Nurses Learning Chemistry: Can One Educator Have an Impact?

Over the past seven years at Georgia Southern University I have developed an interest in reforming a one-semester chemistry course for nonmajors, CHEM 1140, mainly populated by the nursing/pre-nursing students as a required course. (This course can also be used to satisfy a requirement in Area D of the core curriculum at Georgia Southern University.)

My goals in teaching this course, method of action that I have taken to meet those goals, and their potential impact are outlined in the table below:

Goal	Method of Action	Potential Impact
1. Increase student interest in chemistry	Select chemistry topics for this course *relevant* to allied health majors	National restructuring of allied health chemistry curriculum
2. Enhance student learning in the course	Deliver the material in a constructivist, guided inquiry format	Expansion of GI course development within department, college, university, GA K-12 educators, and chemical educators nationally
3. Enhance student's perception of learning chemistry	Create a natural critical learning environment in the classroom	Understand the value of student perceptions of learning as a tool to enhance student learning in chemistry at the departmental to national levels.

Goal 1: Increase student interest in chemistry

Method of Action: Since this course is a required course and mainly populated by nursing majors, these students became the focus of the curricular reform for this course. What chemistry topics are relevant to a career in the health sciences? Through searching the literature, attending symposia, and discussing curriculum changes with nursing faculty and other chemistry faculty teaching this course, my department has now adopted a common list of topics that I played a large role in developing. The selected topics streamline general, organic, and biochemistry topics by integrating these topics by structure and reactivity as well as highlighting their applications to the allied health fields. That is, the general and organic chemistry topics are covered in the context of their biochemical relevance since allied health students are mainly interested in the chemistry of living systems.

Assessment: Does the streamlined "integrated" curriculum increase student interest in the course? Two questions found on the end of the semester student ratings of instruction were examined for sections of this course taught between the Spring of 2001 and the Fall of 2003. During this time 14 offerings of this course were made with 7 sections offering the newly developed "integrated" curriculum and 7 sections offering a "standard" curriculum. The questions analyzed were:

> "What was your level of interest in this subject before taking this course?"
> "What was your level of interest in this subject after taking this course?"

A statistical analysis of student responses (5 point Likert scale) indicated that students coming into either offering of the course had similar interest levels in chemistry. The students taking the "standard" curriculum did not show a change in interest level after taking the course. However, the students who took the course under the "integrated" curriculum had a significant increase in their interest level. This interest level was shown to be independent of instructor for the students taking the "integrated" curriculum. The full results of this analysis have been published [1].

Potential Impact: Since presenting these curriculum changes at two national meetings (American Chemical Society (ACS), March 2003 and Biennial Conference on Chemical Education, July 2004) one of my colleagues (Dr. S. Todd Deal) and I have been contracted to write a one-semester textbook for allied health chemistry that follows our integrated curriculum approach. The first edition of this textbook is slated for publication in the fall of 2009. This will have a national impact on teaching and learning for allied health chemistry.

Goal 2: Enhance student learning in the course

Method of Action: As with all my courses, I seek to engage students in the classroom through active learning. I had first encountered guided-inquiry (GI) learning at a symposium at the Spring 2005 national ACS meeting. In the chemistry discipline, guided-inquiry learning has been developed and formalized to include the development of key process skills. This GI method is referred to by the acronym POGIL (Process Oriented Guided Inquiry Learning). Since that first symposium I have attended several workshops on POGIL implementation. Guided-inquiry is an ideal method for learning material in an introductory science course since it is based on the constructivist learning cycle (based on Piagetian developmental theory) which divides instruction into three phases (1) the gathering data (or exploration) phase, (2) the conceptual invention phase, and (3) the conceptual expansion phase [2].

Consistent with the learning cycle, the premises of POGIL are that students will learn better when [3]

- they are actively engaged and thinking in class;
- they construct knowledge and draw conclusions themselves by analyzing data and discussing ideas;
- they learn how to work together to understand concepts and solve problems;
- the instructor serves as a facilitator to assist groups in the learning process;

- the instructor answers no question that the students can reasonably be expected to answer themselves.

In the Fall of 2006 I instituted POGIL in the nursing/nonmajors chemistry course (CHEM 1140). The basic structure of this classroom is as follows:

- No lectures are given.
- Students work in groups (usually 4) and have assigned roles within the group.
- Groups use GI activities that I developed which follow the learning cycle paradigm assisting them in developing and learn concepts.
- A five-minute quiz is given and reviewed at the beginning of each class on the previous day's material.
- Students are graded individually on hour exams and final exams.

Assessment: Did shifting to a GI classroom enhance student learning of chemistry? Two sections of this course taught in the Fall of 2005 using an interactive lecture format were compared to two sections taught in the Fall of 2006. The following items were examined:

- Final Grade Distribution
- Common Final Exam Scores
- Common Final Exam Questions by Learning Level
    - Clustering of final exam questions using research and analysis from educational psychology on learning levels [4] and analyzing trends in the percentage of correct responses
- Common Final Exam Questions by Topic
    - Clustering of final exam questions by learning outcome and analyzing trends in the percentage of correct responses

An analysis of these items indicates statistically significant increases in course grades, final exam grades, and number of correct answers on the final exam at the lower learning levels and by topic; student learning has increased as a result of shifting to GI methods [5].

Potential Impact: This first success is still under study with current and future sections of this course. This success has been a springboard for continued development of GI materials for the laboratory portion of this course, other courses within my department, university, and regional K-16 educators, and the national chemistry education community.

Last spring, in collaboration with two colleagues (Drs. Michele McGibony and Allison Dobson) I submitted an NSF grant (DUE-CCLI # 0633188) to develop a GI laboratory component for a bioanalytical chemistry lab in our department. Although it was not funded, the reviews were very good and we are currently resubmitting for the current funding cycle.

Through participation in both a faculty learning community of chemistry educators in my department (similar to a teaching circle) and a university-wide weekly reading roundtable discussion group on teaching and learning in the past year, I have been able to share my

experiences with GI instruction with other departmental faculty and university faculty from various departments and colleges across the university.

My class has been observed as a part of the Partnership for Reform In Science and Mathematics (PRISM) and I look forward to upcoming dialogue among science and math educators K-16.

This summer I will be attending a POGIL advanced writing workshop where I will be able to present some of the materials that I have developed to other chemistry faculty involved in POGIL from across the country in an effort to cross-check them for effectiveness and share ideas.

Goal 3: Enhance student's perception of learning chemistry

Method of Action: The classroom environment is a critical component of student's attitudes toward learning often times affecting their ability to learn. I strive for a "natural critical learning environment" described by Bain [6] as a classroom environment that is a safe space for students to construct ideas naturally through the development of habits, skills, and attitudes which allow them to think critically by reasoning. I also operate under the premise that all students can learn chemistry, that every student responds to encouragement, and that all students are individuals and should be treated as such. All students bring a different skill set to the classroom and through interaction with the individual student (which can be done in a group learning setting) I can best help them to tap into that skill set and develop other process skills to increase their learning.

Assessment: In order to assess student's perception of learning in the GI classroom, I have and continue to conduct formative and summative assessments of my classes through voluntary student surveys. Formative evaluations are given approximately mid-term in an open response format to the following questions:

Q1: What has been the most *positive* part of your group work experience in this class?
Q2: What has been the most *negative* part of your group work experience in this class?
Q3: If you could *change* anything about the way this course is designed, what would you change?

From the examination of two semesters (Fall 2006 and Spring 2007) of formative evaluations, it is clear that students would like to get more explanation of concepts from the instructor during the actual class periods. I have found that some topics in chemistry lend themselves better to self-exploration than others and discerning which ones does get tricky. This is an area of GI instruction that may take a few semesters for the instructor as facilitator to perfect. It is encouraging to see that the Spring 2007 comments were more positive about the group learning process than the previous semester [5].

Summative evaluations are given at the end of the semester using the Student Assessment of Learning Gains (SALG) survey instrument [7] which asks students to rate certain aspects of the class and its impact on their learning. In a comparison of the Fall 2005 students learning under

an interactive lecture format and the Fall 2006 students learning in a GI classroom, the two groups did not perceive any difference in their learning [4]. This is quite remarkable since I have noted under Goal 2 above that the GI classroom actually did learn more!

Potential Impact: I have always been a big proponent of student surveys as a way to probe student perceptions and attitudes regarding learning. In the case of the summative evaluations, it is noteworthy that student perceptions of their learning and actual student learning are not always equivalent. My understanding and ability to craft effective student surveys has had an impact in my department as we begin to assess student knowledge and perception in other courses such as our Jr. Seminar course (which I am coordinating this spring) through a pre- and post-course survey [8].

I have recently submitted a grant proposal to the POGIL project for funding to continue assessing student perceptions of POGIL in the nursing/nonmajors course for future sections which will add continued national exposure among chemistry educators for my efforts in this area.

In summary, to answer my question posed in the title: yes. I have been very involved in teaching and learning not only impacting my own classroom but as a teaching and learning scholar impacting student learning not only in chemistry for nurses, but other courses in chemistry, science in general, and teaching in general. I have been actively participating in discussions of guided-inquiry teaching and learning at many levels from my department, college, university, and state as well as nationally in my discipline of chemistry. It is an honor to be nominated for this award.

REFERENCES

[1] Frost, L.D, Deal, S.T., Humphrey, P.B.; *J. Chem. Educ.* **2006**, *83*, 893.
[2] Abraham, M.R., Renner, J.W.; *J. Res. Sci. Teach.* **1986**, *23*, 121.
[3] Farrell, J.J., Moog, R.S., and Spencer, J.N.; *J. Chem. Educ.* **1999**, *76*, 570.
[4] Gagné, R.M. and Briggs, L.J.; Principles of Instructional Design, 2nd Ed. Holt, Rinehart, and Winston, 1974.
[5] Laura D. Frost, *invited* Oral Presentation, Chemistry Education Division, 233rd National ACS Meeting, Chicago, IL, **March 2007**, *peer-reviewed manuscript in progress*.
[6] Bain, K., What the Best College Teacher's Do, Harvard University Press, Cambridge, MA, 2004.
[7] Student Assessment of Learning Gains, http://www.wcer.wisc.edu/salgains/instructor/, (accessed April 2007).
[8] Frost, L., Goodson, L.; *submitted* for poster session at the SoTL Commons Conference, Georgia Southern University, Statesboro, GA, **November 2007**.

LAURA DELONG FROST
Curriculum Vitae

Department of Chemistry
Georgia Southern University
P.O. Box 8064
Statesboro, GA 30460-8064
(921) 681-0850

307 W. Duffy St.
Savannah, GA 31401
(912) 232-9009
ldelong@ georgiasouthern.edu

EDUCATION

University of Pennsylvania, Philadelphia, PA (1986-1992)
Ph.D. Department of Chemistry, Biochemistry sub-division
Course concentrations: biochemistry and biophysics.
Thesis advisor: Dr. J. Kent Blasie

Kutztown University of Pennsylvania, Kutztown, PA (1982-1986)
Course concentrations: chemistry, physics, and biology.
B.S. in Chemistry

TEACHING EXPERIENCE

Georgia Southern University, Statesboro, GA (1999-present)
Associate Professor of Chemistry, (2005)
Assistant Professor of Chemistry, temporary (1999), tenure track position (2000)
Awarded Associate Graduate Faculty Status, Fall 2001
Department of Chemistry, Dr. Mary K. Boyd, chair
Courses taught: General Chemistry, Allied Health Chemistry, Organic Chemistry, and Biochemistry

Shorter College, Rome, GA. (1995-1999)
Assistant Professor of Chemistry, tenure track position.
Div. of Natural Sciences, Dr. M. Craig Allee, chair
Courses taught: General Chemistry, Organic Chemistry, Physical Chemistry, and Polymer Chemistry.

HONORS AND AWARDS

- Award for Teaching Excellence Nomination, College of Science and Technology, GSU (2005).
- NIH Pre-doctoral Training Grant for cardiovascular research (1987-1989).
- Outstanding TA for General Chemistry (1986-1987).
- Recipient of the American Institute of Chemists (Philadelphia section) undergraduate award for scholastic achievement (1986).

TEXTBOOK

Laura D. Frost w/ co-authors S. Todd Deal and Karen Timberlake, General, Organic, and Biochemistry: An Integrated Approach, Prentice-Hall, Pearson Education, Upper Saddle River, NJ, expected publication date, 2009.

PUBLICATIONS ON TEACHING AND LEARNING

(see attached for additional articles)

1. Frost, L.D.; Deal, S.T.; Humphrey, P. Making the Most of a One Semester General, Organic, Biochemistry Course: A Novel Integrated Curriculum. *The Journal of Chemical Education*, **2006**, 83, 893-897.
2. Frost, Laura DeLong; Introducing Measurement in a Chemistry Course for the Allied Health Student: Calculating Percent Body Fat with Skinfold Calipers. *The Chemical Educator* [Online] **2005**, 10, 142-144; DOI 10.1333/s00897050893a
3. Frost, L.D. Glucose Assays Revisited: Experimental Determination of the Glucose Concentration in Honey. *The Chemical Educator* [Online] **2004**, *9*, 239-241; DOI 10.1333/s00897040802a
4. Frost, L. D.; Peart, S.T. DNA Isolation from a Dried Blood Sample, PCR Amplification, and Population Analysis: Making the Most of Commercially Available Kits. *Biochemistry and Molecular Biology Education,* **2003**, *31*, 418 – 421.

PRESENTATIONS ON TEACHING AND LEARNING

Invited Oral Presentations (see attached for full listing)

1. Laura D. Frost, "POGIL in a One-semester GOB Course: How Much Guidance Does a Nursing Major Need?", *invited* Oral Presentation #CHED 98, 233rd National ACS Meeting, Chicago, IL, **March 2007**.
2. Laura D. Frost, S. Todd Deal, "A Capstone Project Linking Concepts in a GOB Course: The Molecule Project", *invited* Oral Presentation #CHED 3, 232nd National ACS Meeting, San Francisco, CA, **September 2006**.
3. S. Todd Deal, Laura D. Frost, "Covering the GOB's of Chemistry: An Integrative Strategy", *invited* Oral Presentation #CHED 2, 232nd National ACS Meeting, San Francisco, CA, **September 2006**.

PROFESSIONAL DEVELOPMENT IN TEACHING AND LEARNING

1. 5/20-22/06 *Three-Day POGIL Workshop*, College of Charleston, Charleston, SC.
2. 11/4/05 *One-Day POGIL Workshop at the SE/SW Joint Regional Meeting of the ACS*, Memphis, TN.
3. 10/27/05 *A Field Guide to GenBank and NCBI Molecular Biology Resources*, Mercer University School of Medicine, Macon, GA.
4. 5/26-28/03 *NSF Short Course in Biotechnology and Bioinformatics for the Undergraduate Biology Classroom*, Georgetown University, Washington, D.C.
5. 3/6-9/02 *Innovative Teaching Faculty Retreat 2002* sponsored by The Center for Excellence in Teaching at Georgia Southern University.
6. 4/20/01 *Molecular Modeling in the Undergraduate Chemistry Education*, USC-Columbia, sponsored by Wavefunction, Inc. Irvine, CA.
7. 5/17-21/99 *A Short Course in Modern Electronic Structure Methods*, Wavefunction, Inc., Irvine, CA , Dr. Warren Hehre, instructor.
8. 11/20-21/98 *Bioinformatics on the Internet*, Tuskegee University, Dr. Sherri Clark, organizer. Sponsored by the National Biotechnology and Information Facility.
9. 6/13-20/98 *Chemical Applications of Lasers*, James Madison University, Dr. Ben DeGraff, organizer. Sponsored by NSF.
10. 6/15-20/97 *Molecular Modeling*, Georgia State University, Dr. Kevin Gilbert, instructor, Dr. Jerry Smith, organizer. Sponsored by NSF.
11. 7/1-26/96 *Polymer Chemistry in the Undergraduate Curriculum*, Rensselaer Polytechnic Institute, Dr. S. Krause, Dr. J. Moore, and Dr. G. Wnek, co-organizers. Sponsored by NSF.

GRANT SUPPORT FOR TEACHING AND LEARNING

EXTERNAL

Total Funded: $34,949.50

1. Laura D. Frost and Michele D. McGibony, Li-COR Biosciences Genomics Education Matching Fund Award "A DNA Sequencer in the Undergraduate Laboratory", July 2005. **FUNDED: $34,449.50**
2. Laura DeLong, American Society for Biochemistry and Molecular Biology Undergraduate Faculty Travel Award to attend FASEB National Meeting, March 2002. **FUNDED: $500**
3. Laura D. Frost, PI, The POGIL Project, Special Project Underwriting Request, "Assessing Student Perceptions of POGIL in a Nonmajors Course", *submitted* April 2007. **PENDING: $2945**
4. Laura D. Frost, PI, Michele McGibony and Allison Dobson, co-PIs, "An Innovative Guided Inquiry Laboratory Course Integrating Analytical Chemistry and Biochemistry for Enhanced Student Learning", NSF-DUE-CCLI May 2006. $132,222 *not funded.* **Currently being resubmitted.**
5. Laura D. Frost, Michele McGibony, Allison Dobson, "An Innovative Guided Inquiry Based Laboratory Course in Analytical and Biochemistry for Enhanced Student Learning", Camille and Henry Dreyfus Foundation Special Grant Program in the Chemical Sciences August 2006. $46,007 *not funded.*

INTERNAL (Georgia Southern University)

Total Funded: $16,468

Grants for Professional Travel:	6	Totaling $2,663
Grants for Development of Instruction:	6	Totaling $10,305
Mentoring Student Grants for Undergraduate Research:	2	Totaling $3,500

SYNERGISTIC ACTIVITIES

- *Development of Curricular Materials:* Author of eleven in-house undergraduate laboratory exercises for biochemistry (5), allied health chemistry (5), and organic chemistry (1). Biochemistry laboratories include the topics of bioinformatics, metabolic assays, DNA isolation, DNA extraction, and PCR. Contracted with Pearson Education as co-author for an integrated, one-semester General, Organic, and Biochemistry (GOB) textbook for the allied health sciences (pub. date 2009).
- *Teaching Innovations:* Leading the department to incorporate process oriented guided inquiry learning (POGIL) into introductory chemistry courses since Fall 2006. Actively assessing the incorporation in own courses to enhance student learning and instructor facilitation. Nationally recognized restructuring of the course curriculum for one-semester GOB involving integrating biochemistry topics.
- *Other Curricular Activities and Affiliations:* Active participant in NSF funded USG Partnership for Reform In Science & Mathematics (PRISM) and the GSU College of Science and Technology STEM Teaching and Learning Research Interest Group (RIG). Symposium organizer at the Spring 2005 National American Chemical Society (ACS) Meeting, Division of Chemistry Education. Participant in university-wide weekly teaching and learning reading roundtable to discuss strategies for effective teaching and learning. Participant in departmental Faculty Learning Community (FLC) focusing on teaching innovations. Reviewer for the *Journal of Chemical Education* and the *Chemical Educator*.

TEACHING AND LEARNING PUBLICATIONS, ARTICLES, AND PRESENTATIONS

Laura DeLong Frost, Ph.D.

TEXTBOOK

Laura D. Frost w/ co-authors S. Todd Deal and Karen Timberlake, General, Organic, and Biochemistry: An Integrated Approach, Prentice-Hall, Upper Saddle River, NJ. expected publication date, 2009.

PUBLICATIONS ON TEACHING AND LEARNING

1. Frost, L.D.; Deal, S.T.; Humphrey, P. Making the Most of a One Semester General, Organic, Biochemistry Course: A Novel Integrated Curriculum. *The Journal of Chemical Education*, **2006**, 83, 893-897.
2. Frost, Laura DeLong; Introducing Measurement in a Chemistry Course for the Allied Health Student: Calculating Percent Body Fat with Skinfold Calipers. *The Chemical Educator* [Online] **2005**, 10, 142-144; DOI 10.1333/s00897050893a
3. Frost, L.D. Glucose Assays Revisited: Experimental Determination of the Glucose Concentration in Honey. *The Chemical Educator* [Online] **2004**, *9*, 239-241; DOI 10.1333/s00897040802a
4. Frost, L. D.; Peart, S.T. DNA Isolation from a Dried Blood Sample, PCR Amplification, and Population Analysis: Making the Most of Commercially Available Kits. *Biochemistry and Molecular Biology Education,* **2003**, *31*, 418 – 421.

ARTICLES ON TEACHING AND LEARNING

1. Frost, Laura; Symposium Reports from San Diego: "Chemistry for the Health Sciences – GOBs of Fun". Chemistry Education *Newsletter Fall 2005*; Division of Chemical Education, Inc., American Chemical Society; 2005;p.40.
2. Frost, Laura D.; "Powerpoint Growing Pains", *The Center Piece*, Center for Excellence in Teaching Newsletter, July 2003, 6: (2) p. 1.
3. DeLong, L.J.; "Applying Computer Technology to the Organic and Biochemistry Curriculum", *The Center Piece*, Center for Excellence in Teaching Newsletter, January 2002, 5: (1) p. 2.
4. DeLong. L.J.; "The Center that is Excellent for Teachers", *The Center Piece*, Center for Excellence in Teaching Newsletter, February 2001, 4 (1) p. 4.

PRESENTATIONS ON TEACHING AND LEARNING

(underline indicates student author)

1. Frost, Laura Delong and Goodson, Ludy. "Teaching Interventions and Attitudes about POGIL." *submitted and accepted* for presentation at the SoTL Commons Conference, Georgia Southern University, Statesboro, GA, **November, 2007**.

2. Frost, Laura and Goodson, Ludy. "How to Use Student Ratings to Asssess Learning." Proposal *submitted and accepted* for poster session at the SoTL Commons Conference, Georgia Southern University, Statesboro, GA, **November 2007**.

3. Goodson, Ludy and Frost, Laura Delong. "Formative Evaluation: Making Sense of Process Oriented Guided Inquiry Learning (POGIL)." *submitted and accepted* for presentation at the Association for Educational Communications and Technology Conference, Anaheim, CA, **October, 2007**.

4. Laura D. Frost, "POGIL in a One-semester GOB Course: How Much Guidance Does a Nursing Major Need?", *invited* Oral Presentation #CHED 98, 233rd National ACS Meeting, Chicago, IL, **March 2007**.

5. Laura D. Frost, S. Todd Deal, "A Capstone Project Linking Concepts in a GOB Course: The Molecule Project", *invited* Oral Presentation #CHED 3, 232nd National ACS Meeting, San Francisco, CA, **September 2006**.

6. S. Todd Deal, Laura D. Frost, "Covering the GOB's of Chemistry: An Integrative Strategy", *invited* Oral Presentation #CHED 2, 232nd National ACS Meeting, San Francisco, CA, **September 2006**.

7. Laura Frost, "The Molecule Project: Linking Concepts in a One-semester GOB Course", Oral Presentation #P88, 19th Biennial Conference on Chemical Education, Purdue University, IN, **July 2006**.

8. Laura Frost and Michele McGibony, "DNA Basics: What is all the Excitement?" Oral Presentation given to the Georgia Southern Math Department, October 21, 2005

9. Laura DeLong Frost, "Using Skinfolds to Teach Measurement: A Lab Exercise for the Allied Health Student", Oral Presentation #1378, 229th National ACS Meeting, San Diego, CA, **March 2005**.

10. J. Patrick Hill and Laura D. Frost, "Design of an Enyzme Kinetics Laboratory: Combining Structural Data Mining and Microplate Screening", Poster Presentation #688, 229th National ACS Meeting, San Diego, CA, **March 2005**.

11. Laura DeLong Frost, "Incorporating Bioinformatics into the Biochemistry Curriculum at Georgia Southern", Oral Presentation #S309, 18th Biennial Conference on Chemical Education, Ames, IA, **July 2004**.

12. Laura DeLong Frost and S. Todd Deal, "Making the Most of a One-Semester GOB Course", Oral Presentation #S566, 18th Biennial Conference on Chemical Education, Ames, IA, **July 2004**.

13. Laura DeLong Frost, "Incorporating 3-D Visualization and Bioinformatics into the Biochemistry Curriculum: One Institution's Practical Approach", Oral Presentation # 286, Southeast Regional ACS Meeting, Atlanta, GA, **Nov. 2003**.

14. Laura DeLong Frost, "Less O, More B: The GoB Course Gets a Facelift", Oral Presentation #159. Chemistry Education Section C, 225th National ACS Meeting, New Orleans, LA, **March 2003**.

15. L.D. Frost, C.M. Davis, A. Stewart, S. Peart, and Z.N. Spencer, "The Bradford Assay Under Fire: A study of Common Protein Assays for the Undergraduate Biochemistry Laboratory", Poster Presentation #273, Chemistry Education Section E, 225th National ACS Meeting, New Orleans, LA, **March 2003**.

16. Sharifa T. Peart, Zandis N. Spencer, and Laura D. Frost, "A Biochemistry Laboratory Exercise to Study Drug Diffusion Through Natural and Synthetic Phospholipid Vesicles", Poster Presentation at the Southeastern Undergraduate Research Conference sponsored by the American Chemical Society, Kennesaw State University, Kennesaw, Georgia, **April 2003**.

17. Laura DeLong Frost, "Incorporating SpartanView Exercises into the Organic Chemistry Curriculum: One Institution's Practical Approach", Oral Presentation #160. SouthEast Regional ACS Meeting, Charleston, S.C., **Nov. 2002**.

18. Laura DeLong Frost, "Incorporating Bioinformatics into the Undergraduate Biochemistry Curriculum: How, What, and When?", Poster #1 Georgia Research Symposium entitled, "Applying Bioinformatics: From Genes to Systems", Georgia State University,**Oct. 2002.**

19. Sharifa Peart and Laura J. DeLong, "An Undergraduate Biochemistry Laboratory Exercise: DNA Isolation from a Dried Blood Sample and Amplification of the Alu-TPA Intron 8 on Chromosome 8", Poster No. CHED 617 presented at the 223rd National Meeting of the American Chemical Society, Orlando FL, **April 2002**.

MORAVIAN COLLEGE

CHEMISTRY DEPARTMENT
1200 MAIN ST.
BETHLEHEM, PENNSYLVANIA 18018
PHONE 610-861-1436 FAX 610-625-7918

April 22, 2007

Beheruz N. Sethna
Interim Executive Vice Chancellor
Academic Affairs and Planning
Board of Regents of The University System of Georgia
270 Washington Street, S.W.
Atlanta, Georgia 30334-1450

Dear Chancellor Sethna:

It is a pleasure for me to write to you in support of Dr. Laura DeLong Frost in the Chemistry Department of Georgia Southern University for the Regents' Scholarship of Teaching and Learning Award. I served as an outside evaluator of Dr. Frost's tenure portfolio, have seen her speak at a National American Chemical Society meeting and have observed her class as part of a POGIL (Process Oriented Guided Inquiry) Project consultancy in the Georgia Southern University Chemistry Department. So I believe that I am familiar enough with Dr. Frost's work to provide insight for her consideration for your award.

Dr. Frost has focused a great deal of effort on development of materials to improve her courses and to assist colleagues with their courses and departmental courses at Georgia Southern. She has clearly been tireless and her efforts have been "sustained" throughout her time at Georgia Southern. She has involved a number of students in her work and the work has "enriched the student learning experience" in chemistry and biochemistry. She has gained national recognition for her work on a novel redesign of the one-semester chemistry course supporting the nursing major. Although this course has a relatively low profile within the standard chemistry major curriculum, it is currently a big problem for many chemistry departments across the country. Traditionally chemistry for the nursing major, the so-called GOB (General-Organic-Biochemistry) course, was a two-semester sequence. The first semester was a survey of general chemistry and the second semester was divided into an initial organic section followed by a biochemistry section. In the last ten to fifteen years, more and more nursing programs have limited their chemistry requirement to a one semester course, but desired the course to "cover" the same range of material. The response of text-book authors and many instructors has been to decrease the sophistication of the presentation and move more rapidly over a list of topics that is very similar to those found in two-semester courses. Consequently, students are having major problems getting anything out of the new one-semester courses.

Dr. Frost and her colleague Dr. Deal are taking an integrated approach to presenting GOB material. They have gained significant national recognition for this new approach. It seems to me to have definite promise for solving the problem of the one-semester GOB course. I have considerable experience with this problem. My institution, Moravian College, instituted a nursing major seven years ago and we were asked to develop a one-semester GOB course for it. This course has been a problem for us from the beginning. In fact my knowledge of Dr Frost's work originally came from the contact our instructor for the GOB course, Dr. Carol Libby, had with Dr. Frost concerning her presentation at the Biennial Conference on Chemical Education.

In addition to her work on the textbook, Dr. Frost has developed and implemented a series of guided inquiry activities for her GOB course. She plans to publish these as a workbook along with her textbook. So she has developed a "lectureless" inquiry based course for the one semester GOB course. The combination of her textbook and guided inquiry workbook will be an important contribution to the education of nursing students and other students pursuing health sciences. She is also in the process of collecting data on the learning outcomes of the students in her GOB course and will be analyzing them to assess the effectiveness of her guided inquiry teaching method and to provide information that will assist her and others in the chemistry education community in improving this fast growing approach to teaching in all of the sciences.

So I believe that Dr. Frost has contributed significantly to the chemistry education and has the potential to be a leader in this area for many years. Consequently, I support her nomination for the Board of Regents of The University System Of Georgia Regents' Scholarship of Teaching and Learning Award. If I can be of further assistance, please feel free to contact me.

Sincerely,

R. Daniel Libby
Professor & Chair
Chemistry Department

April 11, 2007
Center for Excellence in Teaching
Georgia Southern University
Statesboro, Georgia 30460

Dear SoTL Award Reviewers,

I am honored to write this letter of support for Dr. Frost with whom I have worked for the past year in my capacity as the Instructional Design and Services Coordinator for the Center for Excellence in Teaching at Georgia Southern University. In this role, I have been able to observe Dr. Frost's teaching process, review the teaching models and methods used in her classrooms, examine the performance and perceptual data and analyses about the learning of her students, and collaborate with her to support the collection and dissemination of her research and findings related to the scholarship of teaching and learning. This dissemination includes the development and submission of two grant proposals and several presentations at professional conferences.

The methods and discipline of scholarship used by Dr. Frost are exemplary in the specification of her goals, the preparation she accomplishes for both teaching and evaluation, the use of appropriate methods of assessment and evaluation with the deliberate triangulation of data sources, the checking and analysis of results for their significance, the reporting of those results, and the care with which she invites reflective critique. Her reflective techniques include (1) the invitation of external observation, reporting, and consultation about the teaching models as she actually implements them in her schedule of teaching; (2) peer review of her test data and perceptual data on student performance; (3) creative application of the principles of instructional design from cognitive psychology, and an analysis of principles integrated within, as well as absent from the models of teaching that she uses – examples include clustering of test scores for different learning outcome levels and comparison of formative and summative perceptual data.

Dr. Frost is rigorous in her application of research and evidence-based models and principles, not only in the way that she approaches and examines the results of her teaching, but in the way that she approaches the design and delivery of her coursework. In addition, although she sets high standards and requires her students to actively participate in their own learning, their responses to evaluation questions show their high regard for her standards and for her disposition as a caring teacher. Finally, I would be failing in my expression of support, if I did not also acknowledge the strength she has applied in sustained research across several years of teaching to compare results of different methodologies, in carefully checking to ensure validity of her procedures of testing and evaluation, in taking the risk of possibly lower student ratings of instruction when implementing a teaching innovation, and in the ethical choices she makes to learn and put forth the "best" teaching and testing for her students.

Sincerely,

Ludy Goodson, Instructional Design and Services Coordinator
Center for Excellence in Teaching, Georgia Southern University