

*Institutional Effectiveness Report
Academic Year 2013-2014
Undergraduate Chemistry*

*Dr. Barbara Holliman
Associate Professor of Chemistry*

*Dr. Ken Williams
Chair, Department of Chemistry*

Spring 2014

Mission and Goals

The Department of Chemistry offers lower-level courses appropriate for general education and upper-level courses for major and minor programs in chemistry. These courses also serve as foundation courses for majors in other areas such as biology, mathematics, and pre-professional programs. Topics and concepts on the fundamental laws of nature that govern the physical universe and on the methods of scientific inquiry used to investigate and develop those laws are the foundations of course content. A basic understanding of the fundamental laws of nature and a basic understanding of the process of scientific inquiry are essential parts of a liberal arts education.

The chemistry program seeks to offer courses in chemistry that are taught by full-time faculty members with appropriate advanced degrees dedicated to science education at the university level. The courses offered in the department range in level from introductory courses that expose non-science majors to scientific thought to advanced courses that cover current and complex topics in modern chemistry. The laboratory experience is required in appropriate courses to illustrate the importance of experimentation to the scientific endeavor. For the majors in chemistry, the opportunity to undertake undergraduate research is offered. Since part of the research is the interpretation and communication of results, majors graduating from those programs in the department are expected to be proficient in oral and written communication, to be familiar with the scientific literature, and to be aware of the importance and usage of computers in science.

Those students completing either of the two major tracks offered by the Department of Chemistry are prepared to enter into any number of career choices. These include science education at the secondary level; work in local, region, and national industries and with governmental agencies; and entrance into graduate or professional schools.

The current chemistry curriculum consists of two tracks. The first is the track leading to the basic or minimal chemistry major. The second track is the curriculum leading to the American Chemical Society (ACS) certified degree. The ACS-certified degree requires additional advanced course work in chemistry, physics, and mathematics.

Assessment Activities

For 2013-2014, the department used a variety of assessment instruments in CHEM 499, Chemistry capstone course. These included a standardized test of undergraduate chemistry knowledge, an exit survey, and an exit interview. In addition, each student was required to give a 20 minute presentation on a topic in the current chemistry literature.

During the Spring 2014 semester we administered the American Chemical Society Diagnostic Test of Undergraduate Chemical Knowledge to the four students enrolled in the CHEM 499 Chemistry capstone course. The scores ranged from the 5th percentile to the 84th percentile (raw scores of 17 to 40 out of 60 questions). The average score was at the 56th percentile. We will continue to review fundamental topics as part of the course requirement.

The surveys and exit interviews showed that the majors were generally satisfied with the course offerings, with the lab experience, and with opportunities for research. Students were satisfied with faculty knowledge, availability, and advising. Computers were listed as adequate, with a suggestion for some program availability on Macs. Excel and Gaussians were identified as being heavily used. Some concerns were made about the need for Calculus III.

The oral presentations were varied this year in terms of quality. The faculty will continue to look at ways of addressing oral presentations in lower level courses to help improve presentation skills.

Based on each of these assessment tools, the faculty will look at different strategies of reviewing the content from the major areas in chemistry in the CHEM 499 course. We will continue to encourage students to take additional advanced coursework and to participate in research activities.

*Primary Issues Identified During 2013-2014
with a Review of Actions Taken During 2013-2014 for the Department of Chemistry*

Issues of Concern 2013-2014	Actions Taken
New faculty need to be hired as a result of changes in teaching loads.	Budget constraints continue to delay the hiring of additional full-time faculty. Three adjunct faculty were used to cover additional sections during the 2013-2014 academic year.
The Tutoring Program needs to continue to be developed for assisting students in the lower level chemistry lectures and laboratories.	Tutoring sessions from this year were very productive. There were five tutors who worked in the tutoring center. Over 400 individual tutoring sessions were conducted, and reflection statements that were required for tutors and some tutee classes were encouraging. Most have indicated that the tutoring sessions have increased their understanding of chemistry.
Increase membership and participation in the Student Affiliate Section of the American Chemical Society	<p>For 2013-2014, there were a total of 25 chapter members (11 ACS student affiliates and 14 non-student affiliates).</p> <p>Recruitment begins with affiliate members assisting in freshman move-in day. Members wear their organization t-shirts and name tags and make contacts with new students.</p> <p>Recruitment and retention were also achieved by having professors announce the first meeting of the semester in chemistry lectures. Flyers were also posted in various locations around campus. A social in the Fall was held for recruitment as well as many other activities throughout the year. The Student Affiliate Section also was represented at the Student Organization Fair. The Student Affiliate Section also has a Facebook page (Francis Marion University American Chemical Society) to improve our web presence and awareness about the group's activities. In addition, email addresses were collected this year and used to promote affiliate activities.</p> <p>The student affiliates were involved in a variety of activities. These included monthly meetings, social events, field trips, and professional meetings.</p> <p>The Student Affiliate section was recognized with an Outstanding Chapter Award for 2012-2013.</p>

<p>Increase the Chemistry department's ties with the scientific community</p>	<p>With the student affiliates, a demo was set up on the main lawn area on October 23 and 24, 2013. Demonstrations and experiments included activities related to energy – energy sticks, superconducting chips/magnet, potato/fruit clocks, and fuel cells.</p> <p>22 people (faculty and students) attended a tour of Roche Carolina on April 9, 2014.</p> <p>Katelyn Poston gave a presentation to the affiliates about her career as a neonatal nurse on March 5, 2014.</p> <p>Jamell Brown gave a presentation about his job at IRIX Pharmaceuticals on October 1, 2013.</p> <p>Dr. Sonya Garaschuk gave a talk to the science symposium on Feb. 20, 2014 about quantum effects of nuclear motion in large molecular systems.</p> <p>Three chemistry faculty and five students attended the Southeast Regional Meeting of the American Chemical Society in Atlanta, GA from November 13-16, 2013. One undergraduate presented a paper.</p>
<p>Increase the opportunity for chemistry students to participate in undergraduate research</p>	<p>Four students were involved in undergraduate research projects this year.</p> <p>One faculty member with an undergraduate researcher presented a poster at the annual meeting of the Southeastern Section of the American Chemical Society (SERMACS).</p> <p>One faculty member with an undergraduate researcher presented an exhibit at the 1st Annual FMU Research and Exhibition Day.</p> <p>One faculty with an undergraduate researcher and a STEM teacher presented a paper at the 2014 South Carolina EPSCoR/IDeA Annual Conference.</p>
<p>Secretarial help is needed on the third floor.</p>	<p>Due to budget constraints, the Chemistry Department continues to share a secretary with the Physics Department (first floor). This is not an ideal situation and will continue to be revisited as the budget improves.</p>

<p>Examine and apply traditional and new teaching strategies, incorporating new technologies.</p>	<p>Several lab experiments were modified in the General and Organic lab programs. Further modifications will be examined for both programs.</p> <p>Mathematica was introduced in the Instrumental Analysis course to solve systems of linear equations. This type of software is commonly used in industry and academia.</p> <p>A new experiment involved students measuring the voltage produced by a series of standard solutions of different pH values. This experiment demonstrated the nernstian behavior of glass pH electrodes.</p> <p>A new cyclic voltammetry experiment used printed carbon electrodes to study the behavior of the ferrocyanide/ferricyanide redox couple on a carbon surface.</p> <p>Students also synthesized silver nanoprisms, and correlated the color of the nanoprism solutions to their absorbance spectra. This provided students with an introduction to nanotechnology.</p>
<p>Office and instructional computers need to be upgraded.</p>	<p>Extensive student machine upgrades were made over the last two years. One faculty desktop was upgraded to SIN7 during the academic year. In addition, numerous multimedia upgrades were made.</p>
<p>Publicity needs to be improved via local media and the University's Community Relations Office</p>	<p>Flyers announcing events were posted in the Leatherman Science Facility, McNair Science Building, campus housing and the Smith University Center. Communication was also accomplished via Facebook, e-mail and announcements in class. Flyers were used to make students aware of the availability of the chemistry tutoring center and the hours of operation. Order forms for lab coats, t-shirts, and sweatshirts were distributed in the chemistry classes.</p> <p>A Facebook page (Francis Marion University American Chemical Society) has been developed to communicate about events, exchange digital photos, and interact with members. The Facebook page improved our web presence and improved awareness about the group's activities.</p>
<p>Increase the participation of women and minorities in chemistry</p>	<p>Women and minorities were actively involved in all activities of the Student Affiliate chapter, from social events, fundraisers, trips to professional meetings, and interactions with elementary and middle school students. All of the officers of the Student</p>

	<p>Affiliate are women or minorities.</p> <p>Women and minorities are strongly encouraged and actively participate in undergraduate research, in the tutoring program, and in various departmental activities.</p> <p>Two grants were obtained that allowed women and minorities to serve as tutors and to conduct chemical research.</p>
<p>Continue general education assessment in CHEM 101</p>	<p>The general education assessment was administered in spring 2013 to students enrolled in CHEM 101 and CHEM 102. A series of multiple choice questions were developed using the experiment on the conversion of a carbonate to a chloride. Overall, the students showed, as indicated by the correctness of their responses, that they generally understood the scientific principles being questioned.</p>
<p>Continue to be involved in science activities with elementary and middle school students</p>	<p>The department provided science fair judges for the Sand Hills Regional Science Fair and well as for local schools.</p> <p>With the Student Affiliates, there was an outreach to the participants during the Sand Hills Regional Science Fair. The participants were able to make slime. Approximately 206 students were served through this activity.</p> <p>One faculty member conducted an experiment (pH/Cabbage Indicator) with chemistry and physical science students at Robert E. Lee High School.</p> <p>One chemistry faculty member served as host of the Awards Ceremony for the Sand Hills Regional Science Fair.</p> <p>One chemistry faculty member conducted monthly science experiments for Hannah-Pamplico Middle School after school program.</p>
<p>Update of laboratory equipment and instrumentation</p>	<p>An Anasazi FTNMR was added to the department during October of 2014.</p>