Application for a Writing Across the Curriculum (WAC) 2010 Department Development Grant

Title: Sustaining Learning Through Writing Practices in Chemistry Laboratory Courses by the Development and Implementation of a Teaching Assistant Training Program

Team Members:
Dr. Evonne Rezler, Assistant Scientist (team leader), Dr. Donna Chamely-Wiik, Assistant Scientist, and Dr. Jerry Haky, Associate Professor and Associate Chair, Department of Chemistry and Biochemistry.

Project Objectives:
The Organic Chemistry Laboratory (CHML 2211) course at FAU is offered to over 170 students in eight different sections each semester, the Inorganic Chemistry Laboratory course (CHML 3609) is offered in the Spring and Fall to 24 students and the Advanced General Chemistry 2 course (CHMC 2051) is offered each Spring to a maximum of 22 students. The faculty in the Chemistry Department are working on improving student learning in these courses through the development and implementation of a more rigorous writing to learn approach involving a peer-review process and the use of rubrics in to the curricula. This writing-to-learn approach will collectively affect the learning experience of over 500 students per calendar year in either their freshman or sophomore years. This pool of students represents a variety of majors in the sciences spanning chemistry, biology and pre-health professionals. Through this project we will ensure that the changes in curricula of all three courses are sustainable in the long term. This will be accomplished through the development and implementation of a training program for the graduate teaching assistants (TAs) in the processes of peer-review, use of rubrics and assessment of writing.

Project Background and Potential Impact:
In 2007 faculty from the Departments of Chemistry and English (Drs. Haky, Chamely-Wiik and Galin) received a National Science Foundation (NSF) Course Curriculum and Laboratory Improvement (CCLI) grant "Shifting Responsibilities: When Chemistry Replaces First-Year Writing" to develop the writing intensive Advanced General Chemistry 2 course. This course was instituted in Spring 2008 and was designed to enhance student learning, improve critical thinking skills and foster student development of conceptual knowledge through writing intensive assignments and assessments. Grading rubrics were specifically developed for this course and the students were trained in their application to their written assignments. The course also requires instructor-review and peer-review of multiple revisions of written student assignments as a scientific method and "writing to learn" tool. Although the assessment of the relative success of this approach in this course is still underway, the results from preliminary data as well as many previous studies[1-3] are consistent with writing improving learning in the chemistry discipline.

To date the Advanced General Chemistry 2 course has been successfully offered at FAU for three consecutive Spring semesters by Drs. Haky and Chamely-Wiik. We have observed clear signs of student improvement in conceptual understanding, critical thinking and scientific writing of students taking this course and these findings have been published in an article in the following peer-reviewed journal: "Combining Chemistry and College Writing: A New Model for an Honors Undergraduate Chemistry Course." Chamely-Wiik, D. Galin, J., Kasdorf, K., Haky, J. *Honors in Practice*, 5, 77-96, **2009**.

In Fall 2008, Dr. Haky also successfully instituted the instructor-review and peer-review of multiple revisions of a written assignment along with the use of accompanying grading rubric for one experiment in another course, the Inorganic Chemistry Laboratory course (CHML 3609). The student feedback was resoundingly positive in the Student Perception of Teaching (SPOT) survey that semester. Subsequently, the curriculum of that course was redeveloped and updated by Drs. Rezler and Haky in the Fall 2009 semester resulting in the publication of "Experiments in Inorganic

Chemistry", E.M. Rezler and J.E. Haky, Wiley, MA, 2009. The new curriculum is writing intensive and again incorporates the peer-review process and rubric use for multiple revisions of the initial written report based on the first experiment in the course.

As a result of the successes for student learning and writing from the initiatives in the Advanced General Chemistry 2 and Inorganic Chemistry Lab courses, Drs. Rezler, Haky and Galin recently submitted and were awarded a 2010 FAU Faculty Assessment Grant, titled "Improving Learning Through the Organic Chemistry Laboratory Course". This project, currently underway, involves the design and implementation of an improved writing approach based on standardized American Chemical Society (ACS) guidelines[4] to enhance student understanding of the expectations of written scientific lab reports, experimental design and the scientific process in general. We anticipate that in Fall 2010 an instructor-review and peer-review process will be incorporated into the first Organic Laboratory experiment to help students better understand and learn the expectations and requirements in their written lab reports. Students will submit successive drafts of their lab reports and receive feedback in the first instance from their peers and then from their TAs. It is anticipated that addition of the peer-review procedure and a universal and more rigorous written approach to the Organic Chemistry Laboratory curriculum will improve the abilities of the students to understand and properly communicate in writing scientific experimental processes and interpret their data.

During the Summer 2010 semester the Organic Laboratory TAs will need to be trained specifically in the protocols of peer-review and in providing feedback to the students. There is no funding allocated currently for this TA training. In addition, we recognize that there is a tremendous need for ongoing training of new TAs in the protocols of peer-review, grading rubric application and in providing of student feedback in the Advanced General Chemistry 2 course and Inorganic Chemistry Laboratory course. Implementation of this training for TAs in all three courses would ensure long-term sustainability at the highest level of the writing-to-learn practices outlined in this application.

Project Plan:
The team members in close consultation with the University WAC Director and Coordinator will develop and implement a two stage TA training program over Summer 2010 semester. In the early part of summer the team members will meet with Dr. Galin to develop the training program. In late summer the training will be implemented in two seminars. In the first session we will introduce and model the process of peer-review and associated grading rubrics, and in the second session we will engage the TAs in an interactive peer-review process and use of grading rubrics experience through the norming of sample student reports.

Assessment Strategy:
We will assess the TAs ability to carry out their new teaching duties by observing the them in their respective classes and inspecting their grading of the student written reports at each stage of the multiple revision process.

Schedule:
Summer 2010

- May through July 2010 – redesign of an existing Organic Laboratory experiment to be amenable for a peer-review process (including submission of 1st and 2nd drafts) and the corresponding rubric (rubric will be based on that previously developed for the General Chemistry Honors course by Drs. Galin, Chamely-Wiik and Haky). This work is funded through Faculty Assessment Grant received in Spring 2010 by Drs. Rezler, Haky and Galin.
- May though the end of June – Drs. Rezler, Chamely-Wiik, Haky and Galin will meet bi-weekly to develop the Teaching Assistant (TA) training program.
- July 2010 – two stage training of General Chemistry, Organic and Inorganic TAs in the peer-review process and the feedback requirements. Training will be implemented in two seminars:

in the first session the we will introduce and model the process of peer-review and associated grading rubrics, and for the second session we will engage the TAs in an interactive peer review process and use of grading rubrics experience through the norming of sample student reports.

Fall 2010

- Implementation of the peer review process for the first Organic Laboratory experiment of the semester for the entire class of up to 176 students. (involvement from all team members will be required, in collaboration with Dr. Galin a specialist in peer review process)
- The peer-review process is continued in the Inorganic Laboratory course with an effectively trained TA.
- TA assessment commences by observation of TA in-class performance and inspection of their adherence to grading rubrics and the detail of their feedback to students regarding their written assignments.

Spring 2011

- The peer-review process is continued in the General Chemistry 2 Advanced and Inorganic courses with an effectively trained TA.
- TA assessment continues.

Budget:

$500 stipend over the summer 2010 semester for Dr. Rezler
$250 stipend over the summer 2010 semester for Dr. Chamely-Wiik
$250 stipend over the summer 2010 semester for Dr. Haky
$1000 for training ten Teaching Assistants over the summer 2010 semester ($100 stipend each)

$2,000 TOTAL expenses requested for the grant

Commitment to writing a report and making a presentation to the university community:
The team leader is committed to writing a report and making a presentation on the findings from this project to the larger university community.

References:

1. Robinson, R. "Calibrated Peer Review ™: An application to increase student reading and writing skills." *The American Biology Teacher*, **2001,** *63(7),* 474-480.
2. Goodman, W.D., Bean, J.C., "A Chemistry Laboratory Project to Develop Thinking and Writing Skills" J. Chem. Ed., 1983, 60(6), 483-484.
3. Stoller, F., Jones, J.K., Costanza Robinson, M., Robinson, M., "Demystifying Disciplinary Writing: A Case Study in the Writing of Chemistry." Across the Disciplines, Special Issue, May 2005.
4. Coghill, A.M.; Garson, L.R. Eds. *The ACS Style Guide: Effective Communication of Scientific Information*, 3rd Edn, Oxford University Press, Washington DC, 2006.

I fully support this project and the above proposal

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