

GraSUS-II Year Four Formative Evaluation Report

Project Period: June 2007 - May 2008

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This formative evaluation report is prepared to provide the GraSUS-II project leaders with feedback on their progress toward project goals in year four of the five-year project. The report is written in three sections. The first section includes all tables created from the evaluation data sources for the current project year. After a summary of the end-of-year questionnaire responses (Table 1), the remaining tables (Tables 2-19) are sorted according to the project goal with which each table most closely aligns. The second section is a table (Table 20) and a narrative that summarize the findings of this year four formative evaluation. The third section is a set of recommendations for the project leaders to consider as they enter the fifth and final year of the project.

This formative evaluation was based upon analysis of the following data: (1) questionnaire data collected from teachers, students, and fellows in May 2008, (2) summaries of written evaluations of the 2007 Summer Academies and 2007-08 Collegial Study Group sessions, (3) notes from several interviews and focus group sessions from the project site visit during the spring semester 2008, (4) samples of classroom activities/lessons created by the 2007-08 fellows, (5) documentation of NDSU faculty interactions with the project, (6) weekly reports written by fellows, (7) copies of fellows' poster slides, and (8) project reflections written by teachers.

Section 1. Data Tables

GRaSUS-II Project Goals	Questionnaire Respondents	Project Years			
		<i>2004-05</i>	<i>2005-06</i>	<i>2006-07</i>	<i>2007-08</i>
Goal I: Enrichment of student learning in grades 7-12	Teachers	.90	.93	1.00	.99
	Fellows	1.0	1.0	.96	.88
	Students	.82	.83	.76	.78
Goal II: Improved skills and competencies of fellows	Teachers	.97	.86	.99	.94
	Fellows	.86	.93	.92	.92
	Students	.81	.88	.84	.82
Goal III: Professional development of STEM teachers	Teachers	.94	.92	.98	.90
	Fellows	.89	.89	.82	.83
	Students	---	---	---	---
Goal IV: Growth of a partnership between NDSU and schools	Teachers	.75	.91	.92	.86
	Fellows	.45	.60	.27	.50
	Students	---	---	---	---

Table 1. Summary of proportions of respondents who rated end-of-year questionnaire items related to the first four project goals as either positive or very positive. The proportions represent averaged responses of all questionnaire items categorized with each goal. Student questionnaires did not include items related to the goals of teachers' professional development and growth of a NDSU/school partnership.

Tables Related to Goal I: Enrichment of Student Learning (Tables 2-7):

Grades 7-12 GraSUS-II Students	2004-05	2005-06	2006-07	2007-08
Math	124	196	275	208
Science	521	336	817	510
<i>TOTAL</i>	<i>645</i>	<i>532</i>	<i>1,092</i>	<i>718</i>

Table 2. Numbers of grades 7-12 students who participated as respondents to the end-of-year evaluation questionnaires.

Questionnaire Item	Year	Proportion of students who:		
		<i>Somewhat or Definitely Agree</i>	<i>Somewhat or Definitely Disagree</i>	<i>Stated they had no Opportunity to Observe</i>
The NDSU student helps us solve problems and do our work.	2004-05	.90	.09	.01
	2005-06	.93	.05	.02
	2006-07	.93	.06	.01
	2007-08	.94	.03	.03
I have learned some things about science or math from the NDSU student.	2004-05	.85	.14	.01
	2005-06	.95	.05	.01
	2006-07	.89	.10	.01
	2007-08	.89	.06	.05
I do not like science.	2004-05	.21	.77	.01
	2005-06	.21	.78	.01
	2006-07	.28	.64	.08
	2007-08	.31	.65	.04
I do not like math.	2004-05	.24	.73	.03
	2005-06	.36	.62	.01
	2006-07	.35	.63	.01
	2007-08	.37	.59	.04
I think I am a pretty good math student.	2004-05	.79	.18	.03
	2005-06	.75	.24	.01
	2006-07	.62	.37	.01
	2007-08	.73	.25	.02
I think I am a pretty good science student.	2004-05	.85	.13	.02
	2005-06	.88	.10	.01
	2006-07	.75	.19	.06
	2007-08	.77	.20	.03
I like the activities that the NSDU student does with us.	2004-05	.83	.17	.00
	2005-06	.89	.10	.01
	2006-07	.88	.10	.02
	2007-08	.88	.10	.02

Table 3. Grades 7-12 students' responses to the end-of-year questionnaire items about the GraSUS fellows' impact on their learning.

<i>Labs/Activities</i>	
<p><u>Science</u></p> <p>Heat Exploration Simple Harmonic Motion Waves and Wave Motion Spring Constant (k) and Work Acceleration Due to Gravity All Work and No Play Projectile Motion Terminal Velocity Sling shot Tortoise vs. Hare Galileo Free Fall Lab Photo Gate Lab Acceleration & Dynamics Lab Impulse & Momentum Lab Footsteps in Time Creatine WebQuest Reflexes Special Senses: Hearing & Equilibrium Period and Mass Sound Wave Frequency Water Quality Photosynthesis Periodic Table Game Concrete Lab Crazy Coasters Iron vs. Rust Lab Biomolecules Exploring Biomes in North Dakota The Wind Car Project Estimation How to Keep a Scientific Journal M & M Chi Square Fun with Fungus How Many Planets do You Need? Contact Lens Demonstration</p>	<p><u>Math</u></p> <p>Circular Functions Project FactoCards Infectious Disease Activity The Men's Mile Record: Finding the Model of Best Fit Scale in Plans Triangles in the Real World Translations Probability and Odds Walk the Graph Slope in the Real World Deal or No Deal Statistics Pi Derivation Lab Case Study Light Intensity Bernoulli's Law & Water Flow Modeling Properties of Triangles</p>

Table 4. Examples of labs and activities developed or revised by 2007-08 GraSUS-II fellows.

<p>Is science or math class different when the NDSU student helps? If your answer is YES, tell how class is different. (n = 703)</p> <p>YES = 46% NO = 49% Typical comments from those who answered YES:</p> <ul style="list-style-type: none"> • <i>The class is more interesting and fun.</i> • <i>The NDSU student can relate to us better; he/she is younger.</i> • <i>He/she explains things well.</i> • <i>There is someone to help my teacher in answering our questions and helping us.</i> • <i>We do more activities when the NDSU student is here.</i>

Table 5. Grade 7-12 student responses to an open-ended item on the end of year questionnaire completed in 2008.

Questionnaire Item	Year	Proportion of teachers who:		
		<i>Agree or Strongly Agree</i>	<i>Disagree or Strongly Disagree</i>	<i>Stated they had no Opportunity to Observe</i>
My students are enthusiastic about the lessons/activities developed by my fellow.	2004-05	.88	.13	.00
	2005-06	1.00	.00	.00
	2006-07	1.00	.00	.00
	2007-08	1.00	.00	.00
My students are not interested in my fellow or his/her studies at NDSU.	2004-05	.13	.88	.00
	2005-06	.14	.86	.00
	2006-07	.00	1.00	.00
	2007-08	.07	.93	.00
The activities developed by my fellow are helping to increase my students' abilities to solve problems.	2004-05	.94	.06	.00
	2005-06	1.00	.00	.00
	2006-07	1.00	.00	.00
	2007-08	1.00	.00	.00
The work of my fellow does little to increase my students' confidence to learn science or mathematics.	2004-05	.06	.94	.00
	2005-06	.00	.86	.14
	2006-07	.00	1.00	.00
	2007-08	.00	1.00	.00
I have seen little/ no evidence that my students learn anything from my fellow or the activities he/she creates.	2004-05	.13	.88	.00
	2005-06	.07	.93	.00
	2006-07	.00	1.00	.00
	2007-08	.00	1.00	.00

Table 6. Teachers' responses to end-of-year questionnaire items about fellows' impact on student learning.

Questionnaire Item	Year	Proportion of fellows who:		
		<i>Agree or Strongly Agree</i>	<i>Disagree or Strongly Disagree</i>	<i>Stated they had no Opportunity to Observe</i>
I believe that I am influencing students' attitudes about science or mathematics.	2004-05	1.00	.00	.00
	2005-06	1.00	.00	.00
	2006-07	1.00	.00	.00
	2007-08	.92	.08	.00
The students are interested in the fact that I am a college student in science, math, or engineering.	2004-05	1.00	.00	.00
	2005-06	1.00	.00	.00
	2006-07	.91	.09	.00
	2007-08	.83	.17	.00

Table 7. GraSUS-II fellows' responses to end-of-year questionnaire items about their influence on student learning.

Tables Related to Goal II: Improved Skills & Competencies of Fellows (Tables 8-14)

	Total	2004-05		2005-06		2006-07		2007-08	
		<i>Under grads (n=7)</i>	<i>Grads (n=7)</i>	<i>Under grads (n=6)</i>	<i>Grads (n=7)</i>	<i>Under grads (n=6)</i>	<i>Grads (n=5)</i>	<i>Under Grads (n=7)</i>	<i>Grads (n=5)</i>
Architecture	1	0	0	0	0	0	0	1	0
Biological Sciences	10	1	2	1	2	1	1	1	1
Chemistry or Biotechnology	4	1	0	1	0	1	1	0	0
Civil Engineering	7	1	0	1	0	1	0	3	1
Construction Engineering	1	1	0	0	0	0	0	0	0
Electrical Engineering	2	0	0	0	0	1	0	0	1
Entomology	4	0	1	0	1	0	1	0	1
Geosciences	1	0	0	0	0	1	0	0	0
Industrial Engineering	1	0	0	0	1	0	0	0	0
Mathematics	8	1	2	1	0	1	2	0	1
Mechanical Engineering	7	2	1	2	2	0	0	0	0
Pharmaceutical Sciences	3	0	1	0	1	0	0	1	0
Physics/Math	1	0	0	0	0	0	0	1	0

Table 8. Distribution of NDSU GraSUS-II fellows by their majors.

Questionnaire Item	Year	Proportion of students who:		
		<i>Somewhat or Definitely Agree</i>	<i>Somewhat or Definitely Disagree</i>	<i>Stated they had no Opportunity to Observe</i>
The kids in our class ask the fellow questions about NDSU.	2004-05	.66	.28	.06
	2005-06	.78	.18	.04
	2006-07	.60	.35	.05
	2007-08	.53	.34	.13
The NDSU student seems to like working with us.	2004-05	.91	.08	.01
	2005-06	.96	.03	.01
	2006-07	.95	.04	.01
	2007-08	.97	.01	.02
The kids in our class ask the NDSU fellow questions about math or science.	2004-05	.87	.11	.02
	2005-06	.91	.08	.01
	2006-07	.92	.07	.01
	2007-08	.90	.05	.04
The NDSU student is good at explaining things.	2004-05	.81	.18	.01
	2005-06	.86	.13	.01
	2006-07	.87	.12	.01
	2007-08	.87	.08	.04

Table 9. Grades 7-12 students' responses to end-of-year questionnaire items about the GraSUS-II fellows.

Questionnaire Item	Year	Proportion of teachers who:		
		<i>Agree or Strongly Agree</i>	<i>Disagree or Strongly Disagree</i>	<i>Stated they had no Opportunity to Observe</i>
My fellow has good teaching skills.	2004-05	1.00	.00	.00
	2005-06	.86	.07	.07
	2006-07	1.00	.00	.00
	2007-08	.93	.00	.07
My fellow demonstrates weak communication skills.	2004-05	.06	.94	.00
	2005-06	.07	.93	.00
	2006-07	.08	.92	.00
	2007-08	.00	1.00	.00
My fellow is comfortable working with my students.	2004-05	1.00	.00	.00
	2005-06	.93	.07	.00
	2006-07	1.00	.00	.00
	2007-08	.93	.00	.07
My fellow is comfortable working independently on projects or lessons that I ask him/her to develop.	2004-05	.94	.06	.00
	2005-06	.71	.29	.00
	2006-07	1.00	.00	.00
	2007-08	.93	.07	.00
My fellow has a positive attitude about the work involved with teaching.	2004-05	1.00	.00	.00
	2005-06	.79	.21	.00
	2006-07	1.00	.00	.00
	2007-08	.93	.07	.00
My fellow demonstrates interest in helping students learn science or math.	2004-05	.94	.06	.00
	2005-06	.93	.07	.00
	2006-07	1.00	.00	.00
	2007-08	.93	.07	.00

Table 10. Teachers' responses to end-of-year questionnaire items about their fellows' skills.

<i>Fellows' Self-Reports on the Nature of their Classroom Work (n=12)</i>	
Revision/creation of labs and learning activities	12
Interacting with or assisting students	11
Preparing materials for the day's activities	11
Introducing or teaching activities or portions of lessons	11
Observing lessons taught by the classroom teacher	9

Table 11. Fellows' comments during focus group sessions, May 2008.

<i>Fellows' Self-Reports on the Impacts of GraSUS on their Own Growth and Skills (n=12)</i>	
Improved ability to communicate scientific ideas to non-scientists using non-scientific language	12
Better understanding of teachers, teaching, and schools in general	12
Improved mastery of my own knowledge of basic scientific concepts	12
Improved skills in communicating ideas "on demand" in response to student questions	11
Improved ability to teach by creating lessons based on what students can understand	11

Table 12. Fellows' comments during focus group sessions. May 2008.

Questionnaire Item	Year	Proportion of fellows who:		
		<i>Agree or Strongly Agree</i>	<i>Disagree or Strongly Disagree</i>	<i>Stated they had no Opportunity to Observe</i>
A big part of my fellowship work involves developing lessons or activities.	2004-05	.92	.08	.00
	2005-06	.91	.09	.00
	2006-07	.91	.09	.00
	2007-08	1.00	.00	.00
I rarely work with students.	2004-05	.00	1.00	.00
	2005-06	.09	.91	.00
	2006-07	.09	.91	.00
	2007-08	.25	.75	.00
I am satisfied with the amount of time that I have to work with students.	2004-05	.83	.17	.00
	2005-06	.91	.09	.00
	2006-07	1.00	.00	.00
	2007-08	.83	.17	.00
My teacher and I work well together.	2004-05	1.00	.00	.00
	2005-06	1.00	.00	.00
	2006-07	1.00	.00	.00
	2007-08	1.00	.00	.00
I am learning a great deal about teaching.	2004-05	1.00	.00	.00
	2005-06	1.00	.00	.00
	2006-07	1.00	.00	.00
	2007-08	1.00	.00	.00
I am learning a great deal about student learning in science or mathematics.	2004-05	1.00	.00	.00
	2005-06	1.00	.00	.00
	2006-07	1.00	.00	.00
	2007-08	1.00	.00	.00
I feel that my ability to communicate with students is improving through my work in GraSUS.	2004-05	.92	.08	.00
	2005-06	1.00	.00	.00
	2006-07	1.00	.00	.00
	2007-08	1.00	.00	.00
I rarely have the opportunity to answer student questions in class.	2004-05	.42	.58	.00
	2005-06	.18	.82	.00
	2006-07	.00	1.00	.00
	2007-08	.17	.83	.00
I am adequately managing my split time between the fellowship and my student responsibilities.	2004-05	.83	.17	.00
	2005-06	.82	.18	.00
	2006-07	.91	.09	.00
	2007-08	1.00	.00	.00
Our monthly GraSUS seminars are important learning experiences for me.	2004-05	.50	.50	.00
	2005-06	.91	.09	.00
	2006-07	.45	.55	.00
	2007-08	.83	.17	.00

Table 13. GraSUS-II fellows' responses to end-of-year questionnaire items about their work with the project and its effects on them.

Sample Comments from Fellows
<p><i>My GraSUS participation has shown me how difficult it can be to teach math and science. In addition, I have seen first-hand how the two subjects are connected. On numerous occasions when teaching the science activities, mathematics was a significant roadblock for the students in learning the intended material.</i></p> <p><i>I am now more familiar with the challenges that teachers face in developing curriculum and activities. I also have a deeper appreciation for the difficulty that comes with assessing student learning and ensuring that students understand the information at a level where it can be applied to external situations.</i></p> <p><i>Teaching is much more difficult than I ever thought that it would be. One of the most beneficial things I've learned through GraSUS is that adequately preparing a lesson doesn't just involve sitting down and writing what you're going to say; it involves various approaches and fine tunings to see what resonates with the students and what doesn't. I also began to gain an appreciation for the communication skills that are necessary to teach well, and the intuition that you begin to develop when trying to express an idea that you know well to someone who has never encountered that idea.</i></p>

Table 14. Excerpts from fellows' written comments about how GraSUS-II has impacted their views of teaching and learning (2008 end-of-year questionnaires).

Tables Related to Goal III: Professional Development of STEM Teachers **(Tables 15-16)**

Questionnaire Item	Year	Proportion of teachers who:		
		Agree or Strongly Agree	Disagree or Strongly Disagree	Stated they had no Opportunity to Observe
I believe that the Summer Academy was a successful use of our time.	2004-05	.93	.07	.00
	2005-06	.85	.07	.07
	2006-07	.92	.00	.08
	2007-08	.93	.00	.07
Our work in the Summer Academy had no relation to our state or national SM education Standards.	2004-05	.06	.88	.06
	2005-06	.07	.71	.21
	2006-07	.00	1.00	.00
	2007-08	.00	.93	.07
My own understanding of science, math, or technology is expanding as a result of working with my fellow.	2004-05	1.00	.00	.00
	2005-06	.79	.14	.07
	2006-07	1.00	.00	.00
	2007-08	1.00	.00	.00
Our monthly GraSUS seminars are important learning experiences for me.	2004-05	.94	.06	.00
	2005-06	1.00	.00	.00
	2006-07	1.00	.00	.00
	2007-08	.73	.20	.07

Table 15. Teachers' responses to end-of-year questionnaire items about their own professional development.

Questionnaire Item	Year	Proportion of fellows who:		
		<i>Agree or Strongly Agree</i>	<i>Disagree or Strongly Disagree</i>	<i>Stated they had no Opportunity to Observe</i>
I believe that my teacher has an opportunity to learn more science, math, or technology as a result of my work with him/her.	2004-05	.92	.08	.00
	2005-06	.91	.09	.00
	2006-07	.91	.09	.00
	2007-08	.92	.08	.00
My teacher does not utilize my talents very well.	2004-05	.00	1.00	.00
	2005-06	.27	.73	.00
	2006-07	.00	1.00	.00
	2007-08	.25	.75	.00
My teacher values my work with him/her.	2004-05	.92	.08	.00
	2005-06	1.00	.00	.00
	2006-07	1.00	.00	.00
	2007-08	1.00	.00	.00
I believe that the Summer Academy was a successful use of our time.	2004-05	.75	.08	.17
	2005-06	.91	.09	.00
	2006-07	.73	.18	.09
	2007-08	.75	.25	.00
The Summer Academy resulted in some valuable planning time between me and my teacher.	2004-05	.58	.25	.17
	2005-06	.82	.09	.09
	2006-07	.45	.45	.09
	2007-08	.75	.25	.00

Table 16. GraSUS-II fellows' responses to end-of-year questionnaire items about their teachers' professional development.

Tables Related to Goal IV: Growth of a Partnership Between NDSU and Schools (Tables 17-19)

Questionnaire Item	Year	Proportion of teachers who:		
		<i>Agree or Strongly Agree</i>	<i>Disagree or Strongly Disagree</i>	<i>Stated they had no Opportunity to Observe</i>
The university faculty member on our team is not very involved with our GraSUS work.	2004-05	.25	.75	.00
	2005-06	.07	.71	.21
	2006-07	.08	.92	.00
	2007-08	.07	.86	.07

Table 17. Teachers' responses to end-of-year questionnaire items on faculty involvement with GraSUS-II.

Questionnaire Item	Year	Proportion of fellows who:		
		<i>Agree or Strongly Agree</i>	<i>Disagree or Strongly Disagree</i>	<i>Stated they had no Opportunity to Observe</i>
The university faculty member on our team is not very involved with my GraSUS work.	2004-05	.55	.45	.08
	2005-06	.30	.60	.10
	2006-07	.73	.27	.00
	2007-08	.50	.50	.00

Table 18. GraSUS-II fellows' responses to end-of-year questionnaire items on faculty involvement with the project.

Activities	NDSU Collaborators <i># Faculty & Students</i> <i># Academic Units</i>	Community Collaborators <i># Officials</i> <i># Agencies</i>
Provision of supplies, equipment, specimens, or a field site for GraSUS fellows, teachers, or schools	$\frac{9}{5}$	$\frac{1}{1}$
Provision of content advice, curriculum assistance, or a classroom presentation for GraSUS teachers and fellows	$\frac{10}{14}$	$\frac{2}{2}$
Participant in GraSUS Seminars, Collegial Study Groups, or membership on GraSUS Advisory Board	$\frac{7}{6}$	$\frac{4}{3}$
Representation of GraSUS in national ¹ or international ² internet-based broadcasts	$\frac{2}{2}$	$\frac{6}{6}$

Table 19. Collaborative activities enabled by the GraSUS-II project in 2007-08. All of these activities involved current GraSUS fellows and, in some cases, past GraSUS fellows. However, the numbers in the cells do not include GraSUS fellows.

1 - Focus the Nation: An educational broadcast on 01/31/08 focused on global warming.

2 - Megaconference Jr.: An educational broadcast on 02/21/2008 focused on Antarctica exploration.

Section II. Formative Evaluation Findings

Project Goals	Evaluation of Progress in 2007-08			
	Poor	Reasonable	Good	Excellent
Goal 1: Enhanced Student Learning				X
Goal 2: Improved Skills & Competencies of Fellows				X
Goal 3: STEM Teacher Professional Development			X	
Goal 4: Partnership between NDSU and Schools		X		
Goal 5: Dissemination of GraSUS-II Outcomes			X	
Goal 6: Sustainability of GraSUS-II Activities			X	

Table 20. Summary of overall formative progress toward project goals in 2007-08.

Progress toward Goal 1: Enriched Learning by Grades 6-12 Science & Math Students

The GraSUS-II project is making excellent progress toward achieving Goal #1. In the text box below, sample excerpts from teacher reflection writings collected during the 2007-08 school year suggest that teachers feel strongly about the positive impact of the GraSUS fellows on student learning in their classrooms:

At the beginning of the year, [Fellow B] spent many hours making our evolution timeline come to life for biology by finding large photos of the “happenings” the students were to organize. These photos helped kids visualize what events were taking place- much more effective than a list! We built timelines in our classrooms and then could refer to them over and over, and really helped connect students to those events. That unit test went MUCH better this fall than last fall. In fact, for a real statistic, my class average on that unit test last year was a 74%. This year, 82%-- WOW. I really enjoyed reading the student responses as it was a thrill to hear about how they had made this information their own.

[Fellow C] has engaged some of the brightest students [in my classes], and excites them with challenge problems. Students look forward to him being in class, and ask where he is when he's gone. I know that several of them would not still be engaged were it not for [Fellow C], so although I can't yet provide much evaluation on his impact on the whole class, I know that he's made a difference for some.

[Fellow M] did a wonderful job of linking previously created math activities to include concepts in Physics. For example, when working on Newton's Law of Universal Gravitation, students in mathematics studied objects being dropped from a specific height or objects thrown straight up in the air. To illustrate the gravitational constant, [Fellow M] created an activity in which the students use the CBR's (motion detectors) to calculate the length of time it takes for two objects of different weights (but the same surface area) to fall from the same height. Students were required to analyze the data to predict the effects weight have on Newton's Law of Universal Gravitation.

It is difficult to document large-scale improvement in students' achievement scores as a direct result of the presence and work of the GraSUS fellows. However, many comments like those included in the text box above suggest that teachers in the project clearly believe that student learning has been impacted. Furthermore, in talking with teachers during the spring site visit, it is clear that teachers have clear examples of specific activities and interactions to support their beliefs in the positive impact that the GraSUS fellows have on student learning. This finding is also corroborated by data on Tables 3-7. Comments and questionnaire responses from teachers, students, and fellows themselves indicate that the fellows' work on curriculum and interactions with students impacts what and how students learn. A few of the twelve fellows indicated that they wished they had received more opportunities to work directly with students (focus groups, May 2008). However, they believed that the interactions they did have with students did impact students' learning.

Progress toward Goal 2: Improved Communication and Teaching Skills of GraSUS Fellows

The GraSUS-II project is making excellent progress toward achieving Goal #2. When fellows were asked in focus groups about the impact of the project on their own growth and skills, they were unanimous in their beliefs that they had experienced much improvement in the areas of communication and teaching skills (see Table 12). The teachers and the students were similarly positive about the fellows' teaching abilities and communication skills (see Tables 9 and 10). Particularly prominent in the minds of this year's fellows was the belief that they had improved their abilities to communicate scientific ideas to non-scientists using non-scientific language. In focus groups, the fellows spoke a great deal about the value of talking with students and answering their questions. The fellows were also particularly good about recognizing the skill and expertise required to *pose* appropriate questions for students and to "think-on-their-feet" in responding to students' questions and comments.

Additionally, the fellows were strategic, rather than general, in their comments about what they learned about teaching and student learning through their GraSUS activities (see Table 14). For example, during focus group sessions in May 2008, fellows talked about now understanding the difficulties associated with doing teaching "right," such as balancing new ideas that students must learn with: state/national standards, a diversity of learning needs in the class, their own strengths and weaknesses as communicators and teachers, and starting from "where the kids' heads are at." These are quite sophisticated ideas for non-teachers to hold about the essence of teaching and all the decisions that it involves.

Once again, the GraSUS-II fellows have demonstrated skilled levels of competence as teachers of young students and communicators of their STEM disciplines. The honing of the GraSUS-II fellows' strong skills, demonstrated year after year, suggests that the project is providing important professional experiences for these young STEM ambassadors. Regardless of the opportunities that fellows have for future work with K-12 teachers and students, the honing of communication and teaching skills through the GraSUS project will assist the fellows in their work as professionals and in community activities.

Progress toward Goal 3: Professional Development Opportunities for Teachers

The GraSUS-II project is making good progress toward achieving Goal #3. During the May 2008 site visit, an assistant principal and an assistant superintendent at one of the school districts collaborating with the project met with the evaluator to discuss their impressions of GraSUS-II. Without question, both of these educators claimed that the professional development of science and mathematics teachers was the greatest benefit that the GraSUS project provided for their schools. The assistant principal spoke of the way in which the ideas generated in the GraSUS classrooms “infect” the other classrooms. He sees and hears science and math teachers at his school talking about the new activities and asking the fellows working at the school to explain the ideas to them. The professional development benefits for teachers associated with working directly with the fellows is also corroborated by questionnaire data on tables 15 and 16.

The professional development benefits of the Summer Academy and monthly seminar meetings are less clear. This year’s seminar focus on Collegial Study Groups (CSG) was not evaluated highly by all teachers and fellows. The majority of teachers and fellows thought the CSG work was valuable. Those CSGs that identified assessment goals or even assessment data that could be analyzed in their groups seemed to find the experience more beneficial. But, a larger proportion than in past years questioned the value of the CSG focus of the seminars this year. Part of the frustration among some teachers as well as a few of the fellows was the lack of focus in the early part of the year. Some teachers and fellows early on simply did not know what to do in their groups. Yet, the inspection of evidence of student learning seems worthwhile as a professional development activity for teachers as well as GraSUS fellows.

There is one additional idea related to teachers’ professional development that is worth mentioning in this section. The idea was relayed by a few teachers during informal discussions during the site visit as well as in one of the teacher reflection documents (see below). The idea relates to a particular kind of knowledge that teachers gain about university expectations as a result of having the GraSUS fellow working with him/her in the classroom and on the class’ curriculum activities:

For my part, having [Fellow K] involved in this school year was a real positive. She had the time to create and modify materials for use in my classes that prepping with a new AP text didn’t allow me. It was great to know that I could give her a topic and she would research what colleges and universities all over the country were doing in their first year physics labs. But I think the greatest positive for me was a chance to bounce ideas off someone who is currently on the receiving end of the “next stage in learning” – where my students are headed. I could ask “Is this concept really important?” and she could relate the topic to what she has had to do in her college career. (Teacher Reflection, LE, May 2008)

Articulation of expected subject matter competencies between high schools and universities has long been a problem in science and mathematics. University faculty members often question what students are taught in high schools. High school teachers often question why some of their best students have such trouble in their first years at the university. The GraSUS project helps to reduce the chasm of unfamiliarity that exists among STEM educators at both levels with regard to students’

academic preparation/expectations. This is likely an under-reported outcome of the GraSUS project and other GK-12 projects like it across the country.

Progress toward Goal 4: Strengthened Partnership between NDSU and School Districts

The GraSUS-II project is making reasonable progress toward achieving Goal #4. This evaluation claim is made largely because of the documentation of activities that occurred during the 2007-08 academic year that would not have otherwise occurred without the GraSUS project (see Table 19). Over the four years of the project, the fellows have reported a broad range of involvement in the project by faculty members at NDSU (see Table 18). This year, half of the fellows agreed or strongly agreed with the questionnaire statement that “the university faculty member on our team is not very involved with my GraSUS work.” Yet, the documentation of activities such as provision of supplies and equipment, subject matter advice for fellows and teachers, and involvement in internet-based broadcasts highlighting GraSUS activities suggests that NDSU and community collaborators are aware of and supportive of the project’s activities. The GraSUS-II project would certainly be considered an outreach or service activity by university faculty members, a type of activity not highly valued by the academic community. Given the conversations that this evaluator had with evaluators of other GK-12 projects at the PI meeting in 2008, I am reasonably impressed with the number of faculty members who, in some way, have participated in the GraSUS project as documented in the records presented as a summary in Table 19. Probably even more important to note this year is the increase in collaborators from the community. These community collaborators included government officials, members of IT organizations, school board representatives, and members of local health professions. All of this suggests that reasonable progress is being made in moving toward achievement of Goal #4.

Progress toward Goal 5: Dissemination of the Outcomes and Impact of GraSUS-II

The GraSUS-II project is making good progress toward achieving Goal #5. The website has been much improved and updated with recent information. A spring poster session given by the fellows and many of the teachers was well attended on NDSU campus. A professionally-produced newsletter was again published highlighting recent work of various GraSUS fellows and teachers. The research and dissemination committee of the PI group continued to meet regularly, review project evaluation data, build an online survey for past fellows to be disseminated in the summer 2008, and write manuscripts for submission to journals. The following manuscripts were either published, in review, or in revision during the project year covered in this report (June 2007 – May 2008):

- Allen, J.H. and Wold, J. (In press, 2008). Investigating contemporary evolution via size-selective harvest. *The American Biology Teacher*.
- Cömez, D., Montplaisir, L.M., Martin, W.O., Tomanek, D., Bilen-Green, C., and McVicar, K. (In review, 2008). GraSUS: Professional development in mathematics and science through school-university collaboration. *School Science and Mathematics*.
- Forness, S. and Montplaisir, L.M. (Rejected, in revision for another submission, 2007). Community connection to climate change and global warming. *The Science Teacher*.
- Lampert, E. and Taylor, B. 2008. Using a haplodiploid insect to teach inheritance: Eye color genetics of the parasitoid *Habrobracon hebetor*. *American Entomologist*, 54(2): 116-119.

- Podoll, A. Olson, B., Montplaisir, L.M., Schwert, D.P., McVicar, K., Cómez, D., and Martin, W.O. (In press, to be published in Sept 2008 issue). Networking Antarctic research discoveries to a U.S. science classroom. Science Scope.

In addition, the following GraSUS teachers presented lesson ideas from the GraSUS project during sessions at their state conferences during the 2007-08 school year:

- Becky Andres, Sara Forness, and Jill Wold. Presentation at the ND Science Teachers Association Conference, March 2008. Minot, ND.
- Michelle Bertsch and Mason Swanson. Presentation at the ND Council of Teachers of Mathematics, April 2008. Grand Forks, ND.
- Carl Hashbarger and Joe Kennedy. Presentation at the ND Council of Teachers of Mathematics, April 2008. Grand Forks, ND.
- Jack Kiger and Mary Jo McKay. Presentation at the ND Council of Teachers of Mathematics, April 2008. Grand Forks, ND.

The following excerpt from a teacher reflection captures the importance of dissemination of project products to the science and mathematics teaching community:

[Fellow JJ] and I had the privilege of presenting the “Walk the Graph” activity, in Grand Forks, at the NDCTM Conference, held in April of this year. What a great opportunity to meet other teachers from throughout the state and share information! We were able to communicate with several of the teachers, the following week, through e-mails. I shared with them a number of different games, activities and projects that we had accumulated. These teachers were most gracious and very grateful for the new resources. GraSUS is a great service to many more teachers than just those directly associated with NDSU. (Teacher Reflection from MJK, Spring 2008)

Progress toward Goal 6: Sustainability of GraSUS-II Activities in NDSU’s STEM Graduate Programs

The GraSUS-II project is making good progress toward achieving Goal #6. The year of 2007-08 has demonstrated the most promising steps toward project sustainability of any of the project years thus far. This is largely due to the work of the GraSUS-II Advisory Board that met twice in 2007-08. Key individuals on the board represent the school boards in the area, the business community, and local and state legislators. The late spring meeting of the Board centered on three discussions: the marketing group discussion, the district administrators/school board members group discussion, and the teacher/fellow group discussion. The purpose of the meeting was to plan and strategize efforts to sustain GraSUS-like activities within the university and the surrounding community. The discussions resulted in some concrete plans. Another meeting will be held in late summer and again in the fall of 2008. These efforts coincide with recent interest in the Fargo area as well as at the state level to invest in STEM enterprises, including the enterprise of K-12 education in STEM. The importance of the timing of these planning and strategizing activities was emphasized in an interview with one of the key Advisory Board members during the May 2008 evaluation site visit.

Section III: Recommendations

Recommendations for the project leaders during the fifth and final year of the GraSUS-II project include the following:

1. Keep doing what you have been doing in selecting, supporting, and enabling the highly competent fellows and teachers involved with this project! They are doing a great job.
2. For 2008-09, reconsider the purpose of the Collegial Study Group sessions and revise the expectations and guidelines for teacher and fellow participants. Currently, the CSG sessions are not uniformly contributing to the professional development of science and mathematics teachers in the project. Study the teachers' reflections and the comments collected from the seminar evaluations in 2007-08 to ascertain the weaknesses in the model. Then, improve upon the CSG model before introducing the activities to fellows and teachers in the fifth and final year of the project.
3. Although dissemination activities greatly improved in 2007-08, push dissemination to an even higher level of importance in the final year of the project. Only two of the five manuscripts reported earlier in this report centered on project-wide issues. The other three were manuscripts relating to specific classroom activities or events involving classrooms. Two specific suggestions are: (a) PI Cómez and at least one of the Co-PIs involved with the GraSUS Advisory Board should write and submit an article on the evolution of the Advisory Board, the role it plays for future sustainability of school-university collaborations, and ideas on how other universities might emulate the positive beginnings of the GraSUS board. This is important because so many GK-12 projects have difficulty with sustainability. (b) The dissemination and research group associated with the project should work hard at analyzing the data they have already begun collecting from past fellows on the impacts of the project on GraSUS fellows' future professional work. This should be followed up by submission of proposals for presentations at conferences and submission of manuscripts for publication.
4. Continue the productive and important discussions of the GraSUS Advisory Board meetings. The private and public entities represented at the meetings are important links required to build a systemic approach to the improvement of K-20 STEM education. Everybody wins when public K-20 education becomes more seamless: school children, universities, the public, school teachers, and future faculty and business leaders in STEM (i.e., GraSUS fellows). But, there are few entities that can engage all of these stakeholders simultaneously. The GraSUS project may just be one of those entities.