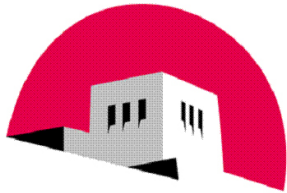


PROGRESS REPORT



The University of New Mexico

GK-12 E-MRGE Project 2008-2009 School Year

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Dan Cathey, MPA, Paul Guerin, Ph.D., and
Elizabeth Watkins, MPA

Prepared for Scott Collins, Ph.D. and
Laura Crossey, Ph.D.

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PREFACE

This Progress Report includes the activities of the Ecohydrogeology in the Middle Rio Grande Environment (E-MRGE) project, through the 2008-2009 school year. The E-MRGE project has completed three years and is now finishing the 2009-2010 school year. This will be the final year of the project under the current grant.

A Brief Overview of the Project

E-MRGE began in 2006 using funds from the National Science Foundation (NSF). It started as a three-year partnership between the Sevilleta Long-Term Ecological Research Program (LTER) at the University of New Mexico (UNM), the Sevilleta National Wildlife Refuge (SNWR), and the Socorro and Belen School Districts.

Initially, the E-MRGE stakeholders envisioned the project would build links between UNM and teachers in Socorro and Belen, New Mexico. By building links, they hoped to create a more enlightened public, improve formal and informal science education, and recruit the next generation of environmental scientists. The project stakeholders selected these communities because of location, interest, and need. These two towns are a distance from Albuquerque so they have less exposure and interactions with career scientists located from an urban center. Additionally, each school district is in proximity - within 19 miles - to the SNWR. The need for the project being in these schools was also justified because of the school's sub-standard educational status. Middle schools in both communities have not met state educational standards and are on disciplinary status. During Year-Two of the project E-MRGE established a relationship with the Laguna Middle School in Laguna, New Mexico and added that school to the project. The school is located on the Laguna Reservation approximately 45 miles west of Albuquerque. Four fellows were assigned to the school during the second year of the project (2007-2008 school year).

In brief, E-MRGE uses UNM graduate students to work with middle school teachers. "Fellows" support classroom activities and develop additional outside activities for teachers and students to learn science. Fellows and teachers also develop inquiry-based activities providing hands-on science opportunities to middle school students. These activities also assist the participant teachers to meet New Mexico science standards. E-MRGE stakeholders anticipate the Fellows will acquire enhanced teaching skills and teachers in the program will gain greater scientific knowledge and a supply of inquiry-based curriculum activities.

E-MRGE Goals

The six goals of the E-MRGE project are to:

1. Develop collaborations that will improve the teaching and outreach skills of the E-MRGE Fellows, and the content knowledge and its application for K-12.
2. Enable graduate teaching Fellows in disciplines related to ecohydrogeology to understand better the educational opportunities and practices of public schools.
3. Strengthen existing partnerships and create new ones among the University of New Mexico and rural school districts.
4. Provide the context for collaborations among K-12 teachers and students and Fellows so everyone can better understand and contribute to interdisciplinary

scientific study, as well as teaching and learning about ecology and water resources, especially focused on regionally relevant topics.

5. Actively involve K-12 teachers and students in relevant inquiry to investigate interdisciplinary ecohydrogeology questions in the Middle Rio Grande Region using the processes, skills and tools of science, technology, engineering, and mathematics (STEM).
6. Familiarize K-12 teachers and students with the literature, media, technology, and local community resources that will increase their STEM knowledge and their ability to access further knowledge.

Project Activities

Ten Fellows were hired before the 2008-2009 school year began. Three were returning Fellows and seven were starting their first year in the project. As in previous years the PI's hired new Fellows from a pool of applicants from UNM's Biology and Earth and Planetary Sciences Departments. Fellows were assigned to schools based on need, schedule, and interest. Initially, four Fellows worked at Laguna, three at Belen Middle School and three at Sarracino Middle School in Socorro, New Mexico. Early in the 2008 Fall Semester, one Fellow left Sarracino and went to Laguna, leaving two Fellows at Sarracino.

Table 1 Fellow Facts for Three Years			
	2006-07	2007-08	2008-09
Number of Fellows	7	10	10
School Assignments	<ul style="list-style-type: none"> • Belen = 4 • Sarracino = 3 	<ul style="list-style-type: none"> • Belen = 4 • Sarracino = 2 • Laguna = 4 	<ul style="list-style-type: none"> • Belen = 3 • Sarracino = 2 • Laguna = 5
Field of Study	<ul style="list-style-type: none"> • Biology = 4 • Earth & Planetary Sci = 3 	<ul style="list-style-type: none"> • Biology = 6 • Earth & Planetary Sci = 4 	<ul style="list-style-type: none"> • Biology = 5 • Earth & Planetary Sci = 5

Fellows continued to work with teachers in science-related activities occurring outside the classroom and the traditional school day. Outside activities focused on biology, hydrology, and geology topics.

Table 2 School Year Facts and Activities

School Year 2008-2009 Facts & Activities
<ul style="list-style-type: none"> • Ten UNM graduate students were employed as Fellows. Three (3) Fellows were assigned to Belen Middle School, two (2) Fellows were assigned to work at Sarracino Middle School in Socorro, New Mexico, and five (5) Fellows worked at Laguna Middle School in Laguna, New Mexico. One Fellow worked in an after school program at Laguna. • Eleven teachers participated in the E-MRGE Project. • Fellows were assigned to work at a specific school and most were assigned to one teacher. • E-MRGE works with students in grades 6 through 8. • PI's conducted a workshop for the Fellows and teachers before the beginning of the 2009 Spring semester.

The Fellows receive contracts for 12-month periods with salaries large enough to attract high-quality candidates in competition for traditional graduate Research Assistantships, Teaching Assistantships, or other fellowships.

In January 2009, nine Fellows, eight teachers, two PIs, and two researchers from ISR, participated in a day and a half workshop at the SNWR. The PIs organized and led the workshop. Time was given to discuss accomplishments of the program; address the teaching and learning process; and plans for the Spring and Summer activities. The workshop was also an opportunity for the second-year Fellows to discuss the project and share resources they developed. Plans for the next GK-12 Conference in Washington D.C. were also discussed and the summer field experience was reviewed and planned.

A proposed product of E-MRGE is a series of learning modules, i.e., lesson plans, for teachers. The teachers and Fellows developed learning modules jointly. These materials focus on specific approaches teachers use to introduce scientific inquiry-based learning in their classrooms, with hands-on investigation, and student-directed learning, in the context of a classroom or outdoor activity. The modules include simple but innovative experiments that integrate recent advances in concepts in physical science, chemistry, and biology, and encourage critical thinking about the impacts of science on the environment and the implications of advanced scientific research on human lives. During the first two-years, Fellows made strides toward building a body of classroom activities. The PI's continued to encourage the Fellows to generate and document any activities, demonstrations, or work products so they might be replicated and memorialized for future Fellows and to demonstrate the benefit of the E-MRGE project. During the third year more effort was made and the PIs began putting the modules on the E-MRGE website (<http://epswww.unm.edu/GK-12/>).

During Year-Two a procedure was implemented for the Fellows to submit weekly work logs of their activities. This endeavor was continued in Year-Three with limited success. All ten Fellows submitted work logs during Year-Three, but only three Fellows provided mostly complete entries for the entire year. One Fellow followed the work logs through from the beginning of her fellowship to the end in August 2009. Two fellows updated their logs weekly and continued until the end of the public school semester. Most Fellows began the year using the work logs but by the end of the semester (December 2008) they had begun to not use the logs and could not seem to begin using the logs again. Work logs include the frequency and amount of time spent on six specific activities: working in the classroom; personal planning; planning with a teacher; special events; administrative tasks, and miscellaneous tasks. This information gives the PI's a management tool and provides ISR with information to compare to Fellow's survey data. The work log form is provided in this report as Appendix (number later).

After Year-One, we observed that the PIs and the Fellows did not meet on a regular basis, between the Orientation and the Mid-Year workshop in January. We suggested they meet a routine basis during the school year. At the beginning of Year-Two the PIs implemented regular scheduled meetings with the Fellows. During these meetings the Fellows and PI's compared notes and reflected on their experiences. The time was also used to discuss future activities, schedules, and national and regional GK-12 events. These meetings occurred during Year-Three but not as routinely or as often as in Year-Two.

Evaluation Questions

Our evaluation questions measure four functions: 1) what is happening; 2) what is working; 3) what problems are occurring; and 4) what changes should be made (if any). The project evaluation questions are:

1. To what extent did the Fellows benefit from the experience of participating in the E-MRGE Project?
2. Did the E-MRGE Project impact middle school student interests and attitudes toward learning STEM related topics [biology and earth sciences specifically]?
3. Did the E-MRGE Project contribute to the classroom teachers' beliefs and professional development toward teaching STEM related topics?
4. To what extent can the E-MRGE Project promote the transfer of plans and technical know how to other schools (i.e., educational institutions beyond the realm of the target study)?
5. How effective were the inquiry based instructional modules in fostering student understanding and enjoyment of STEM related topics?
6. Did the Fellow's participation in the preliminary orientation session promote their abilities in being successful contributors to the E-MRGE Project?

ISR Evaluation Methodology

Our initial evaluation design drew on NSF evaluation methods. During Year-One of the project we used multiple information sources and perspectives to evaluate the project. We used quantitative and qualitative data collection methods in Year-One. During Years-Two and Three we attended workshops, meetings, conducted surveys of the teachers, Fellows, and students, and we reviewed the Fellow's work logs.

Table 3 Data Collection Methods and Quantity Matrix 2008-2009 School Year

Method	Quantity
Surveys:	6 Fellows, 11 Teachers, and 56 Students
Observations:	1 workshop, and 5 weekly meetings during the 2008-2009 school year (attended by ISR)
Work logs:	All 10 Fellows participated to some degree.

During Year-Three, we continued to survey the participants and in January and March 2009 we distributed surveys to each Fellow and Teacher. In April 2009 we surveyed approximately 56 students. Teachers and Fellows were asked questions aimed at measuring their feelings of the importance and level of confidence they have regarding issues related to the E-MRGE project. Fellows were also asked questions regarding, major field(s) of study, teaching experience, etc. Teachers were asked about their years of employment, education level, and college major. Students were asked questions related to their interest in science and the impact of the Fellow on the student's learning experience. Two staff members attended the workshop at the SNWR, and weekly meetings during Year-Three of the project.

FINDINGS

Description of E-MRGE Fellows and Teachers

Table 4 characterizes the 2008-2009 Fellows. Additionally, teachers were also asked to describe themselves in the survey. See Table 5 for their responses.

All the Fellows are in the biology or planetary sciences graduate program and aspire to jobs in teaching or research. Several received honors as undergraduates. There were eight female and two male Fellows. Five of the six surveyed Fellows report they had some teaching experience before coming to the E-MRGE project.

Table 4 Description of 2008-2009 Fellows	
Characteristic	Summary
Demographics	<ul style="list-style-type: none"> 8 are White, 1 is Hispanic, and 1 is Native American. 2 Males and 8 Females. 3 are 2nd Year Fellows and 7 are 1st Year Fellows.
Education	<ul style="list-style-type: none"> 7 had an undergraduate degree plus more than 15 hours. 3 had Master's degrees.

Teachers were asked to describe themselves. One teacher had taught for more than 29 years and three teachers taught for more than 15 years. Four majored in a science related field in college; and three have graduate degrees in education or science related fields.

Table 5 Description of 2008-2009 Teachers	
Characteristic	Summary
Schools & Experience	<ul style="list-style-type: none"> 11 teachers 2 years is the minimum and 29 years the maximum years taught.
Education	<ul style="list-style-type: none"> 4 majored in a science related field in college. 6 majored in an education related field in college. 6 graduated from New Mexico colleges. 3 have Masters degrees related to education or science.

Student Survey

During April 2009, staff from ISR conducted a survey of 56 students in the Sarracino Middle School. All the students were in the 6th grade and most (64%) were 12 years of age. Girls outnumbered boys, 30 to 26. Seventy percent of the students were Hispanic, 12.5% were White, 5.4% were Native American, and 3.6% were Asian. A large majority of the students (82%) taking the survey reported making good grades (A or B).

Results from the Fellow, Student, and Teacher Surveys

Evaluation Question 1: To what extent did the fellows benefit from the experience of participating in the E-MRGE Project?

We compared responses of Fellows experiencing their first year in the program to Fellows going through their second year (Table 6). Overall, first and second year Fellows reported benefiting from participating in the E-MRGE project. They agreed the project had improved their teaching ability. The mean rating in this category improved from 3.6 for first year fellows to 4.3 for second year fellows. The Fellows reported a broader experience the second year over the first also (3.4 first year mean, 3.6 second year mean). Fellows also agreed the Teachers helped the content of their instruction. They expressed mixed opinions about the project benefiting their communication skills. The program experience did not seem to necessarily benefit the Fellows understanding of their own research.

Table 6 Fellows Benefit From Project		
Fellows respond...	First Year Mean (n=15)	Second Year Mean (n=8)
GK-12 has improved my teaching ability.	3.6	4.3
The GK-12 Program broadened/deepened experience this year.	3.4	3.6
My instructional content has benefited from Teacher's contribution.	3.5	3.8
Teachers contributed to better understanding of communication and presenting.	2.9	2.8
GK-12 Program has helped clarify understanding of research.	2.7	2.6

Chart 1 shows the teacher's responses regarding the quality of the E-MRGE Fellows on the project. All teachers agreed the Fellows were capable and qualified. Five teachers gave the fellows the highest rating ("5") for this topic. The mean rating for the three years was 4.4.

Chart 1 Teachers Sum Fellow's Abilities

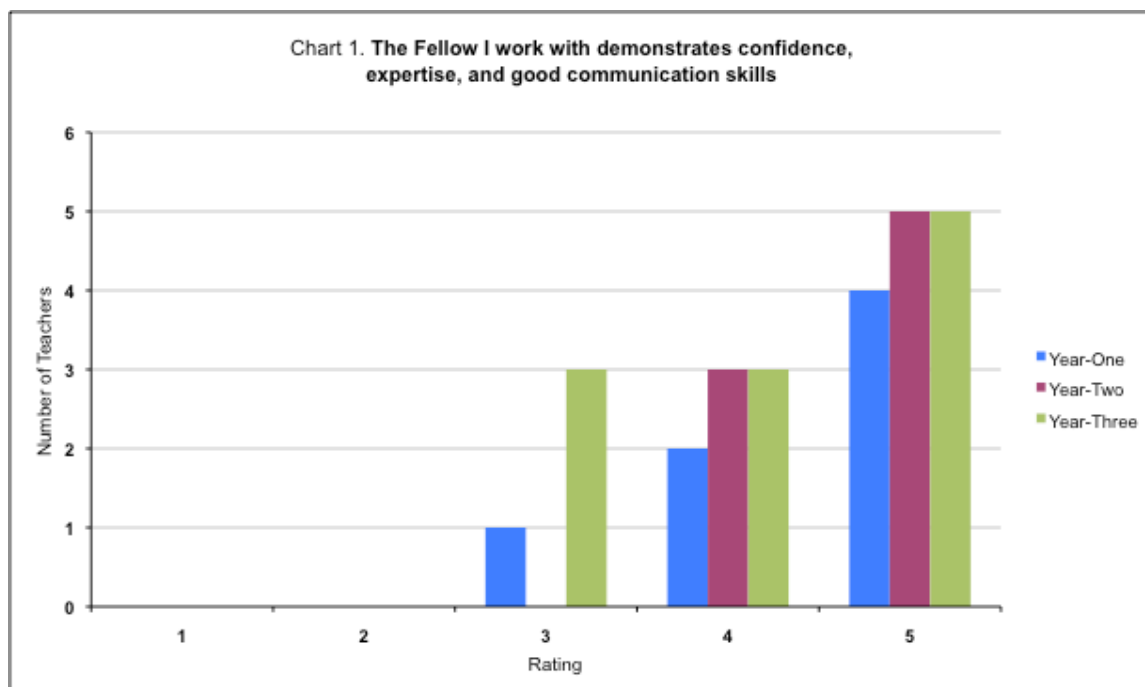


Table 7 expresses the Fellow's level of confidence in their ability to use various teaching techniques to the importance of this ability and shows the difference, i.e., gap. Fellows rated the importance of using teaching techniques as moderately important and their confidence to use those techniques as slightly less. As a measure of change since the previous years, we include a "gap" measure, which is the difference between the mean confidence rate and the mean importance rate. Table 7 shows the gap measure has fluctuated over the three-year period regarding the Fellow's judgment of their ability to use various teaching techniques.

Table 7 Fellows Ability To Use Teaching Techniques			
Year	Mean Confidence Rate	Mean Importance Rate	Gap
Year-One	3.1	3.9	-.8
Year-Two	3.5	3.6	-.1
Year-Three	3.0	3.7	-.7

We also analyzed the Fellow's responses by experience in the project. First-Year Fellows gave a mean rating of 3.8 to the importance of teaching various techniques and a mean of 3.3 for confidence. Second-Year Fellows rated importance as 3.6 and confidence as 3.1.

We asked the students a series of questions describing the Fellow in their classroom. Table 8 shows the average response to each question by the students. Responses were measured on a scale of 1 to 5 with 1 being "strongly disagree" and 5 being "strongly agree." The students rated the Fellows high in almost every instance. Ratings were not significantly different from Year-One to Year-Three.

Table 8 Students Responses About The Fellows			
The fellow...	Year-One Mean	Year-Two Mean	Year-Three Mean
Speaks clearly and can be easily understood.	4.5	4.3	4.5
Challenges me to think about the subject	4.2	3.9	4.3
Makes class interesting	4.3	4.4	4.5
Asks questions that help me understand the topic	4.3	4.3	4.4
Gives clear directions about assignments	4.3	4.5	4.5
Treats me with courtesy and respect	4.6	4.8	4.5
Is patient when working with me	4.5	4.4	4.4
Encourages me to participate in class discussion	4.3	4.2	4.5
Helps me solve problems and do my work.	4.3	4.1	4.5
Seems to like working with me.	3.9	4.1	4.0
Works well with my teacher.	4.4	4.3	4.6
Is a friend of my teacher.	4.3	4.0	4.4

Recap: To what extent did the Fellows benefit from the E-MRGE project? Survey responses from the teachers, Fellows, and students indicate the Fellows benefited from the project. Their educational experiences were enhanced and their communication and teaching skills seemed to have improved. The opportunities to teach, present information, and direct experiments seems to have an impact on the Fellow's improved communication skills.

Evaluation Question 2: Did the E-MRGE Project impact K-12 student interests and attitudes toward learning STEM related topics [biology and earth sciences specifically]?

When asked if students appear to be interested in learning the scientific method Fellows and teachers gave positive responses. Fellows rated the student's interest in learning science an average of 3.2 over three years. Teacher's ratings of student's interest in science also increased from 2.9 the first-year to a mean of 3.3 the third-year (Table 9).

Table 9 Fellows And Teacher's Rating Of Student Interest In Science						
	Fellow's responses			Teacher's responses		
	Year-One	Year-Two	Year-Three	Year-One	Year-Two	Year-Three
n	7	10	5	7	8	11
Mean	3.1	3.3	3.0	2.9	3.1	3.3

Table 10 shows the confidence and importance the Fellows placed on the topic of developing students' interest in science. The first two years of results show the Fellow's confidence decreased slightly in their ability to develop the student's interest in science. In Year-Three, the Fellows confidence in developing student's interest exceeded the importance they gave the topic.

Table 10 Fellows Responses To Developing Student Interest			
Year	Mean Confidence Rate	Mean Importance Rate	Gap
Year-One	3.7	3.9	-0.2
Year-Two	3.4	3.9	-0.5
Year-Three	3.7	3.5	0.2

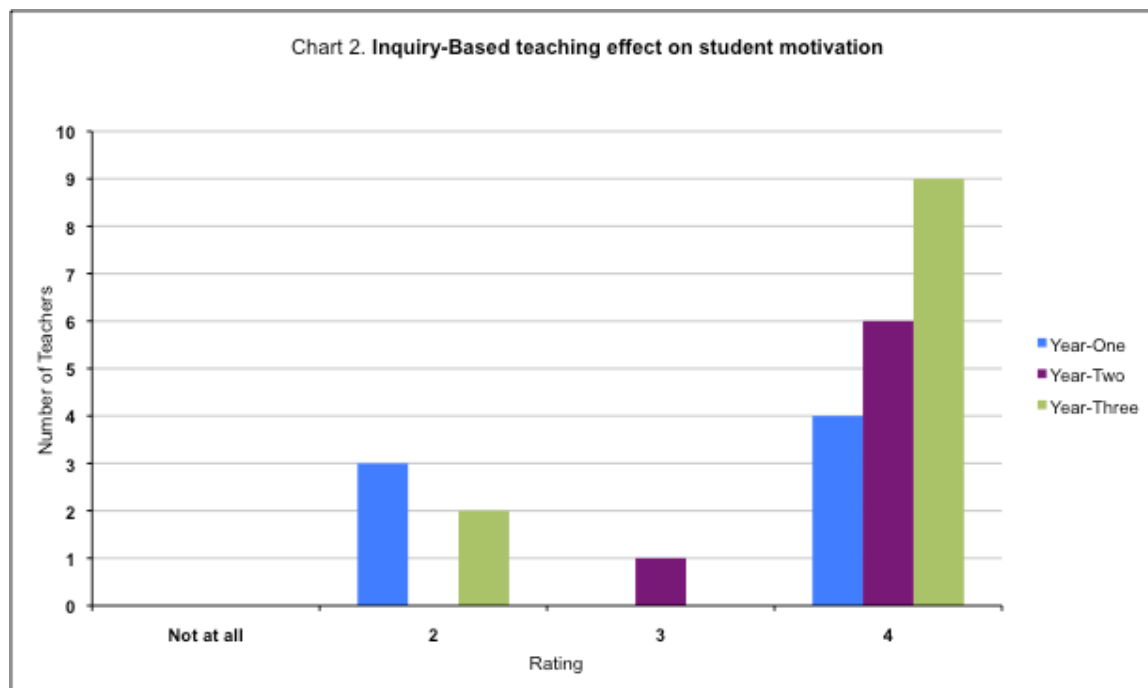
We asked students to describe their attitude about science. Students had a positive attitude about science. Student's described their attitudes at virtually the same positive level for three years, with a little increase from Year-One to Year-Three (Table 11).

Table 11 Students Attitudes About Science			
Students think...	Year-One Mean n=49	Year-Two Mean n=32	Year-Three Mean n=54
Science is very interesting.	4.2	4.2	4.3
It is important for me to know about science in my daily life.	4.2	4.1	4.4
Boys and girls can be equally good at science.	4.3	4.5	4.4
Science is useful in solving every day problems.	3.6	3.8	4.1
I am good at science.	3.7	3.5	3.9

We also asked the students about their interests related to education and science. Students strongly agreed they are interested in going to college. Over the three years, this remains the highest positive response by the students in the survey. Overall, students are interested in science and continuing their education (Table 12).

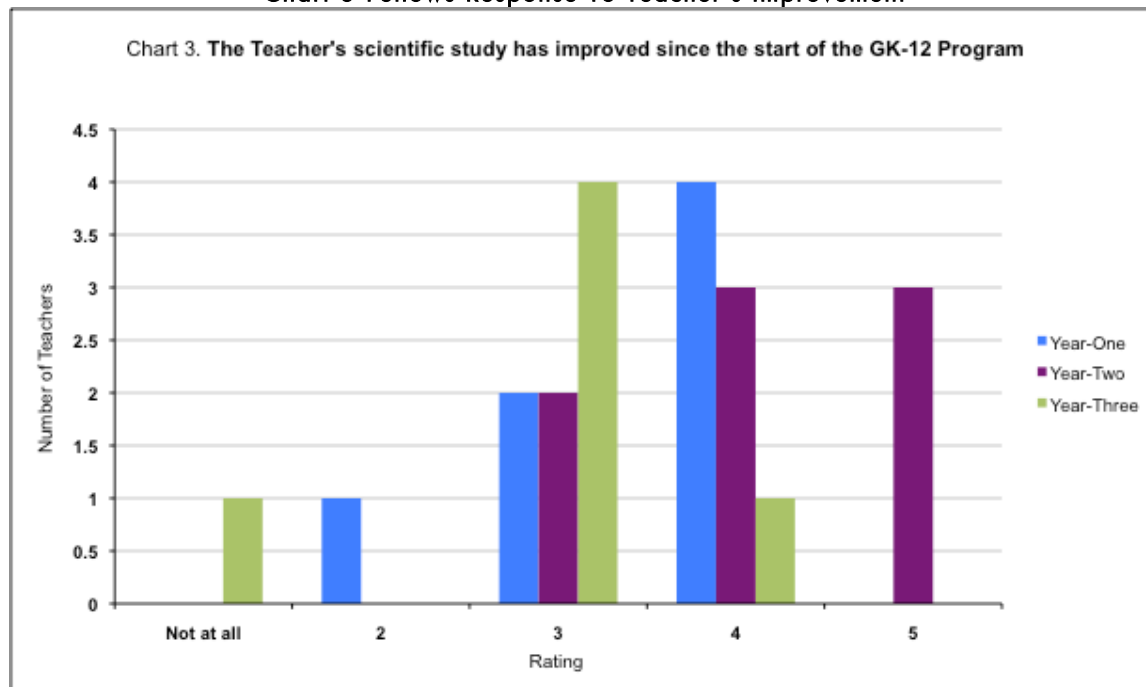
Table 12 Students Interests			
I am interested in...	Year-One Mean n=49	Year-Two Mean n=32	Year-Three Mean n=56
Discussing science with friends and family.	3.6	3.5	3.7
Reading articles about science in newspapers, magazines, or on the Internet.	3.4	3.8	3.6
Taking additional science courses beyond the required ones.	3.2	3.1	3.6
Going to college.	4.8	4.8	4.7
Majoring in a science-related field in college.	3.5	3.6	3.6
Joining a science club or organization.	3.1	3.6	3.1

Chart 2 Inquiry-Based Teaching Effect On Student Motivation



Recap: Responses from the Fellows, teachers, and students indicate the E-MRGE project may have a positive impact on the students. Teachers report the inquiry-based teaching technique has had a positive impact on students' motivation (Chart 2). The three-year mean rating for this question is 2.6. Students appear to be motivated, in part due to the effect of inquiry-based teaching and have more positive attitudes toward the subject matter suggesting the Fellows have had a positive impact on the students.

Evaluation Question 3: Did the E-MRGE Project contribute to the classroom teacher's beliefs and professional development toward teaching STEM related topics?

Chart 3 Fellows Response To Teacher's Improvement

In Year-Two the Fellows generally agreed in their judgment that the teachers' scientific study had improved since the E-MRGE project was introduced (Chart 3). In Year-Three the scores backed up a bit.

Teachers were asked to indicate how confident they felt about using inquiry-based learning techniques in the classroom and how important this issue was for their students. Table 13 shows the teachers overall rating has improved in the third year. Teachers feel this topic is important and use this technique in the classroom and after two years teachers are slightly more confident in their use of inquiry-based techniques.

Table 13 Teachers Use Of Inquiry-Based Techniques			
Year	Mean Confidence Rate	Mean Importance Rate	Gap
Year-One	2.9	3.9	-1.0
Year-Two	2.9	3.9	-1.0
Year-Three	3.1	3.8	-.7

The teachers think they are proficient at teaching facts, rules, and vocabulary. Over three years, the teachers rate their confidence in teaching facts higher than their perceived importance of the issue. Teachers appear confident in their abilities to teach the facts and vocabulary of science (Table 14).

Table 14 Teachers Responses To Teaching Facts			
Year	Mean Confidence Rate	Mean Importance Rate	Gap
Year-One	3.9	3.4	.5
Year-Two	3.5	3.3	.2
Year-Three	3.7	3.3	.4

Table 15 shows the teacher's responses to questions describing their feelings about the E-MRGE program increasing their educational experience and contributing to their understanding of science. Teachers seem to feel the program makes a positive contribution but it is unknown how much the program influences the teachers beyond the classroom.

Table 15 Teachers Acknowledge Program Benefits			
Teacher's respond...	Year-One Mean N=7	Year-Two Mean N=8	Year-Three Mean N=10
Participating in E-MRGE has added to by educational experience.	3.3	3.3	3.4
The Fellow has contributed to my understanding of science.	3.1	3.3	3.4

Recap: Overall, in Year-Three the E-MRGE program seems to have a positive influence on the teacher's. The fellows gave the teachers high marks and the teachers gave themselves slightly higher rankings from Year-One and Year-Two concerning issues related to professional development. Just as in prior years, in Year-Three, Teachers were very confident in their ability to teach facts and vocabulary. They were slightly more certain of their ability to use the inquiry-based technique.

Evaluation Question 4: To what extent did the E-MRGE Program promote the transfer of plans and technical know how to other schools (i.e., educational institutions beyond the realm of the target study)?

During the 2007 UNM Summer Intersession, one Fellow organized a summer camp at the SNWR for mid-school students from Belen and Socorro. The Camp was held for three years. The program was intended to give students the opportunity to experience the scientific process in real-like. Students wrote an application stating why they would like to get this internship and the Fellows selected the 14 best applications. During the weeklong science camp students participated in ongoing research projects, learned various field techniques, and collected data for ongoing field surveys. This year (2009) was the first year previous students were invited back. At the end of the week returning students gave a short presentation to their parents about their camp experiences. Students and Fellows continue to say the camp is a success and has seemed to motivate students to learn science.

The Belen Middle School Fellows and Teachers organized the Belen Outdoor Education Program (BOEP). The first year (2007-2008) the Fellows took students (approximately 7) from Belen Middle School to the Jemez, Organ, and Manzano Mountains, Carlsbad Caverns and the White Sands Monument in New Mexico to explore the geology, flora, and fauna of that area. The BOEP also explored the sites in the Coconino National Forest and the Grand Canyon in Arizona. During Year-Three BOEP explored the Bosque del Apache National Wildlife Refuge, the Rio Grande Nature Center, and Carlsbad Caverns, and White Sands.

The E-MRGE program PI's continue to collect class activities and projects the Fellows have used in their classes. They distribute the instructions of the most successful activities and projects to participant teachers and make the activities available to a broader audience using the E-MRGE website (<http://epswww.unm.edu/gk-12/>). The Fellows shared their experiences at the 2009 "Meet and Greet" Session held in January 2009 at the Sevilleta. During this weekend workshop Fellows shared their "best" class activities with other Fellows, the PIs, and teachers. The Fellows also explored using outside activities to supplement the indoor classroom projects.

E-MRGE teamed with Project Venture in Laguna, New Mexico. Project Venture (PV) is an outdoor experiential youth development program designed for high-risk American Indian youth and youth from other ethnic groups. PV aims to prevent substance use and related problems through:

- Classroom-based problem-solving activities
- Outdoor experiential activities
- Adventure camps and treks
- Community-oriented service learning

The program relies on American Indian traditional values to help youth develop positive self-concept, effective social interaction skills, a community service ethic, internal locus of control, and increased decision making and problem-solving skills. PV is a highly successful after school program. PV has goals of fostering leadership and cultural values in tribal students through outdoor experiential learning. Fellows joined with PV to take Laguna students to ski Sunrise Park Arizona, hike the Sandia Mts., Mt. Taylor, and the Grand Canyon, rafting Moab Utah, and hiking in California. At Grand Canyon the Fellow illustrated classroom topics in geology, astronomy and environmental science.

The issue of supplies and materials remains an issue for E-MRGE Teachers. Adequate science equipment and materials are necessary for the project to succeed and give students a hands-on inquiry-based learning experience. ISR asked teachers and Fellows several questions regarding the importance of the need for supplies to make the GK-12 model succeed (Tables 16 & 17). Both groups continue to feel that adequate supplies in the classroom are very important (3-year mean average of 4.6 for teachers and Fellows respectively). Teachers feel the classrooms are inadequately supplied. The Fellows aren't quite as harsh in their judgment of the supplies in the classroom. Teachers also felt the E-MRGE project probably cannot succeed without special equipment (mean of less than 3.0 over three years). The Fellow's seem slightly more confident that the program can succeed without special equipment (mean of 2.9 in Year-One to mean of 3.4 in Year-Three). After three years, teachers and Fellows continue to feel they have inadequate classroom computers (overall three-year mean for Teachers and Fellows of 2.1).

Table 16 The Importance Of Supplies And Equipment To Teachers

Teacher's respond...	Year-One Mean n=7	Year-Two Mean n=8	Year-Three Mean n=11
Adequate supplies in the classroom are important for the GK-12 program to succeed.	4.9	4.4	4.6
There are adequate supplies in my classroom to perform Standardized Tests.	2.9	2.3	3.1
GK-12 can succeed without special equipment.	2.9	2.8	2.7
I have adequate computing equipment in my classroom.	1.7	1.6	2.3

Table 17 The Importance Of Supplies And Equipment To Fellows

Fellow's respond...	2007 n=7	2008 n=10	2009 n=6
Adequate supplies in the classroom are important for the GK-12 program to succeed.	4.6	4.4	4.7
There are adequate supplies in my classroom to perform Standardized Tests.	3.0	3.8	3.5
GK-12 can succeed without special equipment.	2.9	3.6	3.4
I have adequate computing equipment in my classroom.	1.9	2.6	2.7

Recap: The BOEP, Summer Camp, and Project Venture association illustrate how the Fellows are able to take an idea, i.e., a summer camp, and fold it into their G-12 Program and the local middle school. One Fellow saw an opportunity, marshaled her Fellow colleagues and created the summer camp event for the middle school students. The Project Venture and E-MRGE at Laguna Middle School has also merged via the Fellow.

Indirectly, another example of the interaction outside the initial schools can be seen in the point-of-view the Fellows have toward the equipment questions. The Fellows see that the project can succeed without special equipment. Whereas the teachers are approximately 1 point lower on the rating scale. This difference might be pointing to the self-reliance and skill set the Fellows possess.

Evaluation Question 5: How effective were the inquiry-based instructional modules in fostering student understanding and enjoyment of STEM related topics?

Fellows and Teachers were asked about inquiry-based learning. Fellows report increased exposure to inquiry-based learning the second year but it dropped off in Year-Three. The Fellows see inquiry learning as important and seem to think it is somewhat effective (Table 18).

Table 18. Fellows Rate Effectiveness Of Inquiry-Based Learning

Fellow's respond...	Year-One Mean n=7	Year-Two Mean n=9	Year-Three Mean n=6
I have been exposed to the inquiry-based learning module.	2.4	3.3	2.4
The inquiry-based learning module is important for students.	3.1	3.7	4.3
I use inquiry-based techniques in the classroom.	3.4	3.5	3.7
Inquiry-based learning module is effective in the classroom.	3.2	3.9	3.0

Over three-years, Fellows think the inquiry-based method improved the student's ability to perform classroom activities, teacher-made exams, and recall content (Chart 4).

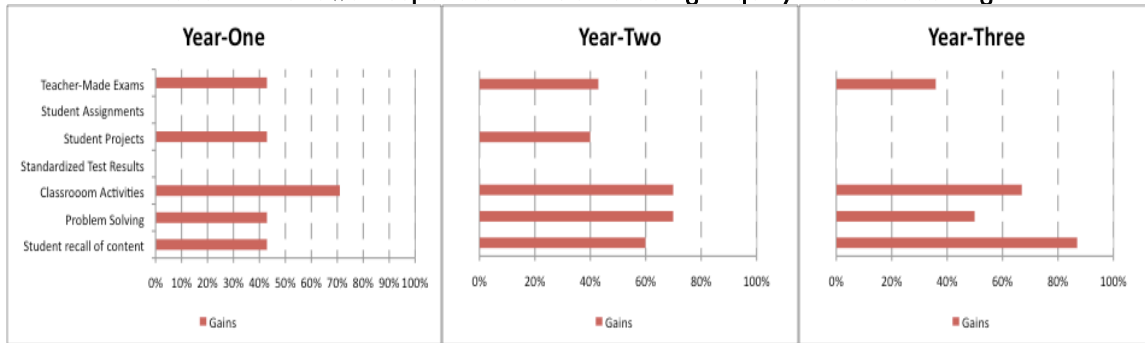
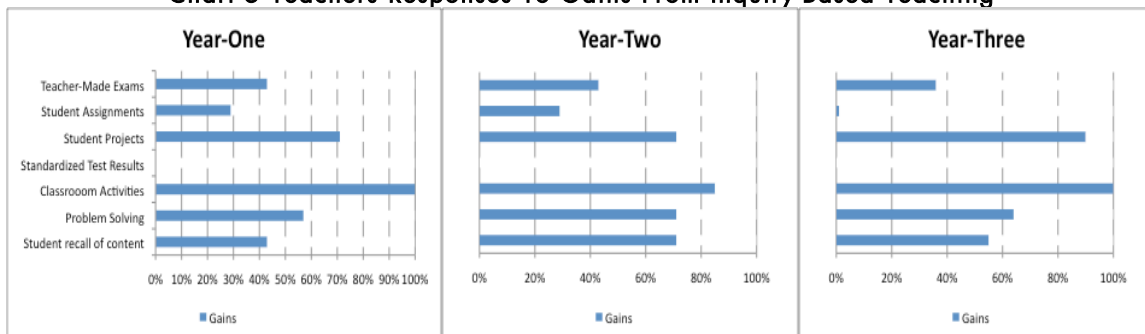
Chart 4 Fellows Responses On Gains Using Inquiry-Based Teaching

Chart 5 shows Teacher's observed gains in student achievement for three-years. Teacher's responses indicate students made gains in all but two areas supported by achievement indicators. Teachers did not see gains attributable to inquiry-based teaching regarding Standard Test Results and Student Assignments.

Chart 5 Teachers Responses To Gains From Inquiry-Based Teaching

Teachers' responses to questions regarding inquiry-based learning were positive. Teachers reported having some exposure to the inquiry technique over the three years of the program. They also report now using inquiry techniques in the classroom. Teachers also seem to think inquiry learning is effective (Table 19).

Table 19 Teachers Responses To Inquiry-Based

Teacher's respond...	Year-One Mean n=12	Year-Two Mean n=11	Year-Three Mean n=3
I have been exposed to the inquiry-based learning module.	3.2	3.6	4.0
The inquiry-based learning module is important for students.	4.2	4.2	4.0
I use inquiry-based techniques in the classroom.	3.5	4.0	4.3
Inquiry-based learning module is effective in the classroom.	3.8	3.8	3.7

Recap: Inquiry based techniques are important to the E-MRGE project. Fellows and Teachers report using inquiry-based techniques in the classroom and inquiry techniques seem to have a positive impact on the students. The Teachers seem to see more

improvement in the Student's performance than the Fellows see, and Teachers attribute the improvement to inquiry-based techniques.

Evaluation Question 6: Did the Fellow's participation in the preliminary orientation session promote their abilities in being successful contributors to the E-MRGE Project?

Seven fellows attended the orientation session in Year-One before the school term began. At that time, Fellows reported having a positive attitude about the E-MRGE project before it began (mean of 4.3). At the time our survey was administered all the Fellows reported a slightly less positive (mean of 4.1) attitude toward the project than they had at the start. At the beginning of Year-Two, all 10 Fellows attended the "Meet and Greet" Orientation. During Year-Two we administered the survey to the Fellows in January, at that time the Fellows report they had a positive attitude about E-MRGE at the beginning of the school year and a more positive attitude at the January mid-term than Year-One (Table 20). Year-Three began with higher mean attitude than the first two starts (4.7) but ended much lower (mean of 3.3). The 'n' is very small (n=2) for Year-Three but may be indicative of the general attitude of the Fellows.

Table 20 Fellows Attitude Toward Project			
Fellow's respond...	Year-One Mean n=7	Year-Two Mean n=10	Year-Three Mean n=2
Attitude about the project before it began (for them)	4.3	4.6	4.7
Current attitude about the project	4.1	4.2	3.3

Fellows offered suggestions for improving the Orientation after the Year-One Orientation: 1) Communicate expectations more clearly; 2) Provide more information on what is GK-12; 3) Explain in writing the logistical aspects of the grant such as money allocated, and how to properly fill out paperwork; and 4) Specifically teach and model inquiry techniques – "how do you get kids to ask and improve their own questions."

Table 21 Fellows Attitude Toward Orientation		
Fellow's respond...	First Year Fellows Mean n=11	Second Year Fellows Mean n=8
The Orientation was helpful	2.6	2.3

The Fellows reported feeling neutral to the "Meet and Greet" Orientation. Table 21 shows the attitude of first year Fellows compared to Fellows during their second year. The Fellow's attitude is lower their second year than it is the first year.

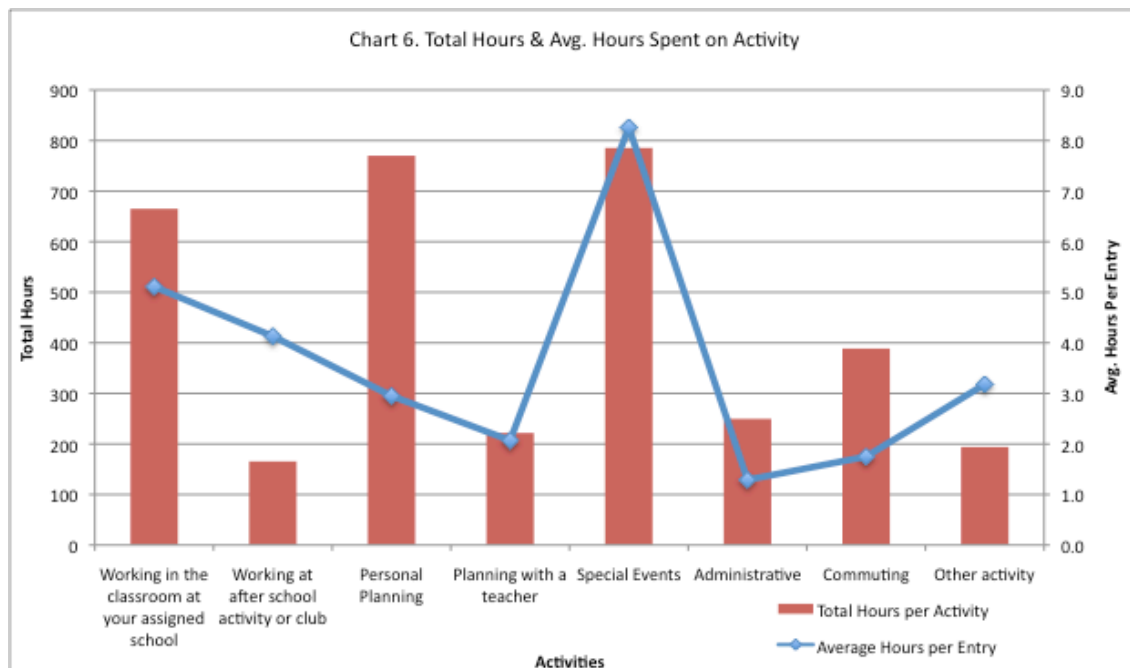
After the Year-Two Orientation, the Fellows offered similar suggestions but with a few more specifics. They suggested having: 1) More examples of inquiry-based learning techniques to implement in classroom; 2) Information on dealing with the Institutional Review Board (IRB) process so the results of classroom activities can be published; 3) Specifics about what is expected of the Fellows as far as products go; 4) Focus on "a day in the life of" type presentation; 5) More teachers should be present; 5) Explore aspects of the inquiry-based method, i.e., make teachers/specialists available to explain what it is, how it works, and provide example lesson plans.

Year-Three got off to a slow start. It happened that the UNM school year did not begin as quickly as the middle schools did so the Fellows were still preparing to join the program when the schools were already underway. Schedules did not coincide, the Teachers and the Fellows could not agree on a time to have an orientation session. The meeting at the mid-year was held in January 2009.

Work Logs

Fellows were asked at the start of Year-Two to submit a record of the time they spend on the project. Each of the Fellows submitted a work log. Three fellows submitted the bulk of the entries. Chart 6 diagrams by activity, the total hours and the average hours per entry for all Fellows. The activities are: Working in the classroom at your assigned school, Working at after school activity or club, Personal Planning, Planning with a teacher, A special event, Administrative, Commuting, and Other or Miscellaneous.

Chart 6 2008-2009 Fellow's Average And Total Hours Spent On Each E-MRGE Project Activity



The activity averaging the most time per entry was: working in the classroom (5 hours per entry) and special events (8.3 hours per entry). Administrative duties, commuting, and planning with the teacher averaged the least amount of time (approximately 2 hours per entry). The total hours do not reflect the complete picture of the time spent, because just 30% (3) Fellows contributed the greatest amount of work entries.

SUMMARY

This report describes the E-MRGE project at the end of its third year (2008-2009 School Year). Statistically significant changes were not discovered from the survey data but just as we found after the second year, overall, Fellows, teachers, and students seem to be benefiting from the project.

Fellows

Fellows in their first year and second year of the project reported benefiting from participating in the project. They also reported the project had improved their teaching ability. Each year of the project, the teachers have rated the Fellow's qualifications and capability very high. Five teachers scored this topic highest overall in the survey. Throughout the project, the students have continually rated the Fellows high in almost every survey category. Students rated the Fellows high during all three years of the project.

Students

Responses from the Fellows, teachers, and students indicate the E-MRGE project may have a positive impact on the students. Fellows and teachers feel students in the project appear to be interested in learning the scientific method. This may coincide with the fact, after two years teachers are slightly more confident in their use of inquiry-based techniques. Inquiry-based techniques are more thought provoking and interesting than the recitation of science facts and vocabulary. In addition to the teachers increased confidence in applying inquiry-based techniques, the Fellows also expressed confidence in their own ability to develop the student's interest in science.

Over the three-years, Fellows and teachers think the inquiry-based method improved the student's ability to perform classroom activities, projects, problem solving, teacher-made exams, and recalling content.

Students report they are very interested in going to college. Over the three years, this remains the highest positive response by the students in the survey. Overall, students are interested in science and in continuing their education. Perhaps, related to the students' initiative to go to college, is the teachers position that inquiry-based techniques have had a positive impact on the students' motivation. Students appear to be motivated, in part due to the effect of inquiry-based teaching and have more positive attitudes toward the subject matter suggesting the project has had a positive influence on the students.

Teachers

Each year, as a starting point we have asked teachers if they feel proficient at teaching facts and vocabulary. Each year teachers report they are very confident in their abilities to teach the facts and vocabulary of science. The teachers' ability to explain scientific facts and vocabulary is important. At every grade, the New Mexico Science Content Standards rely on the student knowing the scientific jargon associated with the topics at each Benchmark. It is appropriate, that the scope of the State Benchmarks for science education is sufficiently broad to be taught using inquiry-based techniques. Topics such as, the scientific method, understanding the processes of scientific investigation, the forms and properties of matter, explaining physical processes of energy, and motion lend themselves to inquiry-based techniques. The E-MRGE project has made a positive impact on the teachers more frequent use of inquiry-based techniques.

The Fellows gave the teachers high marks and the teachers gave themselves slightly higher rankings from Year-One and Year-Two concerning issues related to professional development. Teachers also report they are slightly more certain of their ability to use the inquiry-based technique. Teachers seem to feel the program makes a positive contribution but it is unknown how much the program influences the teachers beyond the classroom. Overall, E-MRGE program seems to have a positive influence on the teachers.

One area that has been hard to define is the impact E-MRGE has had on promoting and transferring plans and technical know how to other schools, i.e., educational institutions beyond the realm of the target study. After Year-One, the Fellows initiated the Summer Camp. This event extended E-MRGE beyond the regular school year. Year-Two, E-MRGE expanded to include one more school. This change also established the relationship between E-MRGE and Project Venture. In Belen, the Fellows created the Belen Outdoor Education Program. This program has broadened the outreach of E-MRGE. Fellows involved other teachers and parents as chaperons.