

Idaho State University GK-12 Annual Report (2004-2005)

Activities and Findings

Research and Education Activities (Brief Summary):

2004-2005 academic year:

The 17 Fellows and 17 Teacher Partners spent over 5000 hours in the local schools bringing "real" science and engineering projects to over 1,000 students in schools and over 5000 that attended the Expo, robotics competitions, zoo, and museum activities. Teachers incorporated many new learning activities for their students (that they report they "would never have done without their Fellows"). A list and description of 45 of these activities is available on our GK12 website. Surveys (self-reports) indicate that Fellows improved in their ability to explain scientific or engineering concepts to a wide audience. An independent measure of communication skills (ratings of quality of responses to the on-line journal prompts) also found a highly significant gain over the Fellowship year. Based on the outcomes of the activities of the 2004-2005 Fellows and partner teachers, we can provide substantial evidence that ISU's GK-12 project is meeting its overall goal of enhancing scientific literacy in southeast Idaho.

2005-2006 academic year:

These GK-12 Fellows have only been in the schools for 8 weeks, so we have limited information to report on outcomes. The 16 Fellows and 16 Teacher Partners have already spent over 1000 hours in the local schools and have encouraged students to participate in a wide-range of science and engineering activities. Just as last year, the Fellows have faced the challenge of explaining what they know to students in these lower grade levels, but their partner-teachers have already noted that they are improving. Various faculty members at ISU have also become involved by loaning lab equipment, making class visits, and providing additional resources for Fellows and teachers.

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.

In a separate document we provide a report from our outside evaluator (Dr. Jack Coffland, Intermountain Center for Education Effectiveness).

Fellow and Teacher selection process: This went very well- in particular both the Fellows and Teachers thought we did a good job in "matching" their interests, expertise, and personalities. In year 2 we included a Fellow and Teacher on the selection committee and they ably assisted with selecting and matching the Fellows and Teachers. Based on our experience in the first year, we altered our Fellow and Teacher selection process the second year so that we could offer the Fellowships to graduate students earlier (before they selected other Fellowships or TA-ships). Despite this change, we had some turnover of Fellows up until the summer workshop, so we need to revise this process again next year.

Project management structure is working well, with only minor changes to personnel in the local school districts and at ISU. The provision for a Project Coordinator position was vital, as this person expertly handles many of the day-to-day operations of the project.

Advisory Council and Formative Evaluation:

Two advisory council meetings generated important information on possible collaborations with local industries, encouraging parental involvement, and assessment plans.

External Evaluators:

The PI and Project Coordinator worked extensively with the external evaluator (Dr. Jack Coffland, of the Intermountain Center for Education Effectiveness) to build surveys, test the on-line format of the surveys, coordinate the data collection process, and review and interpret the accumulated data. The external evaluator also collected information about the project by attending GK12 activities, meeting with, and interviewing participants. These were all summarized into a valuable report on the progress and outcomes of the project (see attachment). We are currently in the process of reviewing the recommendations and implementing them as necessary. Due to retirement, we will be working with a new evaluator, Dr. Chuck Zimmerly, (also at the ICEE) for the remainder of the project.

Annual and Regional Meetings

A team of 8 participants attended the annual GK12 conference in Washington DC in March of 2005. These included Rosemary Smith (PI), Mickle Ellis (co-PI), John Knox (Dean of the Graduate School), Hannah Sanger (Project Coordinator), Todd Hartle (graduate student researcher), Andy Ray, Jason Marena (graduate Fellows), and Teri Mitton (teacher). The meeting provided a great venue to share ideas generated in our project, as well as to learn from other projects. Out of the national meeting was the idea of having a regional meeting, which we will attend in November 2005 on the campus of the University of Utah.

Summer Workshop: We slightly re-designed the summer workshop to address issues raised after the first workshop- primarily to add more time for planning by the partnerships, to provide hands-on introduction to building and programming the Lego robots, and to provide Fellows with information on the state science standards. From the survey data it is clear that the diversity workshop is least valuable to experienced teachers and most valuable to the Fellows. We plan to change the format to provide an alternative presentation for the teachers (for example they would benefit from improving their skill at finding and identifying inquiry-based lessons in their

content area). As recommended by the external evaluators, we provided individual training to the Teacher and Fellow who missed the workshop. (Also see section on Training and Development for specifics on the workshop and seminars).

Activities of Fellows and Teachers:

Below we provide further information and provide brief but specific examples of the activities that the Fellows, Teachers, and faculty conducted or are currently conducting. These are arranged into the five project areas that we defined in our proposal, although we also describe new project areas initiated for the 2005-2006 academic year.

1. Fire and other Environmental Hazards:

2004-2005: Over 160 students from Century High School and 116 students from Highland High School were involved in research on wildfires. Highland HS students (with the assistance of the local fire department) burnt an undeveloped area on their school grounds and took measurements of soil temperatures, rate of burn, and vegetation changes. With the assistance of their teacher and graduate Fellow they made specific predictions before the burn and took several soil and vegetation measures. They developed an ecological restoration plan, including growing native plants in the school greenhouse. Century High School students took field trips to two burned areas near Pocatello to sample soils and vegetation. They conducted soil water percolation tests and expanded their understanding of hydrology. At one site they found no vegetative recovery after a number of years. They worked on this dataset throughout the year and then held a poster presentation competition, with judges (ISU Biology and Geosciences faculty). The winners of this competition presented their posters at a regional conference, the Great Rift Symposium, sponsored by Craters of the Moon National Monument and nine other government agencies (including the NPS, BLM, & USGS).

2005-2006: Based primarily on word-of-mouth about how interesting last year's course was, three times more students enrolled this year in Highland High School Environmental Academy course than did the year before. This course is an elective, which makes the positive response even more significant. The teacher attributed this increase primarily to the activities and efforts of the graduate Fellow. This year's Fellow will now work with two classes (34 students). He and his teacher have already begun studies of soils, tree germination, and plant physiology. A teacher at new Horizons High School (an alternative HS) is partnered with a Biology graduate student and they are developing a variety of hands-on activities for three classes (56 students). The plan is for the students to work on projects that will have a positive impact on both the school and the Pocatello community, including a xeriscape garden and analyses of the local watershed. A new area of research was initiated by an Anatomy and Physiology teacher at Century High School. This teacher is teamed with a Fellow from Biological Sciences to implement more inquiry-based lessons in functional anatomy (55 students). We also have a Geosciences Fellow partnered with a Middle School teacher, they are focusing on topics in Integrated Science as well as participating in the Lego Robotics challenge.

One Fellow states: " In our classroom, we realized that one of the problems that students have had with subjects like physiology is that they are unable to relate to things on a microscopic level. In response, we have utilized analogy to things that are more tangible in our lesson plans. One of the first lesson plans we entitled "Extracurricular Epithelium". In Extracurricular Epithelium, students were presented with "sections" of extracurricular objects (basketballs, baseballs, etc) where they were instructed to describe the epithelium (surface layer) and surmise possible uses for it. After that, they were presented with a lab where they viewed organismal epithelium under a microscope. Students immediately noticed the relationship between form and function, as they described that the thick, multilayered football epithelium and the thick multilayered epithelium of the skin are designed to resist impact repeatedly over their lifetime. During our lectures, we continue to provide analogy to the students, as one of us teaches in front of the class, the other watches for student expressions that say "I'm totally lost here". When this happens, between the two of us, we can almost always find an analogy that the students are familiar with."

2. Portneuf River Project:

2004-2005: Nearly 260 students from Pocatello High School, Shoshone-Bannock Jr/Sr. High School, and Highland High School collaborated to take water samples from specific sites along the Portneuf River. Students at Pocatello High School (N= 142) designed and carried out scientific studies of leaf decomposition in local streams. The graduate Fellow, based on her research experience suggested these "leaf pack" experiments. The Fellow at the ShoBan School worked with 68 students and 2 teachers to construct, plant, and map a wetland on the school campus, and investigate the Shoshoni names and uses of native plants. Students at Highland High School designed experiments related to nutrient levels, pH, and aquatic plant growth, conducted invertebrate samples on nearby sage-covered habitats, and conducted a number of novel experiments including some in molecular biology, forensics, and germination requirements of native plants. Fellows also worked together to combine water quality and invertebrate sampling data collected by students in the three High Schools (as well as one Middle School) and to add these data to the Portneuf River Project website (a scientific site hosted by ISU). Two teachers and a Fellow presented their newly developed lessons at the Idaho Science Teachers Association annual meeting in October, 2005.

2005-2006. This year, two new schools are joining the Portneuf River Project- Taylorview Junior High School (Idaho Falls, with 250 students involved) and the Pocatello Community Charter School (66 students involved). Three Fellows are working with teachers and students. They have already coordinated water sampling, bacterial growth, and invertebrate sampling protocols and are planning a variety of other projects. With the new schools, water quality sampling has been extended further, to include higher reaches of the Snake River. In addition to the PRP, the Fellow and Teacher at Pocatello High School (120 students involved) have initiated a special project in forensic biology in the applied biology/chemistry classes.

3. Pocatello Zoo

2004-2005: Fellows worked with middle-school teachers and over 2000 students in activities related to animal behavior, ecology, evolution, and genetics. The teachers, fellow, and zoo educator coordinated inquiry-based activities in the classroom with fieldtrips to the zoo. The zoo fieldtrips provide students with the opportunity to collect data on animal behavior and physiology. This Fellow (an undergraduate) enjoyed her experience so much that she stayed on and worked as a zoo educator throughout the summer. In addition we had two Fellows partnered with Middle School teachers who taught General Science. They participated in the zoo activities, as well as in a variety of science projects in astronomy, biology, chemistry, and physics. They also started a noon Science Club for interested students.

2005-2006: One graduate Fellow has worked with the zoo educator to design new exhibits, prepare kits for presentations by teachers at schools, and prepared and delivered lessons to over 100 school children, both at the zoo and in their classrooms. In addition, the Fellow has initiated an "Animal Behavior Research Team" (recruited from local high school students) to participate in comparative studies of wild and captive elk and other wildlife. They have already made one trip to Yellowstone National Park and are comparing their observations with the captive elk at the zoo.

4. Idaho Museum of Natural History (IMNH).

2004-2005: One undergraduate fellow from Geosciences worked with the museum educator and the docents at the IMNH. This Fellow assisted with museum visits by school groups as well as providing the scientific information necessary to develop hands-on activities in plate tectonics, volcano studies, and the geology of Idaho. Hundreds of students (including public school and home-schooled students) visited the museum and participated in activities led by the museum educator and the GK-12 Fellow.

2005-2006: No Fellow. Museum educator is on sabbatical this year.

Quotes from current Fellows and Teachers:

"The highlight for the fall would be the forensic entomology experiment."

" I used a free computer program to zoom from hundreds of miles above the earth's atmosphere down to the school. There was a universal "Wow" from the students."

" We conducted an insect science investigation (following the scientific method) while our class was on a camping trip. We modeled and developed a quality science investigation and gathered insects in 2 different habitats using bent and aerial nets. Students compared and made conclusions about the results regarding species abundance and diversity in the 2 habitats. We hope to mount some of the gathered insects."

"We have mapped the school grounds to lay the foundation for a xeriscape garden. We are working on obtaining seeds from seed distributors for our xeriscape garden, which

involved having the students write “mini-grants” to the seed distributors. We also collected water samples from the Portneuf and created conditions for bacteria and protists to grow. Students viewed these samples under microscopes prior to growing them. The students then learned about bacteria and protists and viewed prepared slides of microorganisms. The students have now gone back and started viewing the microorganisms after bacterial growth. This last viewing stimulated and increase in interest."

"One lab [we have conducted] is an inquiry based series of exercises designed to teach students about morphological characteristics of skulls. This lab teaches students the fundamental basics of classification. Students learn to discover animal identity and group animals by using a key designed for the appropriate grades. They develop ideas and life history hypotheses on observations of morphological differences. Our skull lab last week worked so well that I will be using it in the future."

FINDINGS from above projects: These partnerships went far beyond the initial research areas described in the proposal. Fellows were able to bring to the classroom expertise in the nature of science, geology, hydrology, wetland biology, botany, genetics, microbiology, herpetology, physiology, and evolution. One of our key findings was that it is best to not prescribe the scientific topics or activities ahead of time, but to encourage Fellows and Teachers to work together to build on the content-area strengths of the Fellow and the needs of the individual teacher. This worked out really well and led to a great diversity of projects and activities. The Fellows also learned to prepare and teach materials that were a little outside of their disciplines, which was valuable for them. A second key finding was that our Fellows play a huge role in mentoring students. We had reports from several teachers that many of their students are selecting a science class as an elective and that their students opted to apply to ISU or attend other colleges based primarily on the encouragement and assistance they received from their Fellow. Idaho ranks 46th in the nation in the number of high school graduates who go to college, so this is an important positive effect of having a strong GK12 program in our region. Finally, the third finding was that many of our graduate Fellows have greatly increased their interest in, and understanding of, science education. One Fellow has accepted a GK-12 Fellowship at another institution where he is continuing his graduate studies, and several Fellows are preparing manuscripts for publication based on activities they developed during their GK12 Fellowship, and/or are continuing their involvement in some K-12 activities (on a voluntary basis) this year.

5. FIRST robotics and LegoLeague robotics.

2004-2005: The two graduate Fellows from Engineering and one undergraduate Fellow from the College of Technology (Machining) partnered with teachers from two High Schools to design, build, program, and compete with a robot in the FIRST competition. The two teams worked tirelessly with students, leading up to the regional competition in Portland, Oregon. The two team robots performed exceptionally well, taking home a second place finish and a "Best Rookie

Team" award. Several of the students involved continued on to enter college engineering programs.

In the Lego League, Fellows and teachers brought basic science and engineering concepts (making predictions, gears, motors, levers, computer programming) to students at Edgemont Elementary School, Pocatello Community Charter School (PCCS), and Tendoy Elementary schools. Teachers and Fellows at the PCCS used the Carnegie Mellon University Lego League Curriculum to assist them in integrating the Lego League Competition with the science and mathematics curriculum. Incorporating the Lego League into the classroom elicited substantial parental support and an interest in proposal writing. Many local businesses also supported the teams.

The Lego League robotics competition was held in ISU's Reed Gym in May, 2005. Eight teams from three public schools participated, with over 80 students contributing to the design, building, and programming of the robots. The competition was fierce, with an animated announcer and perfectionist judges! Over 200 parents, friends, and supporters from the general public came to view the contest. The winning teams carried off hats, large trophies, and certificates.

2005-2006: Based on its success last year, the FIRST program has expanded to 3 graduate Fellows from Engineering, partnering with teachers in three local High Schools (130 students). The LEGO project has also expanded to 3 elementary schools (215 students) and a Middle School (22 students). Based on last year's experience, this year the Fellow's are starting by focusing on the elements of the engineering design process. All teams will again participate in local and regional robotics competitions. Besides their robots, the teams are currently developing a team logo, business plan, community outreach and parent involvement programs, and presentations for other schools and sponsors.

Hillcrest HS participated in the INL (Idaho National Laboratory) Expo at the Idaho Museum, Sept 22-24th, 2005. The high school students demonstrated their robot and answered questions from 7th and 8th graders. The students also displayed their robot at the homecoming parade. One of the students was selected as student of the month; when he was interviewed by Channel 6 he demonstrated the robot to them – and this footage made the news.

Quotes from current Fellows and Teachers:

"[We] are most excited about the LEGO challenge with the other groups. We have designed three robots, and are beginning to work on the actual LEGO challenges. Students are totally engaged during the Lego building and programming. They are solving problems, analyzing, predicting, and hypothesizing daily. They have just started the challenges on the mat. They can build and program!!!! We are also going to participate in the Science Olympiad after the Lego unit is done.

"In our Intro to Robotics class we split students in 4 groups, with 1 group in charge of designing a moving platform. The other 3 groups critiqued their design. Other groups were in charge of designing parts that could be added to the moving platform robot to get

it to be able to push objects around. The 3rd group had to add a device to knock objects over. The last group had to pick and stack items."

"We worked on a lesson about how electric motors work. We built a simple display/electric motor. The kids learned how electro-magnets and magnets work. In the 1st session this fall, we divided the students into 3 teams and gave each team the challenge of building a robot with a specific sensor and then programming it to cover a maze – within 3 weeks. We invited parents in to view the process. The students built 3 different robots, each of which could find its way through the maze. The different times for travel, and accuracy reflected the good and bad points of each style and each sensor. The students learned early what would and wouldn't work. The parents were so impressed and pleased."

FINDINGS from robotics projects: The external evaluator report provides extensive information on the outcomes of the robotics projects. Key findings were that Fellows were instrumental in bringing both content area expertise and team-building skills to the robotics classes. All of the teacher's responded that they would not have participated in the robotics competition without the assistance of the Fellows. A second finding, taken from survey data, was that there was an overwhelming positive response by the Fellows, teachers, students, and parents to the robotics programs, in terms of satisfaction with the robotics project, interest in engineering, and improving math and science skills. In particular, several students are now pursuing college degrees in engineering or technology. The competitions also generated significant support from local parents, businesses, media, and industry. Finally, the Fellows made significant strides in their understanding of inquiry-based teaching, the constraints involved in teaching, and in their ability to model and explain engineering concepts to students.

NSF GK-12 at Idaho State University. Participating Schools 2005-2006

School District	School	# Teachers	# Graduate Fellows	# Undergrad Fellows	# of Classes	Subject(s)	Grade Levels	Urban - rural	% Free-Reduced Lunch	% Minority	AYP 2004-2005
District 25	Pocatello High School	2	2	1	6	Robotics, Electronics Tech 3, Electronics Tech 4; Applied Biology/Chemistry; Honors Biology; Advanced Placement Biology	9-12	Urban	32%	11%	No
District 25	Highland High School	1	1	0	2	Environmental Science Academy	10-12	Urban	22%	16%	Yes
District 25	Century High School	1	1	0	5	Anatomy and Physiology, Student Council, Competitive Forensics	9	Urban	31%	10%	No
District 25	Irving Middle School	1	1	0	6	Integrated Science, GATE (Gifted & Talented) Program	8	Urban	51%	14%	No
District 25	Gate City Elementary School	1	0	1	2	Robotics Club, GATE (Gifted and Talented) Program	6	Urban	19%	5%	Yes
District 25	Pocatello Community Charter School	1	1	0	3	Elementary Science	5-6	Urban	N/A	6%	N/A
District 26	New Horizons High School	1	1	0	3	Biology, Field Biology, Physical Science	9-12	Urban	76%	50%	No
District 26	Chubbuck Elementary School	1	0	1	4	Elementary Math, Elementary Science	6	Suburban	38%	11%	Yes
District 91	Edgemont Elementary School	1	0	1	4	Lego League, General Science	5-6	Urban	28%	14%	Yes
District 92	Taylorview Jr. Sr. High School	2	0	2	10	Physical Science	9	Suburban	24%	12%	No
District 93	Hillcrest High School	2	1	0	3	Introduction to Technology, Electronics/robotics, Basic Networking	9	Suburban	20%	7%	No
District 60	Shelley High School	1	1	0	3	Survey Science, Ag Science Solutions/Robotics	9, 11,12	Rural	29%	11%	No
N/A	Pocatello Zoo	1	1	0	NA	Elementary Zoo Outreach; Project TRIPS; Animal Behavior	K-12	N/A	N/A	N/A	N/A

Improving Communications Skills: ISU GK-12 Weekly Journals

Background — The GK-12 Communications WebCT site was established in early August of 2004 and put into operation by the end of the same month. The Communications Site is where GK-12 project participants work on improving their communication skills as well as providing a range of reflective self assessment responses to their project activities, both of which are central to the GK-12 project's stated goals. In maintaining a personal reflection journal of their experiences, GK-12 fellows and teachers will gain concrete conscious experience in communication aimed at a range of audiences, both professional and lay. This experience will help them to develop their abilities to organize their writing and speaking clearly and concisely, focusing on primary points and filling in all necessary details to create clear and logically complete written and oral communications. Over the 2004-2005 project year, we had 34 total correspondents on the GK-12 Communications Site, including 17 fellows and 17 teachers. In the 2005-2006 academic year we have 15 fellows and 15 partner-teachers.

In 2004-2005, two of the initial journal responses centered on generating baseline data that project personnel will use for comparison and assessment purposes throughout the project. The first of these asked participants to articulate their understanding of science (see example #1 below), while the second asked project fellows to self-assess their respective strengths and weaknesses as communicators (see example #2 below). A third early prompt asked project teachers to articulate criteria for assessing the effectiveness of the work the fellows are doing in their classrooms (see example #3 below). However, the usual weekly journal responses required of all project participants typically consist of two sections, the first focused on science/engineering content and communication issues, and the second focused on reflective self- and project- assessment (see examples #4 & #5 below).

Methods — In terms of assessing how well project participants — specifically the GK-12 fellows — met the goal of improving their communication skills, a portfolio assessment approach offered the ideal way to both assess goal attainment as well as a way to capture data relative to participant self-assessment of their project activities. The GK-12 Communications Director collected the weekly journal responses of each fellow who participated in the project over the whole year ($n=17$) into a portfolio and identified a subset of journal responses from the larger comprehensive set which could be used for beginning, midpoint, and ending comparisons of each fellow's communication skills. Project personnel then developed a scoring rubric for the portfolios (see appended matrices) which reflects the stated communication goals of the project. Once the portfolios, scoring rubric, and selected journal responses were in place, the Senior PI, the Communications Director, and a writing consultant from the Writing Program in the English department met to read, rank, and norm the portfolios. Each of the readers read each selection in each portfolio and assigned the selection an overall score from 5 (lowest) to 25 (highest), according to the rubric described below. These scores for each fellow by each reader were then examined for inter-rater reliability, and those portfolios showing significant differences between readers were normed. The scores from each reader were then averaged to give each fellow an overall score for each selection in his/her portfolio. The resulting data offered a beginning and ending assessment of each fellow's communication skills, as well as for several data points in between. Aggregate data was compiled from the individual scores to present an overall picture of

how well project fellows met the project's communication improvement goals for this year.

Results — Analysis of both the individual and aggregate assessment data yielded strong support that the goal of improving the GK-12 Fellows' communication skills was effectively met. The aggregate data are summarized as follows (n=17; high score 25 points, low score 5 points):

mean beginning score: 17.18

mean ending score: 20.47

mean increase in scores: 3.33 points, for an overall 13.32% mean increase

median beginning score: 16.00

median ending score: 20.00

median increase in scores: 3.50

Beginning scores ranged from a low of 13.5 (3 occurrences) to a high of 23.5.

Ending scores ranged from a low of 16.5 to a high of 25.

The lowest increase in scores was -0.5 (from 16.5 to 16.0).

The highest increase in scores was 8.0 (from 15.5 to 23.5).

Standard deviation for the mean increase in scores is 2.48, and a t-distribution with 16 degrees of freedom confirms that these results are statistically valid and show significant improvement in the fellows' communication skills.

Discussion — Though the assessment of the weekly journals provided strong evidence for the success of the project's goal of improving communication in the GK-12 fellows, an overall review of the weekly journal process based on both the portfolio assessment and participant feedback resulted in several changes to the journal process which have been incorporated into this year's project journal process.

First, the weekly journal format has been changed to a bi-weekly format to allow participants (both fellows and teachers) more time to develop their responses. Participant feedback and the portfolio assessment both suggested that journal responses would be more focused and coherent if given more development time amidst the larger range of project activities (this is also supported by the larger literature). Second, the journal response prompts were focused more closely on authentic tasks/opportunities for communication, rather than on more abstract prompts disconnected from the real context of the participants' classrooms and larger communities. Again, this change was made in response to feedback (from participants, the portfolio data, and the larger literature) suggesting that participant engagement in the journal process would be greater, given more focus on authentic opportunities for communication. Finally, in order to overcome nagging technical literacy issues with the GK-12 WebCT journal site, the weekly journal was shifted from a discussion board-based approach to an email-based approach which makes it easier for a broader range of project participants to respond efficiently to the weekly journal prompts.

Samples of prompts:

Welcome message — Welcome to our GK-12 Communications Website. This initial prompt is designed to help us establish a baseline of both content knowledge and communication skills, which we can use to help assess and evaluate, project progress over the course of the year. Before beginning your response, please take a moment to review the project's communications goals listed in the "Welcome" section of this site. You should also take a quick look at the self-assessment framework attached as a pdf file to this posting; the framework will form the basis of our project evaluation of your self-assessments.

Journal prompt Example #1

This prompt has two parts, a content-focused question and a reflective self-assessment question; please answer each question in turn in your response posting to your personal topic area. Both GK-12 teachers and fellows will respond to the same prompt for this initial response.

- 1) Explain the nature of science, i.e. the nature of scientific inquiry and what characterizes the practice of science.
- 2) Articulate your personal reasons for becoming involved with the GK-12 project, as well as your personal and professional goals for your work with the project.

Journal prompt Example #2—Please respond to the following points in specific detail.

- 1) Describe your strengths as a communicator and why/how you believe these characteristics to be strengths.
- 2) Describe how and why these strengths relate to your effectiveness as a writer.
- 3) Describe your weaknesses as a communicator and why/how you believe these characteristics to be weaknesses.
- 4) Discuss the specific work and/or resources you need to do to address these weaknesses.
- 5) Briefly reflect on how your strengths and weaknesses as a communicator relate to your work as a GK-12 fellow.

Journal prompt Example #3 — Please respond to the following teacher's prompt in specific detail (not just the criteria, but the rationale behind each item as well).

"List the criteria (and rationale) you would suggest for evaluating the weekly performance of the GK-12 fellow assigned to your class, both in terms of the goals of the larger GK-12 project AND their specific functions in your particular class."

Journal prompt Example #4 — This week's fellow's prompt has four parts; please address each part in detail, as follows:

- 1) Describe the work you have done this week as a GK-12 Fellow, both in terms of WHAT you have done, and how these efforts have fit into the overall plan you and your teacher have developed for the semester (the WHY). Please explain explicitly any concepts and other science and teaching knowledge that you refer to.

- 2) Analyze the work you have done this week in terms of what you have done well/what has worked well and what has not worked well/what you can do to improve.
- 3) Describe how you plan on addressing areas of concern and/or improvement you identified above, including where and how you will find resources for doing so.
- 4) Describe your plan for your GK-12 work next week.

Journal prompt Example #5 — This week's teacher's prompt has four parts; please address each part in detail, as follows:

- 1) Briefly describe the work your Fellow has done this week, both in terms of WHAT he or she has done, and how these efforts have fit into the overall plan you and your fellow have developed for the semester (the WHY).
- 2) Analyze the work you and your fellow have done this week in terms of what you have done well/what has worked well and what has not worked well/what you can do to improve.
- 3) Describe how you plan on addressing areas of concern and/or improvement you identified above, including where and how you will find resources for doing so.
- 4) Describe your plan for your GK-12 work next week.

Marking Guide for each of the characteristics noted below

5	4	3	2	1
<p>Ž -- sharp, distinct focus</p>	<p>Ž -- clear focus</p>	<p>Ž -- adequate focus</p>	<p>Ž -- vague or confused focus</p>	<p>Ž -- absence of focus</p>
<p>Ž -- substantiated, specific and/or illustrative content; sophisticated ideas that are particularly well developed</p>	<p>Ž -- specific and illustrative content</p>	<p>Ž -- sufficient content</p>	<p>Ž -- content superficial or limited to listing, repetition, or mere sequence of ideas</p>	<p>Ž -- absence of relevant content, or does not respond to prompt</p>
<p>Ž -- obviously controlled and/or subtle organization</p>	<p>Ž -- logical and appropriate organization</p>	<p>Ž -- appropriate organization</p>	<p>Ž -- inconsistent or confused organization</p>	<p>Ž -- absence of logical organization</p>
<p>Ž -- writer's voice, tone, sentence structure, and word choice appropriate to audience and purpose</p>	<p>Ž -- precision and variety in sentence structure and word choice</p>	<p>Ž -- some precision and variety in sentence structure and word choice</p>	<p>Ž -- limited sentence variety and word choice</p>	<p>Ž -- lack of control over sentence structure and word choice</p>
<p>Ž -- few mechanical and usage errors</p>	<p>Ž -- some mechanical and usage errors</p>	<p>Ž -- mechanical and usage errors not severe enough to interfere significantly with the writer's purpose</p>	<p>Ž -- significant weakness in mechanics and usage; errors that interfere with the writer's purpose</p>	<p>Ž -- mechanical and usage errors such that writer's ideas are difficult, if not impossible, to understand</p>

Characteristics of Effective Writing

Focus	Content	Organization	Style	Conventions
-- demonstrates an awareness of audience and task	-- information and details are specific and relevant to topic and focus	-- logical order or sequence is maintained	-- precise language	-- mechanics: spelling, capitalization, punctuation
-- establishes and maintains a clear purpose	-- ideas are fully developed and supported	-- paragraphs deal with one subject	-- effective word choice	-- usage: pronoun references, subject-verb agreement, etc.
-- sustains a single point of view	-- ideas demonstrate evidence of integration with general scientific knowledge	-- logical transitions are made within sentences and between paragraphs	-- voice, tone, and language appropriate to intended audience and purpose	-- sentence completeness
-- exhibits clarity of ideas	-- writing shows strength in critical thinking and learning	-- introduction and conclusion are evident	-- variety of sentence structures, types, and lengths	-- effective use of appropriate documentation methods and styles
	-- writing reveals ability to gather, evaluate, analyze, and synthesize material from both primary and secondary sources, where appropriate			

Training and Development:

Summer Workshop- August 8-12, 2005. The five-day workshop met for 6 hours/day, for a total of 30 hours. It was held on the campus of Idaho State University. It was attended by 9 Graduate Fellows, 4 undergraduate Fellows, 16 Teacher Partners, the four PI's/co-PI's, one doctoral student conducting research on the formation/success of GK-12 partnerships, and several presenters. Participating Teachers received 2 Continuing Education credits for their participation in the workshop. Content and Presenters and their affiliations are listed in the table below.

Presentations and content included:

Topic/Content	Presenter
Goals and objectives of the Idaho State University GK-12 Project	Rosemary Smith, PI, Dept. of Biological Sciences
Inquiry Activities (former Fellows and Teachers)	Heather Bechtold, Markette Kelemente, Eric Rude, Doug Alder, Becky Lorig, Janet Cook, Sherri Ellis.
Inquiry and the State Science Standards	Dr. Steve Shropshire, Dr. Rosemary Smith
Inquiry and Diversity	Dr. Ed Galindo, Shoshone-Bannock Jr/Sr. High School
Introduction to sub-Projects (robotics, environment)	Dr. Mikle Ellis, Dr. Richard Wabrek, Dr. Richard Inouye
Understanding Project Evaluation	Dr. Rosemary Smith, PI, Dept. of Biological Sciences ISU
Planning for Productive Partnerships	Dr. Paul Beardsley
Expectations of Teachers & Fellows Guidelines and Logistics for project	ISU GK-12 Project Handbook 2005-2006
Fellow/Teacher Planning Meetings -Year-long curriculum plans, school tours, ISU lab/research area tours	Fellows, Teachers, PI/co-PI's
Improving Communication: reflective journals	Dr. Steve Adkison, ISU
Presentation of partnership goals & plans	All participants

Monthly Seminars- A meeting of all ISU GK-12 Participants is held once per month for two hours. In 2004-2005 two sessions were held on one day and participants elected which session to attend (8-10 AM or 3-5 PM). This did not work out that well because often Fellows and their Partner teachers did not attend the same session, or, we could not have groupings by content area. For the 2005-2006 year we selected just one time (3:30-5:30) for all participants. This is working better. In both years, if necessary, a 1/2-day substitute teacher is paid for by the grant (several of the Teacher partners teach at schools that are a 1-hour drive away). In addition, in 2005-2006 Fellows-only meet once/month with ISU faculty members Dr. Paul Beardsley and Dr. Rosemary Smith to discuss topics related to teaching, learning, and classroom-based research.

Meeting location: ISU campus

Attendees: All Fellows and Teacher partners, Project Coordinator (Ms. Hannah Sanger), PI/co-PI's- Rosemary Smith, Mikle Ellis, Richard Wabrek, Richard Inouye, Communication specialist Dr. Steve Adkison.

Content: the Seminar provides Fellows and partner Teachers the opportunity to discuss and reflect on their partnership, and the PI's and project coordinator the opportunity to connect to the partners and see measurable progress. For example, they may participate in an update on partnership activities, use of website for journals/reflections (used to document activities and measure communication skills), and separate Fellow and Teacher partner meetings to discuss strengths and weaknesses of the program and methods to enhance their partnership. Future meetings will include mini-workshops on scientific inquiry and research, lesson planning, classroom management, collaborations, education standards, and classroom technology.

Outcomes: Fellows and partner teachers learn of successes among the other partnerships, ask and have answered questions about the web-based weekly journaling activity, have the opportunity to collaborate with other participants across classes, schools, and districts, and complete paperwork for the project (for example, evaluations, course enrollment forms for credit, and payment of fellowships). The PI and Project Coordinator discuss the ideas brought up by the discussions and collate and disseminate to the participants' suggestions for enhancing the partnerships. The Project Coordinator also compiles information on how to improve the project for next year.

Research Activities:

Mr. R. Todd Hartle, M.S., currently a graduate student in the Doctor of Arts in Biology program at Idaho State University is conducting a research project entitled "Cultural obstacles to collaborations between K-12 STEM educators and STEM research scientists using the ISU GK-12 project as a model".

Brief Abstract of the Research:

American K-12 STEM (Science, Technology, Engineering, and Math,) educators and research scientists in the STEM disciplines have very different educational experiences and training. They are also familiar with and use very different communication and interaction strategies. These differences are likely to foster miscommunications, conflicts and frustrations when individuals from these different disciplines attempt to collaborate in the education of K-12 students. This study attempts to identify and characterize the cultural and communication-related obstacles that arise during research scientist and K-12 educator interactions by using the GK-12 participants as a model.

Report on Progress to Date:

- November 2004 - The proposal for this study was accepted by Mr. Hartle's Doctoral Dissertation committee and the ISU Department of Biology.
- November 2004 - The ISU Human Subjects Review Committee accepted the proposal and approved of the research methods for 3 years. If there are no major methodological changes a renewal form is all that will need to be submitted annually.
- February 2005 - Mr. Hartle attended the Annual GK-12 Meeting held in Washington D.C. He represented his research at the ISU GK-12 poster as well as in all relevant meetings. Several contacts were made with others involved in primary research of GK-12 projects.
- April 2005 - A preliminary interview study was implemented including 7 personal interviews with GK-12 fellows and 4 focus group interviews with fellows or teachers. All interview recordings have been analyzed for questioning technique, response rates to questions, richness of data generated, and analysis methods. Formal analysis is ongoing.
- May 2005 - A series of journal prompts written specifically for this study were presented to the participants over the course of the school year. All journal responses (including those to other prompts) were collected and sorted. Responses have been analyzed to assist in future prompt development. Full analysis of responses is ongoing.
- August 2005 - A full review of interviewing techniques and data analysis was performed with the assistance of Dr. Elizabeth Cartwright (ISU Professor of Anthropology). Improvements were planned for the 2005/2006 implementation of the study.
- September 2005 - Journal prompts and observations have already started and will continue throughout the 2005/2006 school year.

Future Plans:

- October 2005 - A full round of individual and focus group interviews (~5 Teachers, ~5 Fellows, ~2-4 Focus Groups) is planned for this fall. Select interviews will be transcribed and analyzed throughout the year.
- November 2005 - Mr. Hartle will attend the Regional GK-12 Meeting in Salt Lake City, UT to represent his study and collaborate with other regional GK-12 projects.

- February 2006 - Mr. Hartle plans on attending the Annual GK-12 Meeting in Washington D.C. He would also like to make a more formal presentation of the study in order to obtain feedback from other participants.
- April 2006 - A second round of interviews (same as in October 2005) will be conducted.
- Summer 2006 - Data will be analyzed and final report will be written.

Preliminary Results:

- Although originally hypothesized as a source of tension, no partnerships have so far reported that the differences in content knowledge between fellows and teachers have provided any significant frustrations. It appears that this difference is known from the beginning of the partnerships and is negotiated smoothly by all parties.
- Focused vs. Multi-tasking time management: Teachers appear to have a multi-tasking style of time management where several tasks are worked on at all times and interruptions are handled without conscious recognition. Fellows appear to need a greater degree of focus. They block out periods of time dedicated to different tasks and are always conscious of interruptions. This difference seems to be most frustrating during planning sessions.
- Prior Planning vs. Flexibility: Fellows view the success of any lesson (and most activities) as a direct result of prior planning. Teachers frequently attribute success or failure to the teacher's ability to adjust teaching methods or focus to the each group of students' needs.
- Critical Feedback vs. Encouragement: Fellows tend to support the work of others through detailed and insightful critique. Teachers tend to use detailed and directed encouragement. This difference appears to cause frustration not only in the Teacher-Fellow relationship itself, but also in the ways that each observes the other in their interactions with students.
- Big Picture vs. Detail Orientation: Teachers focus on the "Big Picture" of a given topic. They often use a large number of examples and are less interested in making sure the examples are completely accurate than they are in making sure the overall message is understood. Fellows are much more focused on making sure each detail is accurate and will not use questionable examples. This difference does not seem to cause as much friction when interacting with students as it does with each other. With students, the two styles tend to complement each other. When the teacher and fellow are planning lessons, or instructing each other this difference can cause frustrations.