engagement

The STEM faculty at The University of Rio Grande planned and facilitated all of the professional development sessions. The teachers rated the professional development very highly with 95 percent indicating that the facilitators/presenters provided useful information for their current needs. Three teachers also indicated on the end-of year satisfaction survey that they are interested in participating in additional science content professional development in the future.

Evaluation Question 7: How are the coaches engaged in the project and what are teacher perceptions of coaching experience?

Science Coach Engagement

Four Science coaches were engaged to work with teachers receiving the professional development. They attended the professional development sessions, attended grade level meetings, and among other things, provided individual coaching to most of the GCSD School District grades 3-8 teachers. Each coach was assigned specific teachers and the coaching logs reveal that each coach worked individually with between three and eight teachers. The evaluation included several methodologies to address the coaches' engagement in the project, including

review of coaching logs, teacher discussion groups, teacher surveys and coach interviews (two coaches).

There is also substantial variability in regards to what each coach provided to the teachers to whom she was assigned. Some coaches modeled lessons in the classrooms, co-taught lessons and interacted frequently with assigned teachers while others mainly provided resources and materials for the teachers and did not model lessons or co-teach.

For a number of reasons, the "crosscutting" activities that the coaches tracked are more difficult to tabulate and apply to individual teachers. For example, there was a difference in interpretation of the instrument as well as interpretation of what constituted a crosscutting coaching activity.

Seventeen of the 18 teachers who attended and completed the questionnaire indicated they received individual coaching. Respondents who had received coaching were then asked to rate how helpful the coaching was on a scale of one (Not At All) to seven (Very Much). Responses ranged from three to seven with all but one respondent answering with a four or above. One participant did not respond to this question though they did receive individual coaching. The average response was a five, indicating that most respondents believe the coaching was somewhat helpful. Another way to explore the data is the percentage of teachers who indicated a 5 or higher on the 1 to 7 rating scale. Essentially, 82 percent selected a 5 or higher and thus believed the coaching was beneficial.

When asked to respond to the question, "Has the coaching affected your teaching?" responses ranged from two (Hardly At All) to seven (Very Much). Fourteen respondents answered with a four or above, indicating that they believe their teaching has been affected by the coaching. One respondent answered with a three which indicated that they believe their teaching has been only mildly affected by the coaching, while two respondents answered with a two indicating that the coaching hardly affected their teaching. Overall, the average response was a five.

Those teachers who thought the coaching affected their teaching generally thought that it gave them new ways to teach their students as well as providing new supplies and resources for their class rooms (see Table 7 for a list of quotes). Clearly, the teachers' experiences varied in regards to the type of coaching they received. There may be a number of reasons for that variation.

Table 7. Teachers' examples of how the coaching affected their teaching
"I am more knowledgeable about Earth/Space science. I know how to better set up labs and activities and not to be afraid to talk about them. I know where and how to find better up to date information."
"More interactive activities, better resources, more in-depth knowledge."
"Our coach was very helpful in keeping us up to date on current science news. She put the proper materials in our hands."
"Was open to sharing the class and working with someone else in preparing and supplementing materials."
"I have more resources, activities and better materials."
"I tried an activity that I normally would not have done (M&M activity)."
"I think coaching has shown me various hands on lessons."
"I try to use more inquiry-based science activities. I also try to do more hands-on activities …"
"Support for a few busy lab days. Purchased needed supplies."
"We were able to do a soil experiment, she provided great resources."
"The coach provided material that allowed us to go deeper in the area."
"Student work, understanding of soil erosion on a test - but no work samples saved."
"Providing supplies/resources."
"She shared more than she coached. She did not model any lessons. She did assist in the classroom."
"Provided extra support & materials."

In response to the coaching component of the professional development project, one group of teachers felt that the coaches gave valuable information and were able to connect the classroom teachers with online resources for the classroom. The second group felt that while the coach had good activities and helpful online and outside resources for the classroom, there was not enough follow through for requested help with specific science areas. This same group also expressed disappointment that a science night was never scheduled since this was supposed to be a part of the program. The teachers were unaware that this component was changed to a school day activity that focused on science. They also felt that their coach was not entirely comfortable with all of the science material being taught. Overall, many of the teachers had some form of positive interaction with the coaching component of the project, and many cited that what they liked best about the professional development was the extra help and cooperation in the classroom that the coaches enabled. An important suggestion made about the coaching component of the professional development was to ensure that the coaches were comfortable with their knowledge of the material that they were responsible for coaching.

> *"I mean, she was like my right hand, so. I don't know what I am going to do without her."*

"I wonder if she felt uncomfortable, and I don't know if they could do this with the coaches, if they could have workshops themselves and say, this is what you can take to third grade, this is what you can take to fourth grade, those are things that fifth grade covers and maybe teach them those activities and then have them come in and do those activities, so, you know you are meeting the third, fourth grade standards and they would feel more comfortable. Because I really felt like she felt a little intimidated and uncomfortable with some of the stuff."

Evaluation Question 8: What is the average number of professional development (including coaching) hours that participating science teachers receive?

Average Number of Professional Development Hours

The evaluators requested that the coaches complete a log of activities for each individual teacher with whom they worked during the school year, as well as logs regarding "crosscutting" activities such as attending grade level meetings. Coaches tracked all of their activities on two forms. One was for tracking individual coaching with each teacher and one was for tracking crosscutting activities. Individual or one-on-one hours were provided via the coaching logs, for 20 teachers. The number of one-on-one hours per teacher varied substantially from 2.5 to 77.5. When all of the hours are summed and averaged, these teachers received an average of 19.5 hours of individualized coaching. When coaching hours are combined with the time spent in science professional development workshop sessions, teachers were provided with approximately 54 hours of direct professional development.

The coach interviews, teacher discussions, surveys, and coaching logs reveal that there is substantial variability in the amount of time the coaches' work with individual teachers. This is at least due in part to receptiveness to coaching among the teachers as was reported by one of the coaches. She noted, "During the day, I will generally spend about 2 hours with each teacher, with the exception of one, who is kind of resistant." Conversely, this coach also noted, "And my X grade teacher has been constantly talking to me and emailing me and saying, okay, "this is what I'm on this week, what can we do?"

Evaluation Question 9: 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?

Appropriateness of Science Professional Development

The evaluators surveyed teachers regarding satisfaction at two points, immediately following the professional development at the start of the 2011-12 academic year and in the spring after the professional development and coaching were completed. When initially asked how appropriate the professional development was for their current needs as a teacher, responses ranged from five to seven with an average of six. However, when asked the same question at the end of the school year, responses ranged from four to seven with an average of five. (i.e. Respondents who believed the professional development was appropriate for their current needs dropped from 100 percent to 83 percent by the end of the school year.)

Evaluation Question 10: Is there a change in teacher instructional practices among science teachers receiving the professional development?

Change in Teacher Instructional Practices

Teachers' self-reported instructional beliefs, a satisfaction survey (deployed in in the fall and spring), a coach interview, and teachers' group discussion statements are used to address this evaluation question. Overall, there does appear to be change in instructional beliefs and practices among many of teachers and some are focusing more on scientific inquiry in their classrooms. When asked on the fall satisfaction survey if the professional development has increased their knowledge of inquiry-based strategies, responses ranged from three to seven with an average of six. With regards to the professional development series (*Learning Science Through Inquiry* vs. *Earth and Space Science*), 67 percent of the participants believed they would both be equally helpful to their teaching. An interviewed coach noted she had seen more hands-on and inquiry-based science used among two of the teachers with whom she worked and several teachers noted in the group discussions that they used more hands-on and inquiry-based science in their classrooms.

Teacher responses on the spring satisfaction survey indicate that many believe the professional development influenced their teaching. When asked if the earth and space science workshops at the beginning of the 2011/2012 school year affected their teaching, many responded that it made them more likely to conduct hands-on activities with their students, and that they would be more deliberate in working these types of activities into their lessons (see Table 8 for a list of quotes).

Table 8. Teacher responses regarding whether the professional development affected their teaching
"It made me excited to do more hands-on learning. I was trying to be more deliberate in my planning so that I included more experiments, more observation activities & discussion of results."
"Yes, it affected my teaching by using the inquiry-based activities and involving the students."
"It challenged me to be smarter than the standards I'm teaching."
"It did give me some ideas of a couple of lab activities to try in class. It also helped me get familiar with the new science standards."
"Yes. It gave me a better understanding for the core content."
"The Earth Science was beneficial because we teach it. The space part was interesting but not a part of our curriculum."
"Made me more aware of doing hands on activities."
"The workshop gave me ideas for "hands on" activities."
"Yes - I am more knowledgeable about the content."
"I did assist the science teacher with evaluating science projects this year."
"Rock/Mineral info - helpful."
"Some. A lot of the material did not cover 3rd grade standards. I did take back ideas, websites and motivation.
"In Earth Science provided activities with the stream model and erosion that I haven't done previously."
"Yes! We really did in depth activities on the Super Moon/Seasonal Changes and eclipses."
"Yes - new ideas, help with experiments."
"Yes- Used the sand & hand lens activity."

The teachers also completed a questionnaire in the fall and spring about their instructional beliefs among other items. Table 9 presents responses from 18 teachers' matched pre- and posttest questions that specifically queried about their instructional beliefs. The instrument proposes two statements at either end of a continuum upon which teachers indicate their position on the particular item. The continuum ranges from one to five, with one extreme being number one (Left side), and the other number five (Right Side). The data are reported by the number of teachers whose positions had no change, changed toward the left of the continuum, or changed toward the right of the continuum. Pair D had one of the greatest changes with seven teachers moving toward the right of the continuum, which is, "student role is to apply inquiry and problem solving skills to discover solutions to problems."

Table 9. Teacher Instructional Beliefs

	No Change	Change Toward Left	Change Toward Right	
Pair A Classroom interaction consists of teacher-led lecture with limited response from students	10	3	4	Classroom interaction involves a dialogue among teacher and students
Pair B Students generally work in groups cooperatively	12	3	3	Students generally work independently
Pair C Instruction focuses on the central ideas of a discipline, covering fewer topics in depth	9	5	4	Instruction emphasizes broad coverage of information with little depth
Pair D Student role is to receive/recite factual information and/or to answer questions using repetitive routines	9	2	7	Student role is to apply inquiry and problem solving skills to discover solutions to problems
Pair E Students generally learn concepts and processes using hands-on approaches	12	5	1	Students generally learn concepts and processes through readings, lectures and demonstrations
Pair F I am generally successful in encouraging effort and participation among all students	11	3	4	I find it difficult to encourage the efforts and contributions of certain students or groups of students
Pair G I generally assess students' progress using conventional methods (e.g., paper and pencil tests such as multiple choice, fill in the blank, true/false)	8	5	5	I generally assess students' progress using alternative methods (e.g., open-response questions, hands-on performance, portfolios, observation)

In group discussions, many teachers expressed changes in their approach to teaching. These responses reflect a change in how the teachers taught science in their classroom.

> *" I think for me and Earth and Space, it was one of my deficient areas, so, Cindy (A Coach) was amazing in explaining it, breaking it down, relating it to everyday things. I felt like it was really beneficial."*

> *"We tried to make ourselves do a little more hands-on activities, and think more like scientists and we really tried to focus more on vocabulary in the process, you know, scientific inquiry and using terminology and stuff."*

Evaluation Question 11: What is the percentage of students whose parents attend science night events at their children's schools?

Parent Participation

Initially, the project included science nights, which would take place at each elementary school and the middle school. This plan was altered however and instead daytime events were held. Teachers seemed unaware that this change was planned and in the spring, several teachers expressed disappointment that the science nights did not happen. While there was disappointment, it is desirable that teachers wish to have science events that extend beyond the school day because it may well mean that they are engaged in science education for their students.

CONCLUSION

The Rio Connection: Gallipolis Focus on Science Education project was implemented successfully over the 2011/2012 academic year. Science teachers in grades 3-8 in the Gallipolis City School District were provided with 35 hours of content-specific professional development, an average of 19 hours of one-on-one coaching, plus group coaching and professional development in assessment strategies during the 2011/2012 academic year. The participating teachers' science mean content scores in earth science improved from pre- to posttest. When the GCSD teachers' assessment scores are compared to teachers from a similar district, evaluators found that the GCSD teachers' scores were not significantly higher than the similar district teachers' scores on the same instrument. However, the participating teachers reported they believe their content knowledge increased, and several expressed interest in additional content focused professional development. It is also important to note that the sample sizes of the teacher participant group (18) and the teacher comparison group (12) were relatively small which limits the statistical power when analyzing the data.

Multiple evaluation sources provide evidence of change in instructional practices for some but not all teachers, including increased use of hands-on and inquiry-based science content. The GCSD seventh grade students scored significantly higher on the astronomy posttest than the

comparison district seventh graders. There was not a significant overall difference between GCSD fourth grade students' scores and comparison district fourth grade students' scores.

Overall, the collaborating parties successfully implemented a well-planned teacher professional development project that addressed the identified needs, and with which the teachers themselves felt was valuable. Teachers' responses to the coaching component varied, with some teachers very pleased with the coaching they received and other teachers far less satisfied.

Appendix A:

Rio Connection: Gallipolis Focus on Science Education
Teacher Professional Development Satisfaction Survey

Instructions: Please take a few moments to tell us your opinions on this **Science Professional Development**.

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 earth and space science?	**1** Not At All	**2**	**3**	**4**	**5**	**6**	**7** Very Much	
4. Has the professional development increased your knowledge of inquiry-based strategies?	**1** Not At All	**2**	**3**	**4**	**5**	**6**	**7** Very Much	
5. How confident are you in your ability to implement what you have learned in this professional development in the classroom?	**1** Not At All	**2**	**3**	**4**	**5**	**6**	**7** Very Much	
6. Which aspect of the week-long professional development series do you think will be more helpful to your teaching overall?	**Learning Science Through Inquiry**	**Earth and Space Science**	**Both Equally Helpful**					
7. What did you like best about this professional development?								
8. What did you like least about this professional development?								
9. Do you have any final comments?								

Thanks!

Rio Connection: Gallipolis Focus on Science Education
Teacher Professional Development Satisfaction Survey

Instructions: Please take a few moments to tell us your opinions on this **Science Professional Development**.

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 was this professional development for your current needs as a teacher?	**1** **2** **3** **4** **5** **6** **7** Not At All — Very Much
2. Did you receive individual coaching? *(If no, skip to question 7)*	**Yes** **No** **Not Sure**
3. If yes, approximately how many hours of individual coaching did you receive?	**_____Hours**
4. Was the coaching helpful to you?	**1** **2** **3** **4** **5** **6** **7** Not At All — Very Much
5. Has the coaching the affected your teaching?	**1** **2** **3** **4** **5** **6** **7** Not At All — Very Much
6. If the coaching has affected your teaching, can you provide examples?	
7. Did the Earth and Space Science workshops at the beginning of the 2011/2012 school year affect your teaching and if so how?	
8. What did you like best about this professional development?	
9. What did you like least about this professional development?	

10. Do you have any final comments?

Appendix B:

Rio Connections:

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: Gallipolis Focus on Science Education. This 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.

I would like to audio record the discussion so I 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. Overall, how appropriate do you feel this professional development including the individual coaching was for your current needs as a teacher?

2. Describe how the coaches have been involved and what are your thoughts about the coaches involvement?
   How many received coaching? What worked well and what were the barriers?

3. How has the professional development increased your knowledge in earth and space science and or teaching methods?

4. How much of what you learned in this professional development was transferrable to the classroom?
   a. Ask for examples.

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

6. What did you like best about this professional development?

7. What did you like least about this professional development?

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

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

Thank you!!

OHIO
UNIVERSITY

Voinovich School of
Leadership and Public Affairs