

Idaho State University GK-12 Annual Report (2005-2006)

Project Summary

2005-2006 academic year: The 16 Fellows (10 graduate, 6 undergraduate) and 16 teacher partners spent over 5,000 hours in local schools bringing real science and engineering activities to over 1,500 students in schools and hundreds more who attended events such as the robotics competitions and zoo workshops. The partnerships, each consisting of one teacher-one Fellow, collaborated throughout the year to bring new activities into the classroom, with an emphasis on research relevant to our region. Fellows and Teachers participated in ongoing professional development, including an intensive summer workshop, monthly participant meetings, and responding to prompts in an on-line journal. Faculty and a team of project participants attended and made presentations at GK-12 regional and national meetings. As in 2004-2005, an independent measure of the Fellows' communication skills found significant gains over the Fellowship year. Both teachers and students reported improvements in their understanding of science and engineering topics, acquisition of new science teaching skills, and a more positive attitude towards implementing inquiry in the classroom. Finally, ISU's GK-12 received media attention throughout the year, which helped in attracting interest and financial support from ISU's administration, school district leaders, and local businesses and organizations for continuation of the project's activities. Ten graduate Fellows from Biological Sciences, Geosciences, Chemistry, and Engineering and 7 undergraduate Fellows are partnered with 17 teachers for the 2006-2007 academic year.

1.) Goals and Activities

In our proposal we defined a formative evaluation plan to use as part of our ongoing and annual evaluation activities. This plan allows us to look at specific indicators for each part of our project, and use these outcomes to determine our progress towards our overall goals. Although these are not limited to research and education activities, they are essential to the progress of the project. The first part of the formative assessment plan is to look at structural aspects of the grant, for which we had specific questions and indicators. These aspects include the fellow and teacher selection process, project management structure, partnership activities, summer workshop, monthly meetings, on-line journal (to measure communication skills), and research associated with the ISU GK-12 project. We report on each of these activities below.

The structural aspects of the project were improved based on the previous formative assessments. The Fellow and Teacher recruitment and selection process went very smoothly, the summer workshop was likewise well-received, and the monthly meetings were structured to include more break-out groups relevant to the participant's perceived needs. Both Teachers and Graduate Fellows reported spending at least 10 hours/week in the classroom conducting activities, and Fellows spent additional hours preparing for these activities. Fellows and teachers also spent time during each week, and during the monthly meetings collaborating on STEM activities. Several partnerships presented their efforts at national or regional science education conferences. ISU faculty mentors visited classrooms, provided specialized equipment and expertise, and supported the activities of the graduate student or undergraduate Fellows. Local businesses and organizations provided logistical support for projects, funding, and mentors (particularly for the robotics teams, but also for the environmental monitoring). The project management structure is efficient and capable.

General activities of the project and involvement of fellows, teachers, and institutions in these activities:

- a. Training, workshops, seminars. All participants (fellows, teachers, PI's, and the Project Coordinator) participate in the one-week summer workshop as well as the two-hour monthly meetings. The workshop includes activities to: introduce the ISU GK-12 project goals and expectations, provide tools and training to build successful teacher-scientist partnerships, introduce the Idaho science standards, learn to distinguish and adapt inquiry-based lessons, and reflect on the cultural similarities and differences between teachers and scientists. In addition, Fellows receive advice on teaching Native American and other students found in a diverse classroom, while teachers learn about scientific resources available at ISU. Many of these activities are extended into the monthly meetings held throughout the academic year. Fellows also participate in an additional monthly meeting, led by an ISU faculty member, focused on "How People Learn" and strategies that they can use in their classrooms to measure the effectiveness (impact on student learning) of their lessons. Finally, all Fellows and teachers contribute regularly to an on-line journal, providing them with bi-weekly opportunities to communicate their ideas.
 - b. Curriculum materials adopted or developed. One of the lessons learned the first year was that it is best to not prescribe the topics, but rather to encourage Fellows and teachers to work together to build on the content-area strengths of the Fellow and the need of the individual teacher. Fellows and teachers are loosely associated with specific areas (Fire and other environmental hazards, Portneuf River Project, Pocatello Zoo, FIRST robotics and FIRST LegoLeague robotics), but many developed classroom-based research projects closely allied with the Fellows' research (plant physiology, anatomy of locomotion, microbiology, sensors, geology, amphibian conservation, etc.). Over 45 lesson descriptions are now available on the project website. Several activities were published and/or presented at regional or national meetings.
- 2.) Communication- publications, presentations, and websites associated with project activities.
- a. Journal publications: Ray, A. and P. M. Beardsley. In press 2006. Overcoming student misconceptions in photosynthesis: a model and inquiry-based approach using aquatic plants. *Science Activities (in press, December 2006 issue)*.
 - b. Conference presentations:
National Association of Biology Teachers 2006. Marlys McCurdy and Jason Beck. "Fissures, Foramen, and Fossa: Skeletal anatomy Darwin style". Hands-on Workshop.
Geological Society of America Meeting 2006. Garrett Bayrd. "Successful Teacher / Fellow partnerships in the NSF GK-12 program."
North American Benthological Society Annual Meeting. 2005. Jessica DelMonte "Skeletons in the stream: A temporal study of in-stream leaf decomposition."
National Science Teachers Meeting in Anaheim, CA; 2006. Eric Rude. "Forensics in the Classroom". Presentation; poster: "Idaho State University GK-12 Project."
Idaho State Council for Exceptional Children Conference, Boise and Sun Valley, (2006). Diane Stinger and Cathy Kratz "Lego Robots in the Gifted and Talented Classroom."
 - c. Website developed: www.isu.edu/departments/gradk12/
 - d. Media attention: 20 newspaper articles and at least 8 televised news stories.

GK-12 ANNUAL REPORT *Project Participants, Institutions and other Collaborators*

SENIOR PERSONNEL				
NAME	INSTITUTION & POSITION	GK12 POSITION	TIME	Contribution Statement
Dr. Rosemary Smith	Assoc. Prof., Biological Sciences, Idaho State University	P.I.	>160 hrs	Project Director- directs all project activities including recruitment and selection of Fellows and Teachers, summer workshop, budget, monthly project activities, publicity, reports, and evaluation.
Dr. Richard Inouye	Assoc. Prof., Biological Sciences, ISU	Co- P.I.	>160 hrs	Recruit and select Fellows and Teachers, mentor Fellows, engage in partnership and project activities, including seminar, monthly meetings, special events and activities, evaluation process, and reporting.
Dr. Mikle Ellis	Assoc. Prof., Engineering, ISU	Co- P.I.	>160 hrs	Recruit and select Fellows and Teachers, mentor Fellows, engage in partnership and project activities, including seminar, monthly meetings, special events and activities, evaluation process, and reporting.
Dr. Richard Wabrek	Assoc. Prof., Engineering, ISU	Co- P.I.	>160 hrs	Recruit and select Fellows and Teachers, mentor Fellows, engage in partnership and project activities, including seminar, monthly meetings, special events and activities, evaluation process, and reporting.
Dr. Steve Adkison	Asst. Prof., Writing Center, ISU	External Evaluator	160 hrs	Communication expert- design on-line writing 'prompts', manage communications website, collect writing samples, analyze data and report on changes in communication skills of GK-12 Fellows.
Dr. Paul Beardsley	Asst. Prof., Biological Sciences, ISU	Sr. Personnel	80 hrs	Workshop and seminar leader: emphasis on science education, inquiry, and building successful partnerships.
Dr. Stephen Shrophsire	Assoc. Prof., Physics, ISU	Sr. Personnel	160 hrs	Workshop leader- Science education, outreach, and inquiry
Dr. Charles Zimmerly	Coordinator, Idaho Center for Educational Effectiveness	External Evaluator	---	External evaluator- compiles surveys, prepares annual report.
Hannah Sanger	Project Coordinator, ISU GK-12 project	Coordinator	>160 hrs	Project Coordinator: Coordinates all project activities, including Fellow and Teacher applications and enrollment, stipend distribution, and classroom activity budget disbursal. Coordinates summer workshop and monthly meetings. Maintains project website and communications. Compiles information for annual evaluations and reports.

GK-12 ANNUAL REPORT *Project Participants, Institutions and other Collaborators*

GRADUATE STUDENTS- current			
NAME	YEAR IN PROGRAM & MAJOR	Graduate Work Location	RESEARCH TOPIC
Doug Alder	1, Engineering MS	ISU - measurement & control lab	Robotic kinematics and robotic actuation optimization
Matt Alexander	2, Chemistry MS	ISU- laboratory research	Analytical chemistry
Brandon Briggs	2, Biological Sciences MS	ISU- laboratory research	Biofilm characterization of <i>Acidiphilium cryptum</i>
Rebecca Guthrie	2, Biological Sciences PhD	ISU - laboratory research	Neural development during tadpole metamorphosis
Milana Michalek	1, Geological Sci. MS	Snake River Plain, Idaho	Crustal flexure, structural geology in Snake River Plain
Katie Miller	2, Biological Sciences MS	Upper Snake River Plain, Idaho	Population genetics of a sensitive species of bat
Sarra Moller	3, Biological Sciences MS	Panther Creek Watershed, Idaho	Effects of habitat & bioenergetic factors on trout location
Kira Pontius	2, Biological Sciences MS	Rocky Mtn Biological Lab, CO	Behavioral ecology of <i>Nicrophorus</i> beetles
Steve Seiler	4, Biological Sciences PhD	ISU & Snake River, Idaho	Invasive species ecology; fish ecology
Mike Zaremba	2, Engineering MS	ISU - measurement and control lab	Cooperative robots
GRADUATE STUDENTS- previous			
NAME	Graduate Status- Degree	Current Position	Contact Info
Noah Anderson	PhD anticipated 2008	PhD candidate Biological Sciences	andenoah@isu.edu
Heather Bechtold	MS awarded 2006	PhD candidate, Biological Sciences	bechheat@isu.edu
Jennifer Claypool	MS anticipated 2007	MS candidate, Biological Sciences	clayjenn@isu.edu
Jessica DelMonte	DA anticipated 2007	DA candidate, Biological Sciences	delmjess@isu.edu
Denim Jochimsen	MS awarded 2006	Washington State University lecturer	denim2cure@yahoo.com
Jack Shurley	MS anticipated 2007	MS candidate, Biological Sciences	shurjack@isu.edu
Zachery Lifton	MS awarded 2005	Urban forester, Atlanta GA	zlifton@gmail.com
Jason Marendra	MS anticipated 2006, 2 yr GK12 fellow	MS candidate, Engineering	marejaso@isu.edu
Andy Ray	PhD awarded 2006	Department of Environmental Quality (DEQ) Scientist, Pocatello ID	rayande@isu.edu
Randy Hoover	MS awarded 2005	PhD candidate, U. Colorado	-----
Sheel Bansal	PhD anticipated 2008	PhD candidate Biological Sciences	bansshee@isu.edu
Jason Jones	PhD anticipated 2007	MS candidate, Biological Sciences	jonejase@isu.edu
Renee Horton	PhD anticipated 2006	Accepted a post-Doc U. Colorado	hortrene@isu.edu
Jonathan Knudson	MS awarded 2006	employed	knudjona@isu.edu
Jason Beck	PhD anticipated 2009	PhD candidate Biological Sciences	beckjaso@isu.edu
Pete Coates	PhD anticipated 2007	PhD candidate Biological Sciences	coatpete@isu.edu
Garrett Baryd	MS awarded 2006	Geologist, Seattle WA	garrettbaryd@yahoo.com
Michael Zaremba	MS anticipated 2007, 2 yr GK12 fellow	MS candidate, Engineering	zaremich@isu.edu
Victor Godfrey	MS anticipated 2007	MS candidate, Engineering	godfvict@isu.edu

GK-12 ANNUAL REPORT *Project Participants, Institutions and other Collaborators*

NSF GK-12 at Idaho State University. Participating Schools 2006-2007											
School District	School	# Tchrs	# Graduate Fellows	# UG Fellows	Subject(s)	Select Activities	Grade Levels	Urban - rural	% Free Reduced Lunch	% Minority	AYP 2005-2006
25	Pocatello High School	3	1	1	Zoology, Physical Science, General Biology	FIRST Robotics, general biology	9-12	Urban	32%	13%	NO
25	Highland High School	2	2	0	General & A.P. Biology, Chemistry, Physical Science	Water quality, molecular biology	9-12	Suburban	22%	15%	YES
25	Century High School	3	3	0	Anatomy & Physiology, General & A.P. Biology, Physical Science, Chemistry	Population ecology, water quality, A&P	9-12	Suburban	31%	11%	NO
25	Irving Middle School	1	1	0	Life Science, GATE (Gifted and Talented Program)	Lego Robotics	7-8	Urban	51%	13%	NO
25	Gateway School	1	0	1	GATE (Gifted and Talented Program)	Lego Robotics	5-6	Suburban	22%	no data	N/A
25	Franklin Middle School	1	1	0	World Geography, GATE (Gifted & Talented Program)	Lego Robotics	8	Suburban	26%	13%	NO
25	New Horizons High School	1	1	0	Biology, Field Biology, Physical Science	Water quality	9-12	Urban	76%	28%	NO
25	Chubbuck Elementary School	1	0	1	Elementary Math, Elementary Science	Lego Robotics	6	Suburban	38%	14%	YES
512	ShoBan Jr Sr HS	1	0	1	General Science	Lego Robotics	9-12	Rural	N/A	100%	NO
91	Taylorview Jr. Sr. High School	2	0	2	Physical Science	Water quality	9	Suburban	24%	12%	NO
21	Marsh Valley HS	1	1	0	Physical Science, Chemistry, Robotics	FIRST Robotics	9-12	Rural	35%	4%	YES
60	Shelley High School	1	1	0	Survey Science, Ag Science Solutions/Robotics	FIRST Robotics	9-12	Suburban	29%	11%	NO

GK-12 ANNUAL REPORT *Project Participants, Institutions and other Collaborators*

Other Collaborators 2005-2006	Donation	Donation Use
Idaho Fish and Game	\$3,000.00	Ecology studies
Idaho National Laboratory	\$5,000.00	Robotics
Idaho Governor's Grant	\$1,000.00	various
Simplot	\$500.00	various
Qwest	\$13,789.00	Robotics
SD#25 GATE program	\$400.00	Robotics
NASA	\$30,000.00	Robotics
INRA	\$2,000.00	Robotics
Hillcrest HS	\$1,500.00	Robotics
Bonneville Education Foundation	\$2,500.00	Robotics
SD#91	\$3,300.00	Robotics
Idaho Forest Products Board	\$200.00	Water Quality Studies
Shelley School Board	\$3,000.00	Robotics
local fundraising	\$18,100.00	Robotics
AMIs	personnel	Robotics
SUM	\$84,289.00	



Evaluation
of the
GK-12 Fellows Project

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Project Goals, Objectives, and Methods

Description

Goal: Create a sustainable GK-12 framework that will improve are STEM education (at the levels of all participants) through the use of a) inquiry-based learning and b) content/issues that are relevant, both in local civic terms and to local industry

Objectives:

1. Recruit, select and train 15 GK-12 Fellows (10 graduate, 5 undergraduate) to serve as teaching resources for K-12 educators. Fellows should reflect regional diversity, especially regarding under-represented groups, so as to act as role models for k-12 students.
2. Teachers will develop curricula that will: a) build on locally-relevant STEM content, issues, and skills, b) allow teachers to work jointly with Fellows to design and implement inquiry-based learning exercise into the classroom, at the appropriate level, and aligned with the teacher's curriculum plan, especially as related to state and national science education standards. Teachers will document where they are not in alignment with the standards at the start of the Fellowship, and then reevaluate their curriculum and student progress at fellowship's end. Teachers will participate in training activities, and identify additional areas in which they need professional development to carry out the goal of this project.
3. University faculty will mentor the Fellows and partner teachers, and through direct observation (performance, written reflections and papers, etc.) and secondary sources (e.g. teacher and student feedback), assess the impact of the program on Fellows communication skills.
4. Provide an on-going structure to manage efforts, provide organization and direction to the program, evaluate and disseminate program results. Evaluation will be both internal and external, with particular attention paid to impact on Fellow's communication skills, and the impact on K-12 teaching/student learning. The structure will also provide the foundation from which to sustain and expand the program, as well as pursue other collaborative opportunities as they arise.

Evaluation Methods

In order to ascertain the attainment of the above goal and objectives the evaluation plan, both formative and summative, was based on a Logic Model from the *Logic Model Development Guide* (Kellogg foundation, 2002) and on *The 2002 User-Friendly Handbook for Project Evaluation* (NSF, 2002).

The formative evaluation consisted of two stages, Stage One: Effectiveness of implementation of the Project, and Stage Two: Project progress toward achievement of the goal and its objectives. To this extent the following benchmarks and indicators were developed to measure /evaluate the Project's progress

Formative Evaluation

Stage One – Effectiveness of implementation

- Was the Fellow and Teacher selection process adequate?
 - Number of applicants
 - Match of Fellow/teachers
- Was the summer workshop valuable to participants?
 - Number of participants
 - Participant satisfaction survey
- Were monthly meetings valuable to participants?
 - Participant satisfaction survey
- Did graduate fellows fully participate in school activities?
 - Activities of Fellows
- Did graduate fellows and teachers collaborate on implementing STEM activities?
 - Activities of Fellows and Teachers
- Did ISU Faculty participate in GK-12 activities?
 - Activities of ISU Faculty
- To what extent did local businesses and organizations participate in the projects?
 - Participant activities
- Is the project management structure successful?

GK-12 ANNUAL REPORT *External Evaluation*

- Description of structure
- Participant satisfaction

Stage Two – Progress toward achievement of goals

Fellows

- Improved science and engineering communication skills
- Improved understanding of science and engineering teaching methods
- Improved application of scientific knowledge
- Enhanced view of educational relationship between ISU and the local schools
- Improved confidence in, and interest in teaching STEM

Teachers

- Increased content knowledge
- Enhanced professional development opportunities, including mentoring of fellows
- Increased confidence in teaching STEM
- Strengthened collaboration with ISU

Students

- Improved attitudes toward learning stem
- Positive interactions with scientist role models
- Enhanced understanding of science and engineering

ISU

- Increased participation in K-12 outreach activities by ISU faculty
- Increased interdisciplinary interactions among faculty and fellows
- Increased inclusion of educational activities in graduate programs
- Increased opportunities/recruitment of STEM students to ISU

Community

- Increased participation by business/organizations in collaborative educational activities
- Enhanced view of educational relationship between ISU and local schools

Summative Evaluation

1. In what specific ways did the Fellows improve their science communication skills?
2. What aspects of the program enhanced (or not) the Fellows interest in science education?
3. In what specific ways has the project altered the views of ISU faculty on K-12 outreach?
4. What were the specific benefits to participating students? Did these benefits outweigh any perceived costs?
5. What were the specific benefits of participating students? Did these vary according to school, teacher, fellow, or activity?
6. In what specific ways has the partnership between ISU and the local schools been strengthened?
7. To what extent has the GK-13 concept been integrated into graduate programs at ISU?
8. Is there evidence for an enhanced view by community of educational relationship between the university and the local schools?
9. How strong is the evidence for the observed outcomes? Are there rival explanations for the outcomes (e.g. rival programs, teacher or student activities, community actions)?
10. Were the benefits worth the startup and operational costs of the GK-12 program?

Procedures and tools

The primary tools for data collection were self-reporting *Scantron* survey instruments specifically designed to assess the attainment of the above benchmarks and their indicators. Unique surveys were developed for participating Fellows, teachers, K-12 students, ISU faculty, community, and parents of K-12 students. Surveys were administered at key times over the implementation of the Project activities, e.g. just after the completion of the summer workshop, during the robotic competitions, at the beginning and at the end of the 2005-2006 school year. Surveys were then electronically scored and tabulated, with the resulting raw data formatted into excel spreadsheets for analysis. In many instances a four point non-neutral Likert scale was utilized to measure perceptions. Open ended responses and comments were scored as to negative or positive.

Evaluation Findings Executive Summary

It must be pointed out that an enormous amount of data was collected and analyzed to demonstrate and support the findings given in this summary and impossible to present within the 5-7 page restriction on the length of the external evaluators report.

The following tables illustrate the findings of the external evaluator regarding Stage One and Two of the formative evaluation. In many instances a number of survey questions were asked which focused on a perception of a specific benchmark. In these instances an overall mean value of these questions is given which demonstrates the participant’s perception of that benchmark.

Table 1: Formative evaluation, Stage One - Effectiveness of implementation

Benchmark	Indicator Results
Was Fellow and teacher selection process adequate	Number of Fellows desired - 15 Number of Fellows recruited from large pool of applicants – 16 (10 graduates and 6 undergraduates)
Was the summer workshop valuable to participants?	<ul style="list-style-type: none"> • Overall mean value of satisfaction survey questions (20) = 3.2 on a 4 point scale, with 4 being very satisfied
Were the monthly meetings valuable to participants?	<ul style="list-style-type: none"> • Overall Fellows mean value of satisfaction survey questions (8) =1.7 on a 4 point scale • Overall teacher mean value of satisfaction questions (8) = 3.2 on a 4 point scale, with 4 being very satisfied
Did Fellows fully participate in school activities?	<ul style="list-style-type: none"> • Overall teacher mean value of satisfaction with Fellow’s participation questions (8) =3.7 on a 4 point scale
Did Fellows and teachers collaborate on implementing STEM activities?	<ul style="list-style-type: none"> • Weekly meetings – 64% once a week, 36% twice or more a week • 45% 15 – 30 minutes per meeting • 55% 30 – 60 minutes per meeting • Development/implementation STEM 64% Fellow and teacher equally, 36% teacher only
Did ISU Faculty participate in GK-12 activities?	<ul style="list-style-type: none"> • Level of involvement 4.3 on a 5 point scale, with 5 being significantly involved, and 1 minimally involved
To what extent did local businesses and organizations participate in the projects?	<ul style="list-style-type: none"> • Overall mean value of community awareness of the GK-12 activities and STEM impact on students and classrooms = 3.3 on a 4 point scale, with 4 being very satisfied
Is the project management structure successful?	Yes, administration of the grant, all its activities, recruitment of participants, implementation of activities, monitoring of progress toward goal and objective achievement has been very positive as witnessed by survey satisfaction.

The overall satisfaction from survey results, as indicated above; demonstrate successful and effective implementation of the GK-12 grant goals and objectives.

In the position of external evaluator, large amounts of survey and interview data were examined. From this data several encompassing conclusions can be made:

- Positive satisfaction among all constituents, Fellows, teachers, parents, advisors, and community,
- A very well managed grant administration process,
- Formation of positive collaborative relationships with high need, resource poor rural school districts in southeast Idaho, and
- Sustained interest in STEM activities in rural K-12 students.

Table 2: Formative evaluation, Stage Two – Progress toward achievement of goal and objectives

Benchmark	Result
<p>Fellows</p> <ul style="list-style-type: none"> • Improved STEM communication skills • Improved understanding of STEM teaching methods • Improved application of STEM knowledge • Enhanced view of educational relationship between ISU and local schools • Improved confidence in teaching STEM 	<p>Teacher's survey: 13 question on the teacher survey pertained to these benchmarks, the over all mean response value was 3.6, with 4 being very satisfied, and 1 being very dissatisfied.</p> <p>Fellow's pre-survey on teaching practice 20 questions on the Fellow's survey pertained to these benchmarks; the overall mean response value was 2.3, with 4 being very satisfied and 1 being very dissatisfied.</p> <p>Fellow's post-survey on teaching practice The same 20 questions were asked of the Fellows after one academic year's participation in the GK-12 program; the overall mean response was 2.9, with 4 being very satisfied and 1 being very dissatisfied. A 0.6 improvement was realized moving from dissatisfied to satisfied. Clearly, the Fellows' self-evaluation (2.9) was below the teacher's evaluation (3.6). The difference may be explained by inexperience, Fellows with little K-12 experience, vs. experience, teachers with lots of K-12 experience.</p>
<p>Teachers</p> <ul style="list-style-type: none"> • Increased STEM content knowledge • Enhanced professional development opportunities • Increased confidence in teaching STEM • Strengthened collaboration with ISU 	<p>Teacher's survey: 6 questions pertained to these benchmarks; the overall mean response value was 3.6, with 4 being very satisfied and 1 being very dissatisfied.</p>
<p>Students</p> <ul style="list-style-type: none"> • Improve attitudes toward learning STEM • Positive interactions with STEM role models • Enhanced understanding of STEM 	<p>Students survey: 15 questions pertained to these benchmarks; the overall mean response value was 2.7, with 4 being very satisfied and 1 being very dissatisfied. Most of the student participants were already highly motivated student very versed in STEM. The specific question addressing positive interaction with STEM role models was rated at 3.2.</p>
<p>ISU</p> <ul style="list-style-type: none"> • Increased participation in K-12 outreach • Increased interdisciplinary interactions among faculty and fellows • Increased inclusion of educational activities in graduate programs • Increased opportunities/recruitment of STEM students to ISU 	<p>Faculty Advisor survey: Response rate to the encouragement of increased participation in K-12 outreach was 3.5, 5 being very likely and 1 being very unlikely.</p> <p>No specific measure of this indicator</p> <p>A 3.0 response rate to increasing inclusion of educational activities in graduate programs. 5 being very likely and 1 being very unlikely.</p> <p>No specific measure for this indicator</p>
<p>Community</p> <ul style="list-style-type: none"> • Increased participation • Enhanced view of educational relationship between ISU and local schools 	<p>Community survey: 9 questions pertained to these benchmarks; the overall mean response value was 3.2, with 4 being very satisfied and 1 being very dissatisfied.</p>

Summative evaluation

In what specific ways did the Fellows improve their science communication skills?

A series of eight questions were asked of the Fellows regarding communication, on a 4 point scale, with 4 = Very Able to 1 = Not Able the Fellows rated themselves at an overall mean for the 8 questions at **3.4**, or between Able and Very Able. Specific ways in which Fellows improved in science communication skills involved; 1) Teaching university students [**3.3**], 2) Teaching science or engineering to elementary, middle, or high school students [3.7], 3) Teaching inquiry-based science [**3.1**], 4) Communicating with elementary, middle, or high school students [**3.3**], 5) Leading groups of peers [**3.5**], 6) Leading groups of K-12 students [**3.5**], 7) mentoring K-12 students in research [**3.0**], and 8) Talking about your own research with people who know little about it [**3.4**].

What aspects of the program enhanced (or not) the Fellows interest in science education?

The following are direct quotes from each of the participating Fellows responding to the question "What did you like best about the GK-12 Program?"

1) Being able to work with students in areas of science and mathematics. 2) It was a good opportunity to communicate with people outside of my field of expertise. 3) It gave me a better idea of how public education is evolving. Being able to help students understand difficult concepts. 4) Being part of a working partnership. 5) I enjoyed working with the students during the 6 week build and competing with the robot. The kids had a great experience and sense of accomplishment at the competition. 6) The opportunity to teach what I am passionate about in research - Having students gain knowledge and excitement at learning new things. 7) The opportunity to teach in a grade/middle school classroom without the negatives associated with being a teacher. 8) Interacting with students to produce a robot that they designed and built. 9) Enjoyed working with students on robotics project. 10) Developed good working relationship with students. Learning how to stimulate high school students. 11) The fact that I was in a classroom setting as a representative of my field, and my associations with the students were based on increasing their drive to inquire. 12) I liked that students approached me to express how I helped to make science more fun and more interesting. 13) It taught me quite a bit about K-12 science programs and what needs to be done to improve them. It motivated me to continue learning about it. I thought the Lego League contest was so awesome. 14) The kids that participated gained so much from that experience. Also just sharing cool science aspects with the students that get them thinking more about science as a career. 15) The opportunity to learn to relate my field of training to those who have not been educated in that study.

In what specific ways has the project altered the views of ISU faculty on K-12 outreach?

Obtaining the views of the faculty advisors has been weak, meaning only 4 of 10 set aside time to meet with the external evaluator. To answer this particular question one must first consider that 3 of the 4 indicated an "involved or significantly involved" response to the question "Please rate your level of involvement with your GK-12 fellow." One indicated a neutral involvement. Second, all 4 indicated either a neutral or not at all response to the question "Because of your advisee's participation in the GK-12 program, has your attitude changed regarding the way undergraduate and graduate students should STEM content in the university setting?" Third, when asked "How likely are you to change how you teach to incoming students to prepare them for partnerships with educators or other non-academic setting?", the responses were 3 of 4 saying "not very likely or neutral" and 1 indicating "very likely." While the faculty was positive about the GK-12 project, i.e., its benefits to the fellow, the faculty seemed unaffected; in general, by how the GK-12 project was influence their own views.

What were the specific benefits to participating students? Did these benefits outweigh any perceived costs?

13 questions were asked of the students regarding their perceptions of science and the influence of the Fellow on the student's perception of science. The overall mean value for the response to these questions was **2.9** on a 4 point scale, with 4 being strongly agree, and 1 being strongly disagree. The perception of students about their involvement in the GK-12 project was positive.

<p><i>What were the specific benefits of participating students? Did these vary according to school, teacher, fellow, or activity?</i></p> <p>Perhaps the most interesting revelation in the student survey was the positive response by students and their increased interest in their science class as a result of the Fellow's participation in the classroom (3.3 on a 4 point scale). This result was the mean for 787 respondents across all participating schools. To support this, the community when asked "how would you characterize the student participant's comments about the ISU fellow?" responded with an overwhelming 3.7 on a 4 point scale.</p>
<p><i>In what specific ways has the partnership between ISU and the local schools been strengthened?</i></p> <p>In an era of tight K-12 budgets, any outside assistance that funded by other sources, e.g., grants is a welcomed service. The placement of fellows into school district science classrooms generates bridges, collaborative links, and positive perceptions. (All participating teachers indicated satisfied [18%] or very satisfied [82%] with their Fellow.) Modeling by the Fellow was also positive, as indicated by the previously question. The most revealing survey question was asked of the community, "From my observation, I would say the GK-12 activities have had a beneficial effect on participating schools." with a 3.5 positive response on a 4 point scale.</p>
<p><i>To what extent has the GK-12 concept been integrated into graduate programs at ISU? The ISU administration has committed funds to support continued GK-12 type activities into the graduate student T.A. and R.A. assistantships, given the successful GK-12 proposal for 2007-2011.</i></p>
<p><i>Is there evidence for an enhanced view by community of the educational relationship between the university and the local schools?</i></p> <p>The most revealing answer to this question is found in the survey question, "From my observation, I would say the GK-12 activities have had a beneficial effect on participating schools." with a 3.5 positive response on a 4 point scale. Additionally the community survey indicate a 3.1 response rate to the question "Overall, how would you assess the impact of the GK-12 activities on the student-participant?"</p>
<p><i>How strong is the evidence for the observed outcomes? Are there rival explanations for the outcomes (e.g. rival programs, teacher or student activities, community actions)?</i></p> <p>The surveys utilized to determine the perceptions of the teachers, Fellows, students, faculty, and the community, were designed to illicit responses through a variety of questions to gain the "big picture." As indicated previously, there is an over whelming amount of data gathered which supports the conclusions drawn.</p>
<p><i>Were the benefits worth the startup and operational costs of the GK-12 program?</i></p> <p>Armed with the survey data, the conclusions drawn from participating teachers, students, and community would demonstrate conclusive support for the benefits in starting up the GK-12 project. The weakest data comes from the faculty, mainly from the fact of the few numbers responding.</p>

Recommendations

The first recommendation is, continued progress with the implementation of the original grant goal, and objectives, i.e., placement of the Fellow into science classrooms. Survey data demonstrates a very positive perception of this major grant ingredient.

Second recommendation is to some how generate more involvement of the participation ISU faculty, perhaps by actually having the faculty member participate in K-12 classrooms STEM activities along with the Fellow. And most importantly actually making time to submit their observation and perceptions via the survey instrument to the external evaluator.

Third recommendation is to modify some of the survey questions, for future surveys, to address more specifically answering the effectiveness and success of the above indicators, objectives, and goal.

Fourth recommendation is to revise monthly meeting between Fellows and participating teacher to make more satisfying to Fellows, i.e., provide more structure to the meetings to insure meeting the needs of the Fellows.

Part 3. Collaborative Response Report.

The external evaluator made four specific recommendations, which are each addressed below.

Recommendation 1. Continue to implement original grant, making progress towards the defined goals.

Timeframe for appropriate actions: Many of these actions are already implemented (e.g. changes to selection process, summer workshop, monthly meetings). The remainder will be implemented throughout the 06-07 academic years.

The project PI, in collaboration with the co-PI's and the Project Coordinator have continued in their efforts to implement the goals of the project. We have recruited teachers and Fellows for the 2006-2007 academic year, held the summer training workshop, and scheduled the monthly participant meetings. Based on results from the formative evaluation process, we have continued or modified the following aspects of the program:

The Fellow and Teacher selection process began slightly earlier than previous years, with informational meetings for teachers held at the schools. Both the PI and the Project Coordinator met with teachers at all the local high schools, several junior high schools, and two elementary schools. This active recruitment process yielded both more applicants and more focused teacher applications. The applicant selection process included previous participants, which greatly enhanced both the decision-making and the matching process.

Modifications to the summer workshop were made based on input received from the participants in the previous years. Changes included scheduling a separate session for the Fellows on inquiry and diversity, led by Dr. Ed Galindo, and nationally-recognized leader in science education for Native American students; sessions for teachers on resources for teachers available at ISU, including a mobile Molecular Biology laboratory and physics demonstration equipment. The workshop also integrated a field-based inquiry-based laboratory activity, a change from the physics-based lab activity of previous years. The workshop culminated in presentations by the ISU Fellows on their research pursuits and planned GK-12 activities. These presentations served two purposes- to enable all participants to recognize the broad range of research expertise of the Fellows, and to capture the scientific communication skill of the Fellow at the start of the year. The taped presentation will be compared with a similar presentation made at the end of the year.

The surveys indicate extensive participation by Fellows in the project activities. We monitor activity throughout the year through informal conversations with teachers and Fellows. The project PI's and coordinator have made great efforts to be proactive with any problems in this area, and to address them immediately.

The surveys also indicate a high level of collaboration between Fellows and their partner teachers in planning and implementing STEM activities. This is continually encouraged by setting aside time at the monthly meetings for planning, and informal surveys asking for examples of successful activities. More formally, all participants are regularly requested to add activities to the collection on the ISU GK-12 website. Fellows and partner teachers are also asked to make presentations at regional and national meetings.

ISU faculty participation in GK-12 activities (see recommendation 2).
Effectiveness of monthly participant meetings (see recommendation 4).

There has been outstanding participation by local businesses and organizations in the activities of ISU's GK-12 project. These alliances are a critical part of the robotics programs, but have also proved invaluable to the other partnerships. The project continues to provide the participants training in the tools (and contacts) necessary to generate strong support from the local community.

The project management has become more efficient after two years of successfully running the project. The Project Coordinator's efforts are extraordinary and are an integral part of the day-to-day activities of the project. The PI continues to focus on the budget and meeting project goals. All of the PI's contribute their efforts to community support, university integration, and enhancing the Fellow-Teacher partnerships.

Recommendation 2. The external evaluator suggests increasing the involvement of ISU faculty in the Fellow activities and the ISU GK-12 project more broadly.

Specific actions taken by the PI's and Project Coordinator to address this issue are as follows:

Most of the faculty advisors of the students selected for Fellowships are not PI's on the GK-12 grant, thus their level of knowledge of the graduate fellowship program is limited. The PI's and Project Coordinator have made specific changes in the project design to increase the involvement of these graduate advisors.

- invite all graduate advisors to one activity during the summer workshop, in order to have them meet their Fellow's partner teacher and get the flavor of the project,
- require that all faculty advisors attend one of the monthly meetings, preferably the one in which their student presents with their partner teacher,
- require that all faculty advisors visit their graduate Fellow's classroom to observe the Fellow's activities,
- invite graduate advisors to the end-of-year presentations by Fellows.
- Have the PI contact all graduate advisors prior to the evaluator, to strongly encourage them to participate in the project evaluation process.

C. Discuss project goals and the issues surrounding sustainability.

The PI (with new co-PI's) spend a substantial amount of time and effort demonstrating the sustainability of the ISU GK-12 project in a recent submission of a GK-12 Continuation grant proposal (submitted June 19, 2006). Many of the formative evaluation results were incorporated into the proposed project. In addition, the proposal process involved collaborations with ISU faculty and administrators from the College of Arts and Sciences, the Office of Research, the Graduate School as well as leaders in the local school districts. These collaborations were critical in defining ISU's contributions to sustaining a GK-12 like project as part of the graduate training programs at ISU.

Recommendation #3. The external evaluator suggests modifying survey questions to both streamline and focus evaluation.

The current surveys were generated by adapting surveys from other GK-12 sites as well as generating new questions specifically related to ISU's GK-12 project goals. Based on two years of responses, modifications to the surveys will be made. The external evaluator, the PI's, and the project coordinator will identify goals that are not covered by the current questions as well as redundancies. There may also be a need to ask more specific open-ended questions, especially focused on the outcomes listed for the summative assessment. A preliminary review has already occurred as part of the analysis for the external evaluation report, further efforts will be made during fall 2006. Based on the findings, new questions will be generated and implemented in the surveys in late spring/early summer 2007. The summative evaluation will also include surveys and interviews of key administrators at ISU and participating school districts.

Timeline:

Fall 2006: identify gaps and redundancies in current surveys. Spring 2007: generate new questions/modify old questions and integrate into existing surveys.

Early summer 2007: Implement new surveys at end of academic year. Summer 2007- analyze data collected in surveys, in preparation for Final Evaluation.

Recommendation #4. Revise format and content of monthly participant meetings.

Based on survey results, improvements to the structure and content of the monthly meetings were also implemented. Clearly, the monthly meetings were more valuable to teachers than to Fellows. This is perhaps because Fellows (because they are also students at ISU, often in the same program) confer informally with other Fellows outside of the meeting times, whereas Teachers (because they are at different schools) rarely have the opportunity to confer outside of the monthly meetings. The most positive aspect of the monthly meetings for Fellows was the opportunity to receive assistance from the project faculty and coordinator with materials and ideas for use in the classroom. Based on a variety of inputs, the monthly meetings are now focusing on presentations by Fellows and their partner teachers, with an emphasis on what worked – and why. This gives the Fellows an additional opportunity to communicate their efforts to a different audience. There are also breakout groups of just Teachers or Fellows, to exchange ideas about building stronger partnerships (both among Teachers/Fellows, and with faculty and resources available at ISU). For the Teachers, there are also sessions to clarify the role of the Fellow in their classrooms.

The monthly Fellows-only meetings have been revised to focus each meeting on a specific topic identified by the Fellows and Teachers as important for their success. These include effective teaching techniques, adapting and implementing inquiry-based activities, understanding how people learn, issues facing public schools, obstacles to student success in STEM fields, etc.