



REFLECTIONS

GraSUS Newsletter • Winter 2005-06

NDSU GraSUS - II

(Graduate Student-University-School Collaborative for Science, Mathematics, Engineering and Technology)

Mission

The mission of the NDSU GraSUS-II program is to enhance science and mathematics education in grades 6-12 through the direct involvement of graduate and advanced undergraduate students in SMET (science, mathematics, engineering, technology) disciplines.

The program also provides support and enhanced professional development of science and mathematics teachers.

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Upcoming Events

- Annual Meeting for GK-12 Project Teams: March 24-26, 2006, Washington, DC.
- 2006 MnSTA Spring Science Conference: March 17-18, 2006, Winona State University, Winona, Minn.
- 2006 NDCTM Spring Conference: March 31-April 1, Bismarck High School, Bismarck, N.D.
- 2006 NDSTA Spring Science Conference: March 31-April 1, 2006, Horizon Middle School, Bismarck, N.D.
- GK-12 special session at the AAAS-SWARM meeting in Tulsa, Oklahoma: April 5-8, 2006, University of Tulsa, Tulsa, Oklahoma
- NSTA National Conference: April 6-9, 2006, Anaheim, CA

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NDSU

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From the Director

Greetings!

If one attempts to describe the state of today's society in a few words, the phrases "technologically oriented," "fast paced," or "constantly changing" come to the mind. A society in this state cannot address its challenges properly if the current and future generations are not properly equipped with the appropriate knowledge and skills. Naturally, the education system, particularly PreK-16, needs to be at the forefront of this preparation effort. The GraSUS program is an attempt in this direction, among numerous such endeavors nationwide. It brings cutting edge science and mathematics into our classrooms, aims to enhance the mathematics and science curricula, and provides in-class professional development for the teachers. For that purpose, we bring together secondary school teachers, university faculty, and university graduate and undergraduate students for the single goal of enhancing learning of science and math students in schools.

As you will see reading through this newsletter, we are blessed with many motivated and talented graduate and undergraduate students as well as dedicated and hard-working

teachers that make the program an exemplary one. During its 4-year implementation, GraSUS has also demonstrated the potential for highly productive interactions between university and secondary school teachers. The program successfully lead to changed instruction in science/math classrooms with active involvement, particularly of graduate students and teachers; provided a model that effectively combined development and implementation of specific classroom interventions along with reflection on their relationship to standards and student learning.



As the director of the GraSUS program, I consider myself very lucky to work with such a select group of teachers, graduate and undergraduate students, university faculty and staff that have achieved such valuable results in a short time. I am thankful to all the individuals for their invaluable contribution towards the successful implementation of the program activities.

~ Dogan Cömez, Principal Investigator,
GraSUS Project

Enhancing Student Interest and Understanding in Environmental Science

Sara Forness has always had an interest in water quality issues, so when she started teaching Environmental Science and Biology at West Fargo High School, she knew that this topic should be incorporated into her curriculum. Initially, her students investigated water quality using chemical analysis. Sara wanted her students to learn about other aspects that reflect water quality, such as macro-invertebrate diversity within a stream or river. In order to do this well, she thought it might be helpful to consult biologists who had first-hand experience in sampling the populations in a stream habitat and classifying the organisms.

Sara first sought the help of Kevin Scheidecker, an NDSU student who had worked with the Center for Watershed Education and the Red River Basin Commission. Kevin showed her an activity using a taxonomical classification key for macro-invertebrates, which she adopted to help familiarize her students with the organisms. When Will Clark, a GraSUS graduate fellow pursuing a PhD. in Biological Sciences, came to work with Sara at West Fargo, Sara knew that Will's expertise could really add depth to the unit. So, together they worked on sampling and preserving specimens that the students could use to perform their own analysis. Will and Sara took the Environmental Science students to the Sheyenne River, an adventure that was interesting for students and teacher alike. Here they collected samples and keyed them out. After learning how to use the taxonomical classification keys and stream indices, students identified the overall quality of stream health as being poor, fair, good or excellent. They hope to preserve this data and compare samples taken at a variety of stream sites as well as during fall and spring seasons. Using macro-invertebrates to teach water quality has added an exciting component



West Fargo High School student "tests the water"

to water quality which the students have really enjoyed. Linking science concepts to the real world – at a level few of them have explored before – has been rewarding for the students and Sara, as well.

In addition to gaining valuable skills locating, collecting, and preserving specimens with which she previously had no experience, Sara appreciated the heightened enthusiasm in the classroom.



Sara Forness and her environmental science class on the bank of the Sheyenne

GraSUS-II Project Personnel

Dogan Cömez

GraSUS Project Director
Department of Mathematics, NDSU

Kim McVicar

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William Martin

Interim Chair
School of Education, NDSU

Edward Deckard

Plant Sciences, NDSU

Canan Bilen-Green

Industrial and Manufacturing Engineering, NDSU

Lisa Montplaisir

Biological Sciences, NDSU

Joan Baltezore

Lead Teacher
West Fargo High School Biology Teacher

Michelle Bertcsh

Lead Teacher
Fargo North High School Math Teacher

Steve Kennedy

Lead Teacher
South Fargo High School Physics Teacher

Portrait of a GraSUS-II Teacher – Joan Baltezore

Joan Baltezore is a lifelong learner. This West Fargo Science teacher has always worked hard at staying abreast of new discoveries in



science, and she takes advantage of any opportunity that presents the occasion to learn something new or to better herself as an educator. That explains why her decision to become involved in GraSUS was an easy one. When Joan heard about the GraSUS project, she was intrigued. She liked the idea of having a “resident scientist” in the form of a university student that could develop novel ideas with her and serve as a content resource. Joan worked with her first GraSUS fellow 4 years ago, and during the past two years she has increased her involvement by acting as a Lead Teacher for the project.

One of the most enjoyable aspects of the project for Joan is the opportunity that GraSUS provides for networking with other area teachers. Additionally, Joan commented on the tremendous impact that fellows have on their students; “Students feel very comfortable around Angela, and they are anxious to share things with her. Their enthusiasm for the subject increases.” Joan has noticed that more students are commenting on the projects the team has been doing, and their interest in pursuing science has been piqued.

Joan believes that her involvement in GraSUS has contributed to her success as a teacher. She has had the opportunity to conduct activities that she might not have without a GraSUS fellow working with her, and some of these activities have earned attention from a larger audience. Joan’s efforts towards developing and implement-

ing updated curricular projects and activities have not gone unrecognized. The West Fargo Teacher has received several meritorious awards, including the Presidential Award for Excellence in Science Teaching in 2003, and most

recently, the Milken Family Foundation National Educator Award.

Joan is a great example of the kind of teacher that is involved in the GraSUS-II project: successful, passionate about her subject area, and dedicated to giving her students enhanced learning opportunities whenever possible.

GraSUS-II Works in Missy Eidsness's Class

“Delta Epsilon Proofs” and the “Precise Definition of a Limit” are important concepts to understand before a student embarks on a college Calculus course. Missy Eidsness heard about this frequently from her former AP Calculus students. Missy recognized a great opportunity to address this when a Graduate GraSUS fellow, Angie Klicker, came to work with her at Moorhead High School during the 2004-2005 school year. Angie was excited about this opportunity to work with upper level high school students, and she was anxious to help Missy “beef up the content” for these college-bound students.

The lesson, as complicated as it might sound was presented in such a way that students practiced the proofs repeatedly to show the relationship between delta and epsilon, given one or the other value. The student’s

understanding was further clarified by using the computer program MATHEMATICA to illustrate this relationship graphically.

Was it worth the effort? A quick look at pre-test and post-test data indicates that the answer is a resounding “yes!” Students increased their understanding of these concepts by 40% overall. Missy was pleased with the way that her interaction with Angie impacted her practice. Her students are now being exposed to a more conceptual approach versus the traditional computational approach. This new approach appears to be working: of 17 students who took the AP calculus exam, 7 students earned a score of 5, 8 students earned a 4, and 2 students earned a 2. In the previous year, there were 6 students who earned a 5, 3 students earned a 4, 3 students earned a 3, 9 students earned a 2, and 6 students earned a 1.



Angie Klicker and Missy Eidsness Team Teaching at Moorhead High

An Interview with Jeremy Gustin

Jeremy Gustin worked as a Graduate Fellow for GraSUS-II during the 2004-2005 school year. He was placed with Fargo South Physics teachers Harvey Kruckenberg and Steve Kennedy. Jeremy is now an engineer for Pella Corporation.

What made you want to be a part of GraSUS?

I interviewed several times before finding an internship that was a good fit. When I reflected on those interviews it became clear that companies put a big emphasis on communications skills. After reading about GraSUS I knew it would be an excellent opportunity to interact in a team environment while sharpening my communication skills. In addition, I was eager to educate and motivate students with my experiences in college and industry.

What did you expect GraSUS to be like?

I had high expectations entering GraSUS because the program was highly regarded by the National Science Foundation. I was hoping to work closely with professors, teachers, and other fellows to develop educational content that had real-world applications. I assumed this content would include labs, presentations, and demonstrations.

How did the experience compare to what you expected?

GraSUS exceeded all of my expectations. I had so many opportunities to improve my abilities while positively impacting student learning.

What were the greatest rewards and challenges?

I had so many opportunities to interact with a team, give group presentations, and improve my teaching ability. It was so rewarding to observe students grasping difficult concepts because of labs and demonstrations that our team developed.

Opportunities come with challenges and GraSUS was no exception. It took a few weeks before the students considered me equivalent to their teacher. Breaking this barrier was great experience and an important part in improving my communication skills.

Jeremy Gustin,
2004-2005
GraSUS-II
Graduate Fellow



Did you have any particularly memorable experiences?

Our team developed a speed and acceleration lab that required the students to go outside and use a radar gun to record vehicle speeds at distance markers. The school police officer (Officer Luke Kalsow) talked about different devices for monitoring speed and even showed the students the equipment in his police car. The neat part was seeing the physics teachers squawk their tires as they accelerated in the parking lot. The students were really involved in this lab and seemed to enjoy it a lot.

What are you doing now, and how do you think GraSUS impacted you in terms of your successful start in your career?

I am working as an engineer for Pella Corporation, which is one of the largest window and door companies in America. Over the last year, I have experienced first hand the importance of good communication skills. I am so glad I had the opportunity to work with a great team and sharpen many of my skills above and beyond what is taught in the classroom.

Acknowledgements

The GraSUS Project graciously acknowledges the generous support of:

The National Science Foundation
North Dakota State University

The GraSUS Project also graciously acknowledges the following local businesses who have provided donations:

Applebee's
Barnes and Noble
Buffalo Wild Wings
Cold Stone Creamery
Culver's
GEM
Krispy Kreme Doughnuts
McDonalds
Papa John's Pizza
Starbucks
Taco Bell
Taco John's
Target
Video Action

After reading about GraSUS
I knew it would be an excellent opportunity
to interact in a team environment
while sharpening my communication skills

– Jeremy Gustin

Real World Applications Enhance Understanding of Physics Concepts

"For every action, there is an equal and opposite reaction." Students in Harvey Kruckenberg's and Steve Kennedy's classes have a deeper understanding of this very important concept now that Graduate GraSUS-II fellow, Matt Erickson, found a way to present Newton's Third Law in a more memorable way than ever before.

The lesson that was developed showed students that there are many practical demonstrations of this law. Throwing balls of various sizes from a chair with rollers, stepping on an inclined scale, and performing a mini "tug-of-war" all helped the students to further understand the applications of Newton's Third Law. This lab was designed to be engaging and fun while still providing multiple reinforcements of the concepts.

Pre and post test analysis provided by Matt Erickson reflected the increase in learning among the students. "94% of the students



Two Fargo South students learn about equal but opposite reactions

improved from the pretest to the posttest. The standard deviation for all of the periods combined decreased from the pretest to the posttest, which indicates that there was less spread in the test scores for the posttest. This is a good indication that the lesson and lab reached a

majority of the students, bringing the lower scoring students on the pretest closer to the average score on the posttest. Individually, the class periods all had very similar results. The average pretest scores were very similar. The same trend can be seen with the posttest scores. Hence, each class displayed similar improvement from the pretest to the posttest."

Bringing real-life applications of the concepts of Physics has been a major goal among the GraSUS-II Fellows who are Engineering majors. Matt Erickson and Justin Hoey also recently collaborated on an Impact Biomechanics presentation for physics students from Fargo South and West Fargo. The presentation focused on vehicle safety, crashes and the importance of wearing a seat belt. This project was well-received and has made a positive impact on student learning: pretest and posttest scores in both schools showed significant improvements, ranging from a 15%-28% increase.



Matt Erickson, GraSUS Graduate Fellow works with the Fargo South physics students

What is GraSUS?

How can universities and schools work to strengthen science, technology, engineering and mathematics (STEM) education? That problem was and is the focus of two major projects funded at NDSU by the National Science Foundation. The original GraSUS (**G**raduate **S**tudent **U**niversity **S**chool) collaboration operated from 2001-04. At the heart of the project was the placement of NDSU undergraduate and graduate STEM students in local junior and senior high school mathematics and science classes. The placements, along with collaboration with STEM faculty from NDSU, were intended to provide benefits to all participants: Faculty, college students, secondary students, and school teachers.

The four project goals highlighted the main foci of project activities:

Goal 1. To improve communication and teaching skills of fellows, who are graduate and undergraduate STEM students at NDSU.

Goal 2. To provide enriched learning by science and mathematics students in Grades 6-12.

Goal 3. To provide content gain and professional development opportunities for middle and high school science and mathematics teachers.

Goal 4. To strengthen partnerships involving NDSU and school districts in eastern North Dakota and western Minnesota.

More specifically, the project shared the objectives of the NSF GK-12 program, which funded projects around the United States.

- To provide STEM graduate students – the future faculty of higher education institutions –

insight to and experience in the K-12 system. These faculty will be educating the STEM teachers of tomorrow and need an appreciation of the needs of our schools.

- To provide current, state-of-the-art science and mathematics expertise to school science and mathematics teachers from university faculty and students.
- To increase the collaboration between schools and colleges in STEM areas.
- To provide enriched science and mathematics experiences to K-12 students.

The project achieved considerable success in relation to each goal during the funding period.

Participants worked to extend the project through a second round of funding with the GraSUS II project, which commenced in 2004. GraSUS II was designed to build on the strengths of the original project and included the same four goals and project structure. The GraSUS experience also suggested several new areas of focus, which were incorporated with two new, additional goals:

Goal 5. To document project outcomes, informing others of the potential impact of GraSUS-II activities.

Goal 6. To incorporate GraSUS-II activities as an integral part of the NDSU's STEM graduate programs.

Bill Martin, PhD.,
Co-PI GraSUS



At the heart of the GraSUS projects is the placement of NDSU students in area science and mathematics classes where they work collaboratively with teachers to develop and implement enriched science and mathematics experiences for students. Students and teachers apply to participate in the project each spring. Once participants are selected, placements are arranged that match teacher interests and needs to student characteristics and expertise. Over the year, undergraduate students spend 10 hours per week on the project, including extensive time in schools, and graduate students commit 20 hours per week to project activities.

Support for these collaborative teams is provided by several key project components: Annual Summer Academies and a school-year seminar series. Each summer, participants spend a week in workshops that have three components: (a) exposure to current trends in science and mathematics education, including standards, (b) reflection on how national and state recommendations relate to the teaching of individuals in the project, and (c) planning opportunities for faculty, teachers and students to collaborate on specific enrichment activities for their classes.

Continued on page 7

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During the school year, monthly evening seminars are organized at NDSU and local schools to allow participants to continue work in the same three areas. Often these monthly seminars are organized at the schools of participating teachers to allow all participants to learn about the school facilities and programs as well as the specific GraSUS activities that have been implemented during the year.

The new additional focus of GraSUS II is on providing dissemination of enrichment materials produced during the project within and beyond participating schools. The project is also working to establish a mechanism for continuation of key project elements and the collaborative university-school relationships beyond the NSF funding period. Continuation of the project will require institutional commitments from both NDSU and local schools to support the collaborative relationships that have been established over the past five years.

GraSUS-II Notable News

Joan Baltezore, a GraSUS-II Lead Teacher who teaches Biology and Microbiology at West Fargo High School was recently awarded the Milken Family Foundation National Educator Award. This is a prestigious recognition which carries with it a \$25,000 award given to be used by the teacher for whatever purposes they would like. *Congratulations Joan!*

Michelle Bertsch, GraSUS-II Lead Teacher who teaches Math at Fargo North, and **Sara Forness**, GraSUS-II teacher who teaches Biology and Environmental Science at West Fargo High School have been named 2005 Finalists for the Presidential Award for Excellence in Math Teaching and Science Teaching, respectively. *Congratulations and good luck, Michelle and Sara!*

David Schultz, GraSUS-II Undergraduate Fellow was awarded the McCarthy Science Teacher Scholarship. These scholarships recognize outstanding

undergraduate students, enrolled in physical or earth science departments at NDSU. David will also be co-presenting at the 2006 American Chemical Society National Meeting in Atlanta, Georgia, March 24-30 on the topic "Promoting Understanding and Interest in Chemistry."

Curtis Voss, GraSUS-II Undergraduate Fellow ('04-'05) was a recipient of the 2005-06 National Science Foundation (NSF) Graduate Fellowship Award. Curtis is currently pursuing graduate studies at the University of Iowa College of Engineering.

Joan Baltezore and **Michael Newbrey**, GraSUS Graduate Fellow ('02-'03) submitted a manuscript to the American Biology Teacher. The manuscript: "Newbrey, M.G. and J.M. Baltezore. Poster presentations: Conceptualizing, constructing, and critiquing" has been accepted for publication.

Summary of the accomplishments of the GraSUS project.

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006
Fellows (NDSU students)	18	19	6	13	13
School teachers	21	28	7	21	19
Teachers-fellow-faculty teams	18	19	6	14	13
School districts	7 districts, 12 schools	6 districts, 11 schools	3 districts, 5 schools	4 districts, 10 schools	4 districts, 7 schools
Students impacted (approx.)	1750	2300	400	1801 (direct) 1466 (indirect - resulting from departmental dissemination)	2000 (estimated) 1500 (estimated)
NDSU faculty involved	19	41	12	41	36 (as of first semester)
Class/lab units developed	28	78	61	75	25 (as of first semester)
Teachers receiving graduate credit	23	31	0	12	11 (pending)

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Kim's Web-Picks for Science and Math

<http://www.scirus.com/srsapp/>
<http://mathforum.org/teachers/>
<http://library.thinkquest.org/16661/>
<http://www.pbs.org/teachersource/math.htm>
<http://www.learner.org/teacherslab/index.html>
<http://www2.nsta.org/sciencesites/>

What are People Saying About GraSUS?

"It's an interesting concept – students helping teachers to better educate other students."

~ NDSU-It's Happening At State

"Resources, resources, resources. We don't have a lot of equipment so she is able to borrow the needed material from NDSU. She is also very current on her science, especially genetics. She has also taught freshman biology lab at NDSU and knows exactly what the kids are expected to know when they enter the University. We have raked up the curriculum in response to what she has told us."

~ GraSUS science teacher

"... before the activity, no students could identify what might happen on a graph if you stayed in one spot or moved quickly. After the activity, 92% of the students could show me with their arms what would happen to the graph. As these are confusing ideas even for adults, I am very excited to see the rapid progression of my students."

~ GraSUS math teacher

"... the following week, my fellow will be training the other teachers in my math department on Geometer Sketchpad. This is awesome to have someone personally train our math department on how to use the software. Many times we have ordered software and it has taken us a year to a year and half to implement, because no one has the time to play with it. Geosketch pad was delivered to us at the beginning of this month and we are cooking. Geosketch pad is also going to allow us in import terrific graphics into our worksheets and tests."

~ GraSUS-II Math Teacher

"I think she (the GraSUS fellow) helped our class think about different sides of problems and by asking us things, pointing out things and pushing us to think harder."

~ Student in a GraSUS classroom