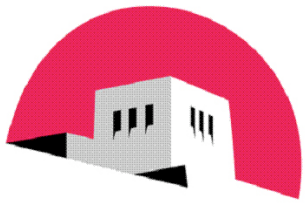
SUMMATIVE REPORT



The University of New Mexico

GK-12 Optics & Photonics Education Project

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Abbreviations

A&S	Arts and Sciences, University of New Mexico
APS	Albuquerque Public Schools
CETP	Collaboratives for Excellence in Teacher Preparation
COE	College of Education, University of New Mexico
COP	Classroom Observation Protocol
GK-12	NSF Graduate Teaching fellows in K-12
ISEF	International Science and Engineering Fair
ISR	Institute for Social Research, University of New Mexico
K-12	Kindergarten through 12th Grade
NSF	National Science Foundation
OPE	Optics & Photonics Education Project
SCIAD	Science Advisors Program
SNL	Sandia National Laboratories
SOE	School of Engineering, University of New Mexico
STEM	Science, Technology, Engineering, and Mathematics
UNM	University of New Mexico

Preface

This report chronicles the GK-12 Optics and Photonics Education project (OPE) in Albuquerque, New Mexico. The Institute for Social Research (ISR) was contracted to evaluate the project after Year-Two. Our Progress Report for the 2006-07 school year relied on the original project proposal and a brief report by the College of Education to describe the first two years of the project. This Summative Report reviews data from 2006 through 2008 and concludes our evaluation of the OPE project.

Overview of the Optics and Photonics Project

In 2003, the faculty of the School of Engineering (SOE), the College of Arts and Sciences (A&S), and the College of Education (COE) at the University of New Mexico (UNM) in partnership with the Albuquerque Public Schools (APS), received funding from the National Science Foundation (NSF) for the OPE project. The objective of the project was to improve math, science, and engineering education at the K-12 level, using the existing strengths in optical science and engineering education, research, and training in New Mexico, and emphasizing the interdisciplinary field of modern optics and photonics.

The vision for the project was to increase K-12 achievement in math and science by creating exciting new curricular enrichment modules in optics and photonics, which would be supported by hands-on learning via optics and photonics experiments and direct contact with GK-12 Graduate fellows. The OPE sought to increase the pool of students who are interested in and knowledgeable about photonics, and engineering. The project also hoped to strengthen the partnership between the local school district, Department of Engineering faculty, and College of Education faculty, and boost the content knowledge for math and science teachers. The focus of the project was to use local optics and photonics resources to enrich the science and math curriculum in several local public schools.

Needs Addressed by the Project

The project was implemented at a cluster of schools within the Albuquerque Public School District. The district is divided into 11 clusters comprised of a high school and the elementary and middle schools that feed into the high school.

As minority students represent more than half of the APS student population, the disparity in scores between white and minority students is a major concern. The math and science results for school year 2002-2003 for schools in the West Mesa Cluster were consistently below the district averages, thus focus on improving student achievement in these content areas was an important goal for this cluster.

Five Goals

The project proposal addressed the four goals of the National Science Foundation (NSF) GK-12 program, and an additional fifth goal set by the project stakeholders:

1. Providing Graduate Teaching fellows supervised by UNM faculty to enhance K-12 education in optics and photonics, and strengthen the existing partnership between the university and the local school district.
2. By involving practicing teachers and education faculty in conducting workshops for the Graduate Teaching fellows, the project provides STEM

graduate students with opportunities to learn new effective teaching methods and to improve their communication skills.
3. By teaming the Graduate Teaching fellows with K-12 math and science teachers, the project will create an environment in which teachers can improve their knowledge of modern optics and photonics while graduate students in STEM disciplines can improve their pedagogical skills.
4. By being an active presence in K-12 classrooms, the Graduate Teaching fellows will serve as role models to K-12 students with whom they can relate, and will directly contribute to enhanced knowledge of ubiquitous applications of optics and photonics in the modern world.
5. A fifth goal of the project was to develop an assessment and evaluation to produce evidence-based outcomes that contribute to the understanding of how students effectively learn science, engineering, and mathematics.

Project Activities

During the first year of the project, stakeholders at APS and administrators in the West Mesa Cluster identified lead contact teachers at each school site in the cluster. Fellows worked with a team of interested teachers at each school site. Each individual school identified teachers to work with the fellow and would identify those activities that met the needs of the individual school in achieving its goals in STEM and in meeting district and state standards in mathematics and science.

To assign fellows to schools and classes, a model developed in UNM's College of Education was used. Fellows chose four schools to visit in teams of two during the project orientation session. The fellows observed classrooms and teachers who would be participating in the project. After the visits, the teachers and fellows met and matched up to work together.

The GK-12 fellows worked with their teacher or teachers to enhance the existing curricula and optics and photonics demonstrations in the classroom. Fellows learned the teachers' objectives for STEM and the state and local standards. Additionally, the fellows worked with the teachers to modify existing instructional materials to improve the level and quality of inquiry-based experiences and to develop new learning modules. The GK-12 fellows did not act as a substitute teacher.

Fellows also worked with teachers in science-related activities occurring outside of the traditional school day. Such activities included family science events, existing or new science clubs, and school-wide science expositions that included student-developed experiments, demonstrations, models, and collections. All of these "outreach" activities had an optics/photonics focus.

During the first three years of the project, new GK-12 fellows were recruited into the program at the beginning of each Spring semester. Consideration was given to student's academic records and to their potential as a role model in the classroom. Efforts were made to recruit underrepresented minorities (preferably bilingual), women, and persons with disabilities into the GK-12 fellowships.

The GK-12 fellowships were awarded contracts for 12-month periods. Fellows were given lucrative salaries to attract high-quality candidates in competition for traditional graduate Research Assistant, Teaching Assistant, or other fellowships. The stakeholders determined that participation in the GK-12 program, should enrich the fellow's communication skills and knowledge of pedagogy but should not result in a longer time to graduation compared to other students. Fellows spent a minimum of 10 hours each week providing direct assistance to K-12 teachers and 5 hours a week preparing outside the classroom.

During the first three years of the project fellows participated in a training and orientation workshop one week before the beginning of the Fall semester. Throughout the project, fellows participated in an on-going seminar.

The project incorporated an on-going training and support session for the fellows in the form of a bi-weekly seminar. Initially, led by the project PI and later led by the APS project coordinator, all fellows were required to attend the bi-weekly seminar. Most seminar sessions focused on improved pedagogy and planning upcoming activities. Teachers were invited but rarely attended. The seminars were held beyond the teachers' contracted duty day. Seminars provided an opportunity for the fellows to strengthen their network by discussing challenges and successes they are experiencing, sharing resources they located or developed, and report on their progress in developing the learning modules. Fellows shared how they made connections between existing curricula and optics and photonics instruction. Time was allocated to further their understanding of the teaching and learning process, as well as address other needs identified by the fellows or the APS project coordinator.

The project proposal anticipated yearly summer workshops at UNM, where teachers would meet with faculty mentors for preliminary training in optics and photonics concepts and the creation of a series of new learning modules developed by faculty mentors, teachers, fellows, and experts from the College of Education. During the time ISR observed the project the fellows spent their summers developing a demonstration DVD of their best presentations and experiments for classrooms. This activity was different from the initial idea of creating traditional learning modules but the DVD's seem to be of practical use for teachers and students.

Evaluation Transition to ISR

At the end of the second year of the project, the NSF was concerned that "independent" reviewers accomplish the assessment of all GK-12 grants. As the OPE stakeholders prepared for the grant renewal, they decided to shift the assessment/evaluation function for the final year of the grant from COE to the UNM Institute for Social Research (ISR). The transition from the COE to the ISR occurred on July 31, 2006 and ISR continued on the project through the end of the fourth year.

Paul Guerin Ph.D., the PI for ISR, designed a modified evaluation drawing on work by evaluators from COE and the initial evaluation methodology to finish the initial grant and support any grant extension.

Evaluation Questions of the Project

The evaluation questions in the initial proposed project description were designed to 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). Specifically, the project evaluation questions were:

1. To what extent did the Graduate fellows benefit from the experience of participating in the GK-12 Project?
2. Did the GK-12 Project impact K-12 student interests and attitudes toward learning STEM related topics [optics and photonics specifically]?
3. Did the GK-12 Project contribute to the classroom teachers beliefs and professional development toward teaching STEM related topics?
4. To what extent did the GK-12 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 Graduate fellow's participation in the preliminary orientation session and periodic seminars promote their abilities in being successful contributors to the GK-12 Project?

The First Two Years

At the request of ISR, the College of Education staff completed an assessment of their involvement in the first two years of the OPE project. Below is a summary of the COE's assessment.

Evaluation Process

A graduate student designed the evaluation process used by the College of Education. This process relies on survey instruments, requiring all the participants in the program to be surveyed at least twice a year. The fellow students were surveyed after their orientation, after the first semester and at the end of the second semester. The teachers were to be surveyed at the end of both the first and second semester. The students were to be surveyed at the beginning and end of each school year.

This process did not prove to be entirely successful, especially during the first year, because so many students did not return the surveys. This was partially influenced by APS IRB policy requiring students to get permission from their parents to fill out these surveys. Many teachers also failed to turn in their surveys, the most common obstacle being the length of the survey. The surveys took an average of 10 to 15 minutes to complete. To remedy the problems experienced in the first year, the evaluation process in the second year used more classroom observations and interviews were used in place of surveys.

Fellows

The GK-12 program consists of up to 12 fellow graduate students working at a high school (West Mesa), middle schools (Truman, Carter, and Adams) and elementary schools (Carlos Rey, Alamosa, Susie Rayos Marmon, Chaparral, Edward Gonzalez, and Mary Ann Binford). All of these fellows have previous undergraduate work in sciences and engineering. Even though the GK-12 project focuses on optics and photonics, the fellow students were not from that field. Most of the fellows are male, and one is female in this year's cohort. The fellows were very good students but had little to no background in teaching. These fellows receive generous stipends (considerably more than assistantships pay) and career opportunities as incentives to participate on the project.

Generally, the fellows enjoyed the project and found it challenging and rewarding. The main obstacle to the project resulted from scheduling and coordinating with teachers. Often times, fellow students would have to work with substitute teachers because the normal teachers were not present. Fellows did not have any problems with keeping up with their schoolwork as observed by their academic advisors. A frequent complaint coming out of the fellows dealt with unmotivated students in the classes. Another complaint dealt with the fact that many teachers (especially in the elementary school) were not familiar with the science subject matter, which meant that the bulk of the teaching load fell onto the shoulders of the fellows. The project outlines the fact that the fellows are "subject-matter experts" and that the teachers are "instructional experts." So in essence, some of the teachers violated the program's guidelines.

Judging from the observations, the fellows adequately met the goals of the National Science Foundation. These goals include getting graduate students "out

of the lab and interacting with the schools to help improve science education in public schools. The conference in Washington, D.C. especially helped because fellows from all over the country were able to collaborate with each other.

Schools

The main problem concerning all the schools relates to overcrowding. To adequately house students every school in the cluster has to use portable buildings. Because of the overcrowding issue, many of the middle school classes do not have enough materials and supplies for all of the students. This mitigated the intended lesson put forth by the experiments. Language barriers also inhibited the lessons and were particularly evident at Alamosa elementary. At West Mesa High School, about 1/3 of the students clearly seemed disinterested in the subject matter.

Teachers

Teachers at the high school and middle school levels are expected to be "science teaching specialists," and at the elementary level, "science teaching generalists." Of the two teachers at West Mesa High School that participated in the GK12 program, one was a veteran physics teacher involved in the program's creation, and the other was relatively new to full-time teaching. At the middle schools, the teachers had a similar range as the one described at West Mesa High. The teachers particularly appreciated the fellows' help with the science fairs, since the teachers lack expertise in the area. The teachers and fellows worked the best when the teachers "made it clear to the fellows what they need in the area, and the fellows developing modules that address the standards directly."

Year-Three

ISR Evaluation Methodology

The third year of the project, ISR staff implemented a quantitative and qualitative data collection method and developed an observation instrument, a scaled questionnaire, methods for observing, protocols for conducting observations in the classroom, and survey instruments. The evaluation team made an effort to triangulate research methods because ISR and APS agreed a the project evaluation might benefit from a qualitative component. During Year-Three, quantitative and qualitative strategies described in Table 1 were used to adress the OPE project research questions.

Table 1 Data Collection Methods

Year Three Data Collection Methods and Quantity Matrix	
Method	**Quantity**
Surveys:	9 out of 9 fellows - 25 out of 37 teachers
Observations:	101 observations during the 2006-2007 school year; seminar observations
Informal Interviews:	Informal conversations with participants
Official UNM Registrar Data:	8 fellows described

Surveys

Surveys were deemed the most economic and efficient method for sampling large numbers of participants. In December 2006, the ISR staff created two survey instruments; one was given to the OPE teachers and one to the fellows. After the surveys were approved by the UNM IRB, ISR staff distributed the instruments by hand to each fellow and teacher in February 2007. In the fourth year of the project, ISR again administered the survey instruments to the fellows and teachers.

Non-Participant and Participant Observation

During Year-Three, ISR staff took observation notes and made objective descriptions of the activity in the school classrooms. Additionally, ISR staff created analytical notes, which provided an analysis and interpretation of the events and activitities in the classrooms. Typically, ISR staff did not agressively participate in classroom activities so as not to influence the process and affect the lesson. However, in a few situations the ISR observer was obliged to participate when the OPE fellow or the classroom teacher specifically invited the observer to participate in the activity.

Interviews

To accommodate busy teachers and fellows, ISR observers often conducted informal interviews during breaks between observation sessions. Comments from the fellows and teachers were included in the observer's notes. Overall, interviews proved useful in identifying obstacles and successes in the project.

Official School Data

During the third year, ISR staff distributed consent forms to teachers and fellows. These consent release forms were used to acquire the fellow's official UNM records, i.e., grade point averages, majors, etc. Teacher information included years of employment, education level, and college major.

Overview of Year-Three

During the first two years of the project, 16 graduate fellows were placed in 10 schools in the West Mesa Cluster of the Albuquerque Public School District. During the third year of the project (2006-2007 school year), nine (9) graduate students from the University of New Mexico (UNM) School of Engineering were employed by OPE to work as fellows. The OPE fellows provided direct assistance to three (3) science teachers at one high school, three (3) science teachers at two middle schools, and 31 teachers at six elementary schools in the West Mesa Cluster. As conceived in the project description, fellows assisted teachers in the classroom and were responsible for developing and presenting Inquiry-Based science projects to the teachers and students. Fellows were also expected to support existing or assist in developing new science clubs and participate in family science events, e.g., science fairs and expositions. At the beginning of the 2006-2007 school year, fellows attended a training and orientation session organized by the APS Project Coordinator and the OPE PI. Fellows attended the regularly scheduled seminar led by the Project Coordinator and reported their hours weekly to the Project Coordinator via e-mail. Seminar sessions had an average attendance of eight fellows per session (89%) throughout the year.[1] The seminar sessions afforded the Project Coordinator an opportunity to advance the fellow's knowledge of the public school system, plan future activities required by the grant, provide information on the standards-based curriculum, debrief and discuss the previous weeks' activities, and connect the fellows to other STEM activities in Albuquerque. Table 2 provides a brief summary of facts and activities for the OPE project during the 2006-2007 school year.

[1] Seminar attendance compiled from fellow's weekly work logs.

Table 2 School Year Facts & Activities

Third Year of the Project - Facts & Activities

School Year 2006-2007

- Nine UNM graduate students were employed as fellows. One fellow was assigned to West Mesa High School, two fellows were assigned to work at middle schools, and six fellows were assigned to work at elementary schools in the West Mesa Cluster of the Albuquerque Public School District.
- 37 teachers participated in the OPE Project.
- Fellows were typically assigned to work at a specific school.
- The OPE Project dealt with students in grades 4 through 12.
- Fellows spent a minimum of 10 hours each week providing direct assistance to teachers and 5 hours a week preparing outside the classroom.
- PI's and APS staff conducted a training/orientation workshop for the fellows, one week before the beginning of the 2006 Fall semester.
- The APS Project Coordinator worked closely with the fellows on a daily basis and led a well-attended on-going bi-weekly seminar for the fellows.
- OPE fellows had approximately 4,900 contacts with students during the 2006-2007 school year.
- During the 2006-2007 school year, ISR staff observed a total of 101 classroom sessions, 10 sessions at West Mesa High School, 33 at the middle schools, and 58 sessions at elementary schools. ISR staff also attended all the seminar sessions and several administrative meetings during the school year.

Spring 2007 Mid-Year Summary

ISR made several suggestions to the OPE stakeholders in the February 2007 Report in Brief. Obviously, the more information that exists about the OPE project the more can be learned about how the project works and what could be improved for the benefit of other GK-12 projects. Our observations and informal interviews were a beginning but we felt the surveys and background information on the fellows would add to our ability to measure the project. Findings from the quantitative and qualitative data suggest that several time management changes would improve the program. We suggested two immediate changes to the project in our report in brief.

1. Planning – The teachers and fellows would benefit by routinely planning together. Time is a factor, but a few minutes of planning would benefit the student's learning experiences. Planning, or the lack of planning, impacts the teacher's capacity to use and learn Inquiry-Based techniques; the student's opportunities for discovery; and the fellow's chances to transfer their research to the classroom. Planning is an integral part of our second suggestion as well.

2. The Role of the fellow – We have observed fellows serving in many different roles in the classrooms. Some fellows are encouraged by the teacher to take an equal share in teaching the class, other fellows are "encouraged" to sit and help when asked by the teacher for a special demonstration. Obviously, it is too late to make significant changes in the teacher's functional use of the fellows, but lesson planning would clarify the fellow's job in the classroom. The fellows are extremely intelligent, motivated, and energetic and clarifying their role would be a positive change in the OPE Program.

Third Year Summary

Fellows, teachers, and ISR observers agree they did benefit from the project. Fellows experienced enhanced educational opportunities and their communication skills improved. Teachers seem to have been stimulated by participating in the project to expand their teaching skills and students were exposed to science in new meaningful ways.

The OPE project existed for two years, before ISR joined the project. ISR designed a two-part method for collecting qualitative and quantitative data. Survey findings and observer ratings show the fellows benefited from the project as their educational experience and communication skills improved. The activity of teaching and presenting experiments seems to have impacted the fellow's more than the teacher's guidance. Teachers and ISR observers report the students were attentive to the fellows and had positive attitudes toward science. The GK-12 Project seems to have impressed teachers and increased their practice of using the Inquiry-Based teaching technique. Fellows, teachers, and observers noted that inquiry techniques are being used in the classrooms and seem to be having a positive impact on the students. Teachers feel that equipment and materials are important to teach students and the OPE has provided resources to the schools but the fellows and the teachers do not associate UNM support with routine support in the local schools. The project stakeholders made an effort early in the project to recruit qualified fellows, match fellows to teachers, and require the fellows to manage their time on the project. Additionally, planning events and regular advisory sessions, i.e., seminars were well attended and useful to the fellows.

The project originally proposed the creation of a series of new learning modules for teachers and students. The University of New Mexico College of Education was to mentor the project with expertise on classroom instruction and education theory. The COE did not assist with this task.

Constraints prevented the researchers from surveying students. Responses from the students would have broadened the understanding of the impact of the OPE project. Two, collecting student test scores from the teachers and a specific pre/post test to measure precisely the impact of the OPE project goals would have enriched the findings of the research. Finally, a significant weakness of the project was the loss of the COE midway through the project. The lack of early data and foundational analysis diminished the evaluation of the project and probably disrupted some continuity gained over the first two years of the project.

Year-Four Fellows and Teachers

The UNM Prinicpal Investigator was permitted by NSF to extend the program for a fourth year. The UNM PI and the APS Project Coordinator met and agreed on a fourth year plan. Under the extention plan, as many fellows as could be supported were allowed to continue in on the project. This allowed six fellows to remain in the program at the beginning of the 2007 Fall Semester. Very quickly into the semester one fellow quit to persue another opportunity. Five fellows remained in the program for Year-Four (2007-2008 School Year).

ISR collected information to describe the five OPE fellows. Table 3 describes the 2007-2008 Fellows.

Table 3 Description of 2007-2008 Fellows

Description of 2007-2008 Fellows	
Characteristic	**Summary**
Demographics	• 3 fellows are Hispanic, one is Asian, and one is White. • 4 Males and 1 Female. • Average age is 26.4 - Maximum age 33 years old, minimum is 23 years of age. • 1 fellow is working his third year on the project – 4 are second year fellows.
Education	• All fellows have BS degrees in optical, electrical, or mechanical engineering. • All fellows are in Masters Degree program. • All fellows have GPAs above 3.0. • 4 fellows received their BS degree from New Mexico colleges.
Employment & Income	• All fellows have a previous employment history. • All aspire generally to jobs in research or development. • All fellows report GK-12 Scholarship is their primary source of income – 3 fellows report also rely on grants and student loans.

All the fellows are in an engineering graduate program and aspire to jobs in research or scientific development. Several received honors as undergraduates. Most of the fellows (4) are males, three are Hispanic, one is Asian, and one is White. As noted in Table 15 on page 22, the fellows have remained very positive about the OPE Project during their tenure. It was noted in Year-Three by ISR Observers, the fellows are very intelligent and have many innovative ideas for assisting the teachers and instructing the students about science.

ISR discontinued the classrooom observations but continued attending the seminar sessions and administering surveys to the fellows and teachers. ISR gave 14 teachers surveys at the end of the school year and received 5 responses. Teachers were asked in the survey to describe themselves. Their responses are summarized in Table 4. The small number of responses was probably due to the survey being distributed late in the school year. Most (4) of the teachers responding to the survey have masters degrees and three have taught science for more than 10 year. The level of experience is very different from our findings in Year-Three. At Year-Three, almost half of the 25 teachers in our survey had less than 5 years of teaching experience.

Table 4 Description of 2007-2008 APS Teachers

Description of 2007-2008 OPE Project APS Teachers	
Characteristic	**Summary**
Schools & Experience	• 5 teachers responded to the survey – 1 elementary – 4 middle school. • 3 have taught science 10 years or more – 4 year is the minimum and15 years the maximum years taught.
Education	• 2 teachers majored in a science related field in college. • 2 majored in education or a field unrelated to science in college. • All the teachers graduated from a college in New Mexico. • 4 have Masters Degrees.

Year-Four Results

Evaluation Question 1: To what extent did the Graduate fellows benefit from the experience of participating in the GK-12 Project?

The fellows continue to report they have benefited from participating in the GK-12 Project. The ISR Survey for Year-Four included four questions that addressed the benefit and experience the fellows identified from participating in the project. Fellows were asked if the project broadened and deepened their educational/professional experience; did the assigned teacher contribute to the fellow's ability to communicate; and did the GK-12 project help the fellows clarify their research (Table 5). Fellows are even more supportive of the project in Year-Four than in Year-Three. The largest positive increase was in the areas of "teaching ability" and "communication." Regarding their own research, the fellows were not quite as positive that the project has helped them clarify their own research.

Table 5 Fellows benefit from project

Fellows respond…	Year-Three Mean	Year-Four Mean
GK-12 has improved my teaching ability.	4.5	5.0
The GK-12 Program broadened/deepened experience this year.	3.8	4.0
My instructional content has benefited from Teacher's contribution.	4.2	4.6
Teachers contributed to better understanding of communication and presenting.	3.0	3.5
GK-12 Program has helped clarify understanding of research.	3.2	3.3

Chart 1 shows the teacher survey responses regarding the quality of the GK-12 fellows on the project. All teachers agreed the fellows are capable and qualified. Four teachers gave the fellows the highest rating ("5") for this topic.

Chart 1 Teacher's summation of Fellow's abilities

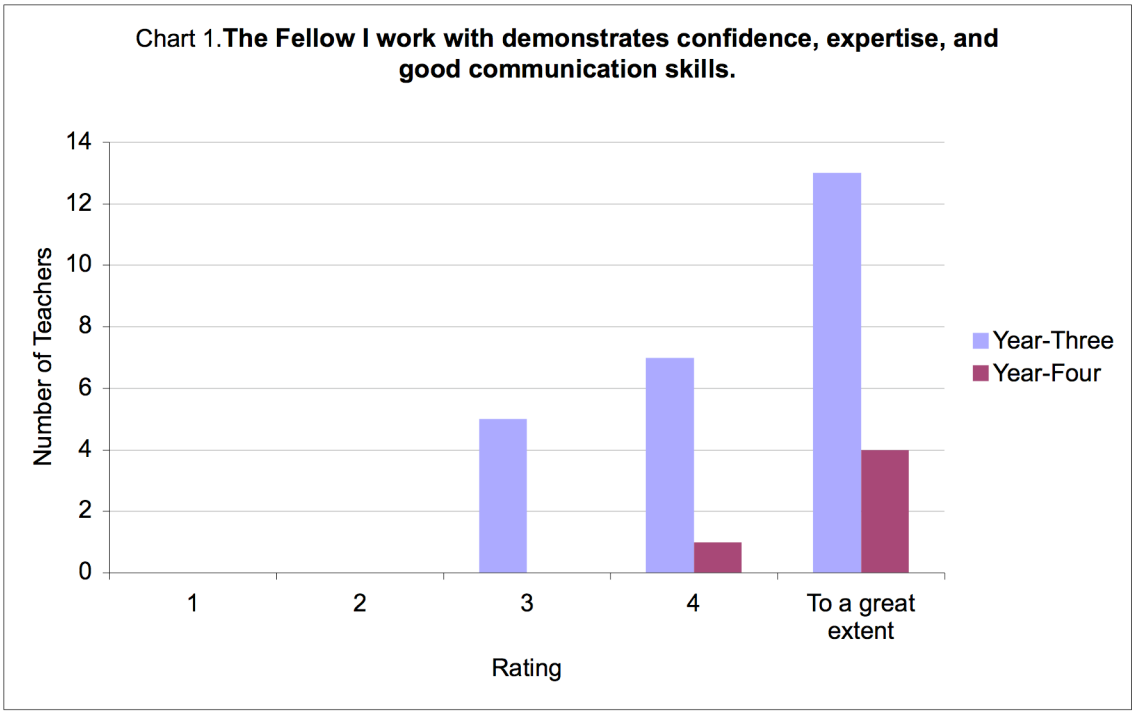


Table 6 shows the fellow's level of confidence in their ability to use various teaching techniques and importance of this ability. Despite the fellows experience in the project, they rated their confidence in teaching much lower than in Year-Three.

Table 6 Fellows ability to use teaching techniques

Year	Mean Importance Rate	Mean Confidence Rate	Gap
Year-Three	3.4	3.0	-0.4
Year-Four	3.6	2.2	-1.4

To what extent did the fellows benefit from the GK-12 project? The data from the surveys points out the fellows did benefit from the project. Their educational experiences were enhanced and their communication skills improved. The opportunities to teach, present, and direct experiments seem to have influenced the fellows. The fellow's lower confidence rate may indicate that after two years in the program they understand their limitations and have more realistic expectations of their skills and the needs of students. Additionally, the teachers gave the fellows more freedom in the classrooms and the fellows may have found their own teaching skills to be lacking. These situations may explain the lower rating they gave for confidence in the ability to use teaching techniques.

Evaluation Question 2: Did the GK-12 Project impact K-12 student interests and attitudes toward learning STEM related topics [optics and photonics specifically]?

Teachers and fellows were asked if students appear to be interested in learning the scientific method. Fellows were neutral to positive in Year-Three and remain fairly neutral on this issue in Year-Four. Table 7 shows the confidence and importance the fellows placed on the topic of developing students' interest in

science. They rated the importance of the topic high with an average score of 4.0 but they rated their confidence in developing the student's interest lower, with an average score of 3.6.

Table 7 Fellows Responses to developing student interest

Year	Mean Importance Rate	Mean Confidence Rate	Gap
Year-Three	3.9	3.1	-0.8
Year-Four	4.0	3.6	-0.4

Teachers rated the student's interest toward the subject more positively than the fellows did. The mean rating for Year-Three was 3.8 and remained the same for Year-Four (Table 8).

Table 8 Teacher's Responses to student's interest

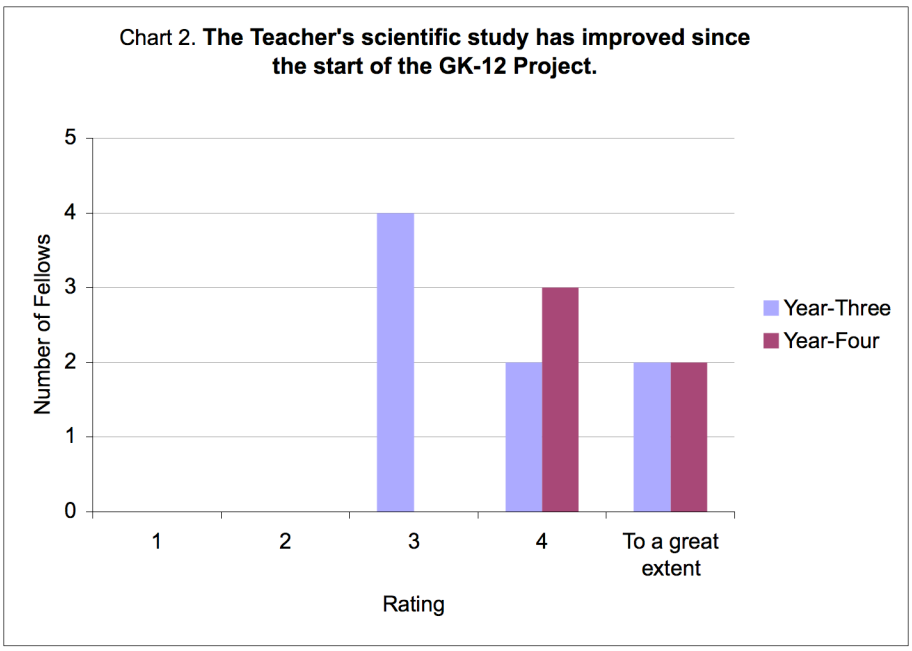
Teacher's respond...	Year-Three Mean	Year-Four Mean
Students in my classes appear to be interested; learning the scientific method.	3.8	3.8

Responses from the teachers indicate the GK-12 Project impacted the students in a positive manner. The fellow's responses indicate the fellows felt a little inadequate. Findings related to this question suffered due to a lack of data from students. A word from the students would have possibly been insightful on this question.

Evaluation Question 3: Did the GK-12 Project contribute to the classroom Teachers beliefs and professional development toward teaching STEM related topics?

During Year-Four the fellows are higher in their judgment of the teachers' scientific study improving because of the OPE project and the fellow's contribution (Chart 2).

Chart 2 Fellows response to Teacher's improvement



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 9 shows the teachers felt this was important (average rating of 4.0) but they are not confident in their use of this technique in the classroom (average rating of 3.2). The gap between Importance and Confidence widened from Year-Three to Year-Four.

Table 9 Teacher's Rating of the use of Inquiry-Based techniques

Year	Mean Importance Rate	Mean Confidence Rate	Gap
Year-Three	3.5	3.0	-0.5
Year-Four	4.0	3.2	-0.8

The teachers think they are very proficient at teaching facts, rules, and vocabulary. They rated their confidence on this question with an average score of 3.8, but the importance of teaching facts and vocabulary is not as significant to the teachers. They gave this topic an average importance rating of only 3.4 (Table 10).

Table 10 Teacher Responses to teaching facts

Year	Mean Importance Rate	Mean Confidence Rate	Gap
Year-Three	3.2	3.5	0.3
Year-Four	3.4	3.8	0.4

Overall, the GK-12 Project continues to stimulate the teacher's awareness of their need to develop their teaching methods, and to emphasize student inquiry more and teaching science facts less. Teachers are very confident in their ability to teach facts and vocabulary but less sure of their ability to use the Inquiry-Based technique as advocated by the OPE project. The fellows rated the teacher's fairly high in the area of scientific aptitude. As for teaching facts and rules, the teachers continue to show they are confident in teaching, but not so confident using the Inquiry-Based method.

Evaluation Question 4: To what extent did the GK-12 Project promote the transfer of plans and technical know-how to other schools (i.e., educational institutions above and beyond the realm of the target study)?

In the fourth and final year of the OPE Project, it is perhaps not so critical to judge the expansion of the project, but grade the sustainability of the initiatives of the GK-12 Program. Several issues are important if the examples set by the GK-12 Project are sustained in the APS system. ISR viewed the adequacy of science equipment and materials as partial examples of the sustainability of the project and the opportunity for APS to continue to incorporate the Inquiry-Based learning experience. ISR asked teachers and fellows several questions regarding the importance of the need for supplies to the GK-12 model. Teachers felt that adequate supplies in the classroom are very important (mean of 4.6, Table 11). They rated their existing classroom supplies as inadequate, a mean of 2.5 (1.1 less than in Year-Three). Teachers also felt GK-12 cannot succeed without special equipment (mean of 2.5).

Table 11 Teacher responses to importance of supplies and equipment

Teacher's respond…	Year-Three Mean	Year-Four Mean
Adequate supplies in the classroom are important for the GK-12 program to succeed.	4.6	4.6
There are adequate supplies in my classroom to perform Standardized Tests.	3.6	2.5
GK-12 can succeed without special equipment.	2.6	2.5
I have adequate computing equipment in my classroom.	3.0	2.8

Teachers continue to score the project high on the ability, knowledge, and science experience of the GK-12 fellows, and they continue to agree equipment and materials are needed for complete success. Resources remaining from class projects and demonstrations were identified with special tags and distributed to APS schools on permanent loan to the schools.

As in Year-Three we asked teachers, if the UNM stakeholders had provided resources to enhance science in the classroom. In Year-Four, teachers gave UNM higher ratings on the issue of collaboration (Table 12). In Year-Four we did not ask the fellows the question regarding UNM collaboration. The question was deemed to be outside the sphere of the fellow's experience and bias.

Table 12 Teacher responses to UNM collaboration

Teacher's respond…	Year-Three Mean	Year-Four Mean
UNM has provided resources to enhance science instruction.	3.0	3.4

Beginning in Year-Three and continuing in Year-Four the fellows produced a DVD of their best science experiments. The five fellows organized to develop and produce the DVD containing video demonstrations and accompanying text documenting their most successful classroom presentations. The APS Project Coordinator, making certain the lessons were aligned with New Mexico state science standards and the Inquiry-Based Learning Module for students, oversaw this effort. Plans for distributing the DVD included making it available to APS science teachers, other teachers statewide, posting on the OPE web site and linking to other web sites, and coordinating with NSF for other dissemination options.

During Year-Three the fellows were involved in the International Science and Engineering Fair held in Albuquerque and many science fair competitions held in and around Albuquerque. During Year-Four they continued to participate in special science events, including the Starbase Academy an Air Force Research Lab education outreach program. Fellows also participated in a Solar Fiesta in Albuquerque, giving demonstrations of how to make solar ovens.

Fellows have inspired participating teachers also. An elementary teacher who has been involved in the OPE program for two years applied and was awarded a grant-in-aid for an after school science program in which she made sure a stipend was included to involve a "visiting" university graduate student.

The New Mexico Optics Industry Association (NMOIA) provided a 6-kit curriculum, "Hands-On-Optics", to APS. Working with the district's science coordinator, the first 2 modules were piloted in the three middle schools involved in the OPE. The cooperating teachers at the schools received training from the NMOIA, and the fellows assisted the teachers in classroom implementation. The program will be centrally located for use by all middle schools.

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

During Year-Three and Four, fellows and teachers were asked questions regarding Inquiry-Based instruction. Fellows rated their exposure to the Inquiry-Based module higher in Year-Four (Table 13). After an additional year in the OPE project this would be expected. Fellows also agreed Inquiry-Based learning is important and they frequently use inquiry-learning techniques in the classroom.

Table 13 Fellows responses to gains from Inquiry-Based teaching

Fellow's respond...	Year-Three Mean	Year-Four Mean
Been exposed to Inquiry-Based Learning Module	2.6	3.4
The Inquiry-Based Learning Module is important	3.8	4.0
Use of Inquiry-Based techniques	4.2	4.0

They rate the effectiveness of the Inquiry-Based module a little better than average (Chart 3).

Chart 3 Fellows rating effectiveness of Inquiry module

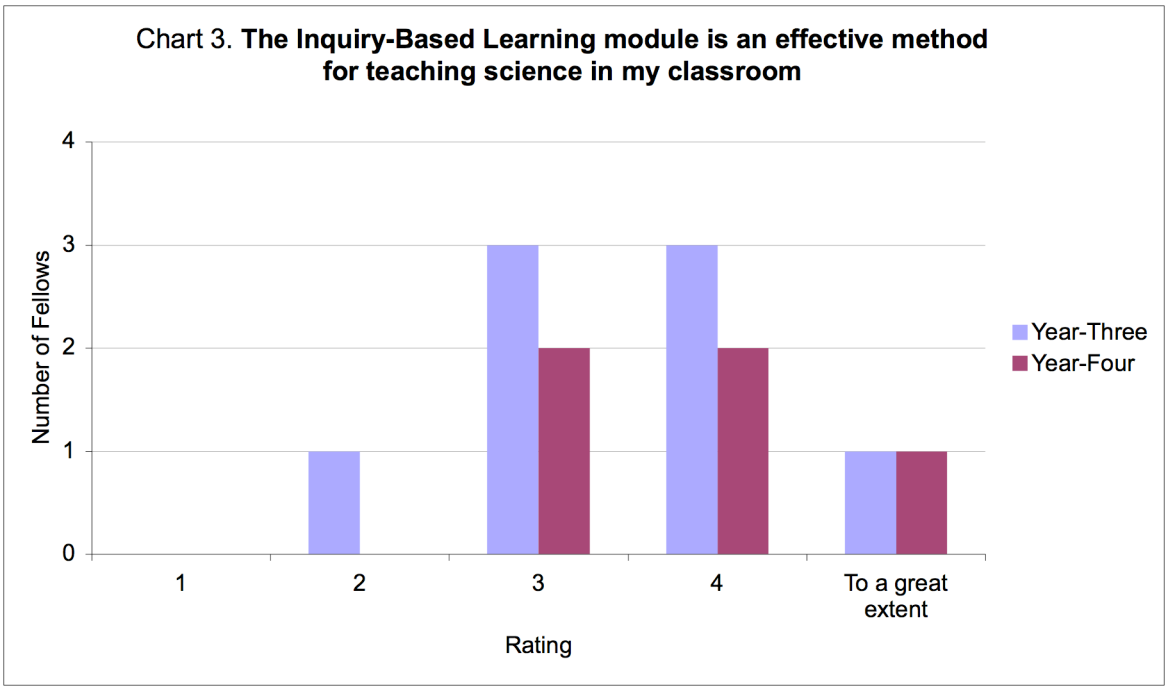
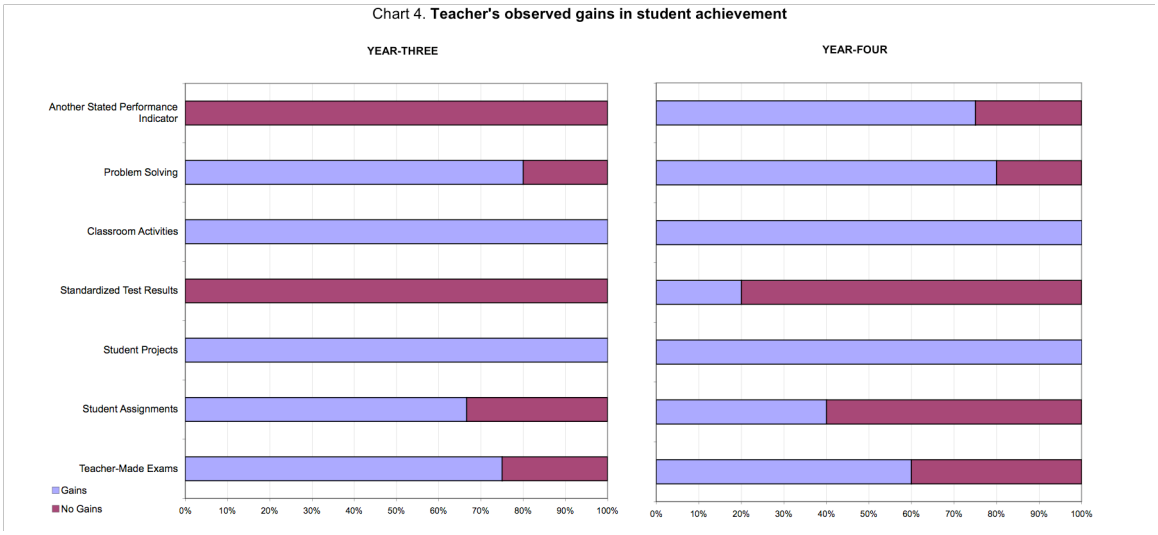


Chart 4 shows teacher's responses regarding specific gains from Inquiry-Based teaching in the classroom. Responses have changed to some extent between Year-Three and Year-Four. Teacher's still report positive gains on teacher-made exams, student assignments, student projects, classroom activities, problem solving, and from other indicators. Some gain was observed on standardized tests. Fellows and teachers agreed that Inquiry-Based instruction techniques have been effective in the classroom.

Chart 4 Teacher responses to gains from inquiry-based teaching



Teacher's report improvement in all areas related to the Inquiry-Based Learning Module. Teacher's reported higher rates than the fellows or having some exposure to the Inquiry-Based Learning module (mean of 4.3). Teachers also seem to feel it is very important (mean of .48), they use the technique in the classroom, and they seem to think Inquiry-Base Learning is effective (See Table 14).

Table 14 Teacher responses to Inquiry-Based Learning

Teacher's respond...	Year-Three Mean	Year-Four Mean
Been exposed to Inquiry-Based Learning Module	3.4	4.3
The Inquiry-Based Learning Module is important	3.9	4.8
Use of Inquiry-Based techniques	3.7	4.3
Inquiry-Based Learning Module is effective in the classroom	4.0	4.8

Inquiry based techniques are the common denominator and very important to the OPE project. As fellows were asked to assist with various science topics, not always optics and photonics, they were able to perform at a high level using the Inquiry-Based Learning Module. Fellows and teachers have noted that Inquiry-Based techniques are being used in the classrooms and seem to be having a positive impact on the students.

Evaluation Question 6: Did the Graduate fellow's participation in the preliminary orientation session and periodic seminars promote their abilities in being successful contributors to the GK-12 Project?

At the beginning of Year-Three, the five fellows attended the preliminary orientation session before the 2006-07 school term began. The fellows reported having a positive attitude about the GK-12 project before it began, mean of 4.5. They rated the program even higher at the beginning of the 2007-08 school term, and all the fellows reported a very positive attitude toward the project, mean of 5.0 at the time they completed our survey (Table 15).

Table 15 Fellows attitude toward project

Fellow's respond...	Year-Three Mean	Year-Four Mean
Attitude about program before it began	4.5	4.6
Current attitude about program	4.9	5.0

In the 2006-2007 Progress Report, we noted a high percentage (89%) of the fellows routinely attended the bi-weekly seminars. In the survey, the fellows agree the seminars were helpful (see Table 16). Fellows also gave three suggestions for improving the seminar: 1) include the teachers; 2) learn more teaching skills; 3) more contact between seminars, i.e., e-mail and small group planning. During Year-Four the seminars continued to be well attended. Throughout the last two years of the OPE project the APS Project Coordinator used the seminars to continue to focus the project on providing mentor scientist services to schools in the West Mesa Cluster of the school district.

Table 16 Fellows attitude toward seminars

Fellow's respond...	Year-Three Mean	Year-Four Mean
The Seminar was helpful	3.6	3.6

During the course of the OPE project, fellows participated in the orientation event at the beginning of Year-Three and the bi-weekly seminars. Fellows report having a good attitude about the OPE project and agree that the seminars were helpful.

Conclusion

In general, the OPE GK-12 program appears to have been successful. We surveyed fellows and teachers over a two-year period and the results indicate they graded the program as a success. The goals of the program focused on the fellows and the teachers. Fellows were to learn new effective teaching methods, improve their communication and pedagogical skills, and serve as role models to students. Teachers were to improve their knowledge of modern optics and photonics. The program was to produce an evaluation demonstrating evidence-based outcomes that contribute to understanding how students learn science. Additionally, the program was to strengthen the partnership between the university and the local school district.

Despite the difference in the skill sets of the fellows and students, the fellows were able to teach at a level the students could understand. The fellows reported they did not feel adequately versed in various teaching techniques, but they were still able to meet the students on their own level and teach. The Inquiry-Based Learning module probably was the common denominator in the fellows being able to teach despite having very little training. Teachers advised in their survey responses the fellows were very capable and increased the level of learning in the classrooms. The teachers gave the fellows very high marks in the category of teaching. The small age gap between fellows and students may have played a part in the ability of the fellows to reach the students. ISR observers determined the science knowledge, confidence, and creative skills the fellows possessed contributed to their ability to teach the students. In addition to the fellows own skills, the OPE project helped the fellows work together and share experiences. Each month fellows went as a team to a middle school in the district. As a team they would bring the lesson to a class or entire grade level of science students. Working independently, planning, coordinating, team teaching, and the subsequent debriefing in the seminar session increased the fellow's pedagogical skills. Working together, personal investment, and a creative response, is perhaps

a successful way science can be taught to elementary and mid-school students. These same skills seem to have stimulated the teachers.

Teachers appear to have been inspired by the creative skills, and work the fellows brought to the classroom. During the OPE project, the teachers increased in their approval of the Inquiry-Based Learning module. Teachers seem to understand the significance of teaching students to "do" science using the scientific method, rather than just teaching rules and vocabulary. Further evidence of the teacher's learning optics and photonics can be seen by the DVD project the fellows developed. At the time of this writing, the teachers were given the DVD and with a little bit of effort will be able to incorporate the activities in their classroom lessons. Teachers seem to also be stimulated by the positive changes in the achievements of their students. It could be the gains, which the teachers see in the students that may motivate the teachers to continue using the Inquiry-Based Learning module.

ISR designed an evaluation plan for the third and fourth years of the project. The method included evaluation questions designed to address the NSF goals and measure outcomes, surveying teachers and fellows, and observing classrooms. Taken as a whole, the analysis of our survey data indicates students may have gained as a result of the skillful use of the Inquiry-Based Learning module (see Chart 4). The evaluation plan was constrained by the lack of survey responses from the students, but the experience of the teachers – more than 10 years – and their understanding of pedagogy, maybe sufficient to judge how successful the OPE was in reaching the students.

Finally, the OPE project was able to strengthen the connection between the university and the local school district. Teachers reported the university contributed to the school. This response could be due to the OPE project loaning materials to the schools after the project concluded. The OPE project was a four-year opportunity for the two education institutions to collaborate in creative ways. This opportunity probably was not magnified to the fullest degree.

Later GK-12 projects should benefit from the work of the Optics and Photonics Project. The project demonstrated how organization, team building, adherence to the Inquiry-Base Learning module, intelligent creative fellows, and open-minded teachers can make the GK-12 program succeed. The OPE project demonstrated the positive impact that high quality upper level researchers can make while participating in a local public school system.

Appendix

Appendix 1 Class Room Observation Form

Appendix 2 Observer Scale

Appendix 3 Teacher Survey

Appendix 4 Fellows Survey

ISR Observer:_____

GK12 Engineering

Classroom Observation Form

DRAFT – (revised 09/28/06)

Site (*circle one*): Belen Socorro Albuquerque

Name of School: _____

Name of Class: _____

Activity (*tutoring session, regular class, experiment*): _____

_____

Date: _____ **Begin time**: _____ **End time:** _____

Name of Teacher and Fellow: _____
(*if Fellow is not present write: "Fellow not present"*)

How many students are involved? _____

Grade Level(s) of students involved: _____

Are others present (*i.e. parents***?** *If so, how many?)* : _____

_____

Observer Comments:

OBSERVATION NOTES

What happened during the class session? Who was involved? What questions were asked? Were students paying attention? Did activity leader have control of students? Please be as descriptive as possible. Use quotation marks for direct quotes; describe interactions, recurrent themes, non-verbal communication. Avoid assumptions and vague language. This space is for observational notes only. **Please attach your typed analytical notes to this completed form. At the end of your analytical notes, you should make bullet points of issues, concerns or items that may deserve further attention.**

Field Notes	**Notes to Self (interpretive/analytical)**

OBSERVER SCALE

		Not at all				To a great extent	N/A
1	The Teacher encourages the Students; uses hands-on interactive activities; uses science terminology; and asks probing questions.	1	2	3	4	5	6
2	The Fellow encourages the Students; uses hands-on interactive activities; uses science terminology; and asks probing questions.	1	2	3	4	5	6
3	Students are allowed to discover on their own with Teacher guidance; work in groups	1	2	3	4	5	6
4	Students are allowed to discover on their own with Fellow guidance; work in groups	1	2	3	4	5	6
5	Students appear to be interested; learning scientific method.	1	2	3	4	5	6
6	Teacher and Fellow plan together before class.	1	2	3	4	5	6
7	Fellow demonstrates confidence, expertise, and communication skills.	1	2	3	4	5	6
8	Teacher's instructional content benefits from the Fellow's contribution.	1	2	3	4	5	6

The University of New Mexico

GK-12 Survey for Teachers

The Institute for Social Research at the University of New Mexico has been contracted to conduct an evaluation of the GK-12 Program. The attitudes and opinions of the program participants are an important part of our evaluation. We would like to ask you about your experiences in the GK-12 Program. Your answers to this survey will help us to evaluate the program and make recommendations to secure the future success of the program.

This questionnaire is confidential and will only be seen by the researchers. We are legally bound to preserve the confidentiality of all respondents. Your participation is completely voluntary.

SECTION I – DEMOGRAPHIC DATA

1. Your Name _____
2. School Name _____
3. The grade level(s) you teach _____
4. Counting this year, how many years have you taught at either the elementary or secondary level? *(round to the nearest year and include part-time teaching experience)* _____ years.
5. How many years have you taught science? *(round to the nearest year and include part-time teaching experience)* _____ years.
6. What was the major field of study for your Bachelor's degree? _____
7. What year did you receive your Bachelor's degree? _____
8. What college or university did you graduate from? _____
9. Do you have a Master's degree? _____
10. What was the major field of study for your Master's degree? _____
11. What year did you receive your Master's degree? _____
12. What was the major field of study for your last degree? _____
13. What college or university did you graduate with a Master's degree?_____
14. During the last two years, how many college courses have you taken in science or science education? _____

15. During the past two years, have you taken college courses in any of the following? Check all that apply.

___ Methods of teaching science
___ Biology / Life Science
___ Chemistry
___ Physics
___ Earth Science

16. During the past five years, have you taken courses or participated in professional development activities in any of the following?

___ Use of computers in the classroom
___ Use of computers for data analysis
___ Use of multimedia for science education
___ Laboratory management or safety
___ Inquiry-based science instruction

17. Please estimate how many hours you spent in professional development workshops or seminars in science or science education during the past year? _____ hours.

18. Do you belong to one or more professional organizations related to science?

___ Yes
___ No

SECTION II – INQUIRY BASED TEACHING METHODS

19. Since becoming involved with the GK-12 program, how frequently have you used inquiry-based activities in your science teaching?

___ Not at all
___ Less than once a week
___ Once a week
___ More than once a week

20. How has inquiry-based teaching affected student achievement in your classroom? (go to Question 22 if "no observable gain" was observed)

___ No observable gain have been noted.
___ Some gains have been observed.
___ Moderate gains have been observed.
___ Large gains have been observed.

21. If gains in student achievement have been observed, which performance indicators have shown improvement? Check all that apply.

___ Performance on teacher-made exams
___ Student assignments, like homework
___ Student projects
___ Standardized tests results
___ Hands-on classroom activities
___ Student problem-solving in the classroom
___ Student recall of content
___ Other (please state) _____

22. Which performance indicator(s) demonstrate your observation of "no observable gain"? Check all that apply.

___ Performance on teacher-made exams
___ Student assignments, like homework
___ Student projects
___ Standardized tests results
___ Hands-on classroom activities
___ Student problem-solving in the classroom
___ Student recall of content
___ Other (please state) _____

23. How has inquiry-based teaching affected student motivation in your classroom?

___ No observable differences have been noted.
___ Students are less receptive/responsive to learning.
___ Students are more receptive/responsive to learning.

SECTION III – PERCEPTION OF INQUIRY AND TEACHING SKILLS

Please indicate <u>how confident</u> you feel about the following aspects of skills and knowledge related to teaching and <u>how important</u> you believe these issues are for the grade level(s) you teach.

My Level of Confidence					Level of Importance			
Not Confident	Slightly Confident	Moderately Confident	Very Confident		Not Important	Slightly Important	Moderately Important	Very Important
1	2	3	4	Teaching facts, rules, and vocabulary	1	2	3	4
1	2	3	4	Use of inquiry-based learning techniques in the school	1	2	3	4
1	2	3	4	Encouraging students to explore methods for solving problems.	1	2	3	4
1	2	3	4	Implementing inquiry-based instruction in the classroom	1	2	3	4
1	2	3	4	Guiding students as they carry out an experiment.	1	2	3	4
1	2	3	4	Developing students' abilities to critique and analyze results.	1	2	3	4
1	2	3	4	Developing student interest in science.	1	2	3	4
1	2	3	4	Knowledge of the state curriculum standards for science.	1	2	3	4
1	2	3	4	Ability to use a variety of instructional techniques in the classroom.	1	2	3	4
1	2	3	4	Incorporating hands-on materials in teaching.	1	2	3	4
1	2	3	4	Motivating students to consider advanced studies in science.	1	2	3	4

Not Confident	Slightly Confident	Moderately Confident	Very Confident		Not Important	Slightly Important	Moderately Important	Very Important
1	2	3	4	Facilitating student learning using a collaborative teaching environment.	1	2	3	4
1	2	3	4	Facilitating students working in small groups.	1	2	3	4
1	2	3	4	Overseeing classroom discipline/classroom management.	1	2	3	4

Please respond to the following statements by circling the number that best indicates your response to the statement.

		Not at all				To a great extent
38	Students in my classes appear to be interested; learning the scientific method.	1	2	3	4	5
39	I guide students to make discoveries and to work in groups.	1	2	3	4	5
40	I encourage students to use hands-on interactive activities, science terminology, and ask probing questions.	1	2	3	4	5
41	I plan with the Fellow before class begins.	1	2	3	4	5
42	The Fellow I work with demonstrates confidence, expertise, and good communication skills.	1	2	3	4	5
43	My instructional content has benefited from the Fellow's contributions.	1	2	3	4	5
44	Collaboration between the Fellow and the Teacher is important.	1	2	3	4	5
45	I am satisfied with my current level of collaboration with the GK-12 Fellow.	1	2	3	4	5
46	Adequate supplies, materials, and equipment in the classroom are important for the GK-12 Program to succeed.	1	2	3	4	5

47	There are adequate supplies, materials, and equipment in my classroom to perform the experiments required by the Standardized Test Program.	1	2	3	4	5
48	The GK-12 Program can succeed without special equipment.	1	2	3	4	5
49	I have adequate computing equipment in my classroom.	1	2	3	4	5
50	I have been exposed to the Inquiry-Based Learning module.	1	2	3	4	5
51	The Inquiry-Based Learning module is important to teach science to students.	1	2	3	4	5
52	I use Inquiry-Based Learning techniques in the classroom.	1	2	3	4	5
53	The Inquiry-Based Learning module is an effective method for teaching science in my classroom.	1	2	3	4	5
54	I have knowledge of the scientific method adequate to meet the needs of my students.	1	2	3	4	5
55	It is important for Teachers to increase their scientific knowledge.	1	2	3	4	5
56	Working with the GK-12 Fellow has improved my knowledge of science.	1	2	3	4	5
57	Working with the GK-12 Fellow has improved my ability to teach science.	1	2	3	4	5
58	I was involved in the planning and design of the GK-12 Program in my school.	1	2	3	4	5
59	I had a positive attitude toward the GK-12 Program before it began.	1	2	3	4	5
60	My current attitude toward the GK-12 Program is best described as positive.	1	2	3	4	5
61	I was given the resources, training, and direction necessary to perform my role in the GK-12 Program.	1	2	3	4	5

		Not at all				To a great extent
62	The Fellow who I am most familiar with plans activities for the classroom.	1	2	3	4	5
63	The Fellow's ability to communicate to the students has improved since the start of the GK-12 Program.	1	2	3	4	5

Next 3 Questions for Belen & Socorro Teachers only

64	The GK-12 Orientation was beneficial for understanding my role and responsibilities in the Program.	1	2	3	4	5
65	The Orientation handouts and materials were helpful to the job I perform in the classroom.	1	2	3	4	5
66	The training during the orientation was adequate for working with students in my school.	1	2	3	4	5

Next 2 Questions for Albuquerque Teachers only

67	My understanding of the GK-12 Program would benefit from a formal Orientation about the program.	1	2	3	4	5
68	Handouts and materials about the GK-12 Program would be helpful to me.	1	2	3	4	5

SECTION III – COLLABORATION AND PROFESSIONAL DEVELOPMENT

69. Do you have a Fellow assigned to work with you?

___ Yes
___ No

70. How often do you meet or communicate with your Fellow?

___ Almost daily
___ Once a week
___ Several times a month
___ Once a month
___ Less than once a month

71. What is the **primary** focus of your meetings or communications with the Fellow? **(choose one)**

___ Study of academic content of the subject I teach
___ Understanding New Mexico standards and helping students master the NM standards.
___ Prepare lesson plans for the next day or week.
___ Collaboration for improving instruction.
___ Strategies for creating and maintaining safety and order in the classroom.
___ Other; specify _____

72. What **else** do these meetings or communications focus on? **(Choose all that apply.)**

___ Study of academic content of the subject I teach
___ Understanding New Mexico standards and helping students master the NM standards.
___ Prepare lesson plans for the next day or week.
___ Collaboration for improving instruction.
___ Strategies for creating and maintaining safety and order in the classroom.
___ Other; specify _____

Finally, please circle the response that best describes your answer to the statement.

73. Participating in the GK-12 Program broadened and deepened my educational/professional experience this year.

Strongly Disagree	Disagree	Agree	Strongly Agree

74. The GK-12 Fellow has contributed to my better understanding of scientific study.

Strongly Disagree	Disagree	Agree	Strongly Agree

75. The University of New Mexico through the GK-12 Program has provided professional development resources to me to enhance my science instruction in the classroom.

Strongly Disagree	Disagree	Agree	Strongly Agree

76. University of New Mexico faculty through the GK-12 Program collaborates with my school and is engaged in professional development programs.

Strongly Disagree	Disagree	Agree	Strongly Agree

77. What do you <u>like most</u> about the GK-12 Program? Explain your answer in the box.

This completes the survey. Thank you for assisting us in this important research. Your time and effort are appreciated.

GK-12 Survey for Fellows

The University of New Mexico

The Institute for Social Research at the University of New Mexico has been contracted to conduct an evaluation of the GK-12 Program. The attitudes and opinions of the program participants are an important part of our evaluation. We would like to ask you about your experiences in the GK-12 Project. Your answers to this survey will help us to evaluate the program and make recommendations to secure the future success of the program.

This questionnaire is confidential and will only be seen by the researchers. We are legally bound to preserve the confidentiality of all respondents. Your participation is completely voluntary.

SECTION I – DEMOGRAPHIC DATA

1. Your Name _____

2. Name of the School(s) where you teach _____

3. The grade level(s) you teach _____

4. Before the GK-12 program, did you have any teaching experience?

   ___ Yes
   ___ No

5. Have you taught at either the elementary or secondary level?

   ___ Yes
   ___ No

6. If you answered yes to Question 5, how many years have you taught? *(round to the nearest year and include part-time teaching experience)* _____ years.

7. Please check the highest level of formal education you have completed.

   ___ Bachelor's degree
   ___ Bachelor's degree + 15 hours or more
   ___ Education specialist
   ___ Master's degree
   ___ Master's degree + 15 hours or more
   ___ Doctorate

8. What was the major field of study for your last degree? _____

9. During the past two years, have you taken courses or participated in professional development activities in any of the following?

___ Use of computers in the classroom
___ Use of computers for data analysis
___ Use of multimedia for science education
___ Laboratory management or safety
___ Inquiry-based science instruction

10. Do you belong to one or more professional organizations related to science?

___ Yes
___ No

SECTION II – INQUIRY BASED TEACHING METHODS

11. Since becoming involved with the GK-12 program, how frequently have you used inquiry-based activities in your classroom teaching?

___ Not at all
___ Less than once a week
___ Once a week
___ More than once a week

12. How has inquiry-based teaching affected student achievement in your classroom? (go to Question 14 if "no observable gain" was observed)

___ No observable gain have been noted.
___ Some gains have been observed.
___ Moderate gains have been observed.
___ Large gains have been observed.

13. If gains in student achievement have been observed, which performance indicators have shown improvement? Check all that apply.

___ Performance on teacher-made exams
___ Student assignments, like homework
___ Student projects
___ Standardized tests results
___ Hands-on classroom activities
___ Student problem-solving in the classroom
___ Student recall of content
___ Other (please state) _____

14. Which performance indicator(s) demonstrate your observation of "no observable gain"? Check all that apply.

___ Performance on teacher-made exams
___ Student assignments, like homework
___ Student projects
___ Standardized tests results
___ Hands-on classroom activities
___ Student problem-solving in the classroom
___ Student recall of content
___ Other (please state) _____

15. How has inquiry-based teaching affected student motivation in your classroom?

___ No observable differences have been noted.
___ Students are less receptive/responsive to learning.
___ Students are more receptive/responsive to learning.

SECTION III – PERCEPTION OF INQUIRY AND TEACHING SKILLS

Please indicate <u>how confident</u> you feel about the following aspects of skills and knowledge related to teaching and <u>how important</u> you believe these issues are for the grade level(s) you teach.

My Level of Confidence					Level of Importance			
Not Confident	Slightly Confident	Moderately Confident	Very Confident		Not Important	Slightly Important	Moderately Important	Very Important
1	2	3	4	Teaching facts, rules, and vocabulary	1	2	3	4
1	2	3	4	Use of inquiry-based learning techniques in the school	1	2	3	4
1	2	3	4	Encouraging students to explore methods for solving problems.	1	2	3	4
1	2	3	4	Implementing inquiry-based instruction in the classroom	1	2	3	4
1	2	3	4	Guiding students as they carry out an experiment.	1	2	3	4
1	2	3	4	Developing students' abilities to critique and analyze results.	1	2	3	4
1	2	3	4	Developing student interest in science.	1	2	3	4
1	2	3	4	Knowledge of the state curriculum standards for science.	1	2	3	4
1	2	3	4	Ability to use a variety of instructional techniques in the classroom.	1	2	3	4
1	2	3	4	Incorporating hands-on materials in teaching.	1	2	3	4
1	2	3	4	Motivating students to consider advanced studies in science.	1	2	3	4
1	2	3	4	Facilitating student learning using a collaborative teaching environment.	1	2	3	4
1	2	3	4	Facilitating students working in small groups.	1	2	3	4
1	2	3	4	Overseeing classroom discipline/classroom management.	1	2	3	4

Please respond to the following statements by circling the number that best indicates your response to the statement.

		Not at all				To a great extent
30	Students in my classes appear to be interested; learning the scientific method.	1	2	3	4	5
31	I guide students to make discoveries and to work in groups.	1	2	3	4	5
32	I encourage students to use hands-on interactive activities, science terminology, and ask probing questions.	1	2	3	4	5
33	I plan with the Teacher before class begins.	1	2	3	4	5
34	The Teacher(s) I work with demonstrates confidence, expertise, and good communication skills.	1	2	3	4	5
35	My instructional content has benefited from the Teacher's contributions.	1	2	3	4	5
36	Collaboration between the Fellow and the Teacher is important.	1	2	3	4	5
37	I am satisfied with my current level of collaboration with the GK-12 Teacher(s).	1	2	3	4	5
38	Adequate supplies, materials, and equipment in the classroom are important for the GK-12 Program to succeed.	1	2	3	4	5
39	There are adequate supplies, materials, and equipment in my classroom(s) to perform the experiments required by the Standardized Test Program.	1	2	3	4	5
40	The GK-12 Program can succeed without special equipment.	1	2	3	4	5
41	I have adequate computing equipment in my classroom(s).	1	2	3	4	5

42	I have been exposed to the Inquiry-Based Learning module.	1	2	3	4	5
43	The Inquiry-Based Learning module is important to teach science to students.	1	2	3	4	5
44	I use Inquiry-Based Learning techniques in the classroom(s).	1	2	3	4	5
45	The Inquiry-Based Learning module is an effective method for teaching science in my classroom(s).	1	2	3	4	5
46	I have knowledge of the scientific method adequate to meet the needs of the students.	1	2	3	4	5
47	It is important for Teachers to increase their scientific knowledge.	1	2	3	4	5
48	Working with the GK-12 Teacher has improved my knowledge of public education.	1	2	3	4	5
49	Working with the GK-12 Teacher(s) has improved my ability to teach science.	1	2	3	4	5
50	I had a positive attitude toward the Program before it began.	1	2	3	4	5
51	My current attitude toward the GK-12 Program is best described as positive.	1	2	3	4	5
52	I was given the resources, training, and direction necessary to perform my role in the GK-12 program.	1	2	3	4	5
53	The Teacher who I am most familiar with plans activities for the classroom.	1	2	3	4	5
54	The Teacher's scientific study has improved since the start of the GK-12 Program.	1	2	3	4	5

SECTION III – COLLABORATION AND PROFESSIONAL DEVELOPMENT

55. How many Teachers are you assigned to work with during this semester?____

56. Typically, how often do you meet or communicate with a Teacher?

___ Almost daily
___ Once a week
___ Several times a month
___ Once a month
___ Less than once a month

57. What is the **primary** focus of your meetings or communications with the Teacher? **(choose one)**

___ Study of academic content of the subject I present
___ Understanding New Mexico standards and helping students master the NM standards.
___ Prepare lesson plans for the next day or week.
___ Collaboration for improving instruction.
___ Strategies for creating and maintaining safety and order in the classroom.
___ Other; specify _____

58. What **else** do these meetings or communications focus on? **(Choose all that apply.)**

___ Study of academic content of the subject I teach
___ Understanding New Mexico standards and helping students master the NM standards.
___ Prepare lesson plans for the next day or week.
___ Collaboration for improving instruction.
___ Strategies for creating and maintaining safety and order in the classroom.
___ Other; specify _____

E-MRGE Belen & Socorro Fellows answer Questions 59- 61.

59. I attended a GK-12 Orientation at the beginning of my assignment.

___ Yes
___ No

60. The GK-12 Orientation was helpful.

Strongly Disagree	Disagree	Agree	Strongly Agree

61. What would you do to improve the GK-12 Orientation?

_____

_____

Optics & Photonics Albuquerque Fellows answer Questions 62-63.

62. The Seminars facilitated by the APS Program Manager were helpful.

Strongly Disagree	Disagree	Agree	Strongly Agree

63. What would you do to improve the Seminars?

_____

Finally, please circle the response that best describes your answer to the statement.

64. Participating in the GK-12 program broadened and deepened my educational/professional experience this year.

Strongly Disagree	Disagree	Agree	Strongly Agree

65. My Teacher(s) has contributed to my better understanding of communication and presenting scientific research.

Strongly Disagree	Disagree	Agree	Strongly Agree

66. Presenting my research and understanding of science to students and teachers has helped me clarify my understanding of my research.

Strongly Disagree	Disagree	Agree	Strongly Agree

67. University of New Mexico faculty through the GK-12 program collaborates with the school(s) where I am assigned and are engaged in professional development programs.

Strongly Disagree	Disagree	Agree	Strongly Agree

This completes the survey. Thank you for assisting us in this important research. Your time and effort are appreciated.