University of Arkansas at Monticello
School of Mathematical and Natural Sciences
Chemistry Program Review
External Review Report
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Submitted by
Steve McKim, Ph.D.
Associate Professor of Chemistry
Southeastern Oklahoma State University
Durant, OK 74701

Introduction

The School of Mathematical and Natural Sciences at the University of Arkansas at Monticello (UAM) was visited by the external reviewer on Friday, February 26, 2016 as part of the Chemistry Program Review. The reviewer met with the entire chemistry faculty (save one lab instructor) and some of the biology faculty, mathematics faculty, and physics faculty. The reviewer also met with a handful of students, Dr. Morris Bramlett, the Dean of the School of Mathematical and Natural Sciences, and Dr. Peggy Doss, the Interim Transitional Leader for Academic Affairs.

The internal *Chemistry Program Review* document was provided to the reviewer seven weeks before the site visit. This document details the chemistry curriculum, goals and objectives of the department, and activities and accomplishments of the department and students/graduates. This document is currently available on the School of Mathematical and Natural Sciences website:

(http://uam-web2.uamont.edu/pdfs/mnsciences/chem%20program%20review.pdf).

UAM is a comprehensive post-secondary institution in southeast Arkansas, serving the needs of students through teaching, research, and service. The School of Mathematical and Natural Sciences offers programs/courses in astronomy, biology, chemistry, earth science, mathematics, and physics. The focus of this review is the chemistry program.

I. Program Goals, Objectives and Activities

In essence, the mission of UAM's School of Mathematical and Natural Sciences is to provide opportunities for every student to enhance their own understanding of science and mathematics and to provide an appropriate level of education for budding scientists and mathematicians through a comprehensive curriculum. Courses are offered to support the general education program, other majors, and their own respective majors and minors. The School's graduates, through a curriculum guided by specific goals, are prepared for careers in industry, teaching, and for graduate studies in education, mathematics, science, and the health professions.

All of this helps guide the Chemistry program, whose primary objectives are to offer Bachelor of Science degrees with a major or minor in Chemistry, or to contribute to a double major in Biology and Biochemistry.

An important goal in the Chemistry program is to provide service courses for other majors and for the General Education program. For the general education program, the chemistry department offers Introductory Chemistry and General Chemistry I. The service courses provided are Introductory Chemistry, General Chemistry I, General Chemistry II, Introduction to Organic and Biochemistry, Organic Chemistry I, Organic Chemistry II, and Quantitative Analysis. These courses serve majors such as: Agriculture, Biology, Education, Forestry and Natural Resources, General Studies, Land Surveying, Natural Science, and Nursing.

It is evident that the chemistry faculty have high expectations for their courses and for their students. They are willing to assist students as much as possible, whether in the general

education courses, service courses, or major courses. The faculty and students are also involved in multiple activities outside the classroom. A selection includes:

- The Sigma Zeta Math and Science Honor Society: an active student organization which fosters group camaraderie and allows students to network with others in the School. The students in the Sigma Zeta chapter participate in various service projects throughout the year.

- Participation in the Southeast Arkansas Regional Science Fair (SEARSF), which has been hosted by the UAM School of Mathematical and Natural Sciences for fifty-nine years. The fair is open to all high school and junior high school students from schools located in the southeastern region of the state. Chemistry faculty members and students often assist participants in setting up displays properly, serve as judges of the projects, or work with teachers during the research phase of project preparation.

- Participation in the Arkansas Space Grant Consortium (ASGC), which is funded by NASA. The grants awarded from ASGC have provided stipends for students to work with UAM Chemistry faculty members. Some of these students have also visited NASA research facilities. The ASGC also has an annual meeting where UAM students and faculty have presented their research results.

- The UAM Medical Science Club is a group consisting of pre-professional students. This group has several chemistry majors as members. This group promotes pre-professional studies and also provides a social outlet for the students. The Medical Sciences Club sponsors visits by recruiters from various medical, pharmacy, and veterinary schools, and promotes talks from UAM graduates who can share their experiences with current students. The club sponsors visits by groups of UAM students to medical schools, dental schools, pharmacy schools, and graduate schools.

- The UAM Tutoring Center employs many of the chemistry majors as work-study students to tutor lower-level chemistry students.

- Participation in the UAM Research Program for Minority Students (UAM-RPMS) to promote research skills for students who are members of underrepresented minorities.

The chemistry department uses four primary means of student assessment and program assessment. First, students are assessed by their performance in courses through the standard means of exams, projects, presentations, homework, etc. Second, all students in General Chemistry, Organic Chemistry, and Biochemistry take the American Chemical Society standardized final exam in these respective courses. Since inception, many students have achieved at or above the national average scores on these standardized exams which is an impressive statistic.

Third, chemistry majors have the option of taking Advanced Laboratory Techniques, Senior Research, or Chemistry Seminar (rarely offered) as the capstone course. Typically, the course is taken during the student's senior year after completing the bulk of required and elective course work. An exception is made for students that participate in undergraduate research that leads to a presentation at a state, regional, or national meeting. They are not required to take one of these capstone courses. Each student in these courses will select a topic related to the special topics portion of the course, gather research data, and prepare for an end of term seminar presentation that is graded accordingly. Fourth, the program is assessed by the placement of graduates. The vast majority of graduates are successful in finding teaching positions, entering graduate or health-career programs, or finding other gainful employment.

In addition, graduates are invited to interview with the Dean of the School of Mathematical and Natural Sciences. Many students take advantage of this opportunity. Exit question responses provide anecdotal evidence that can be used to assist in the assessment process. The chemistry department has not done an employer satisfaction survey in several years, but does have a working relationship with the public school districts that hire UAM graduates. Many of the department graduates have done very well in these settings.

II. Program Curriculum

Essentially, the chemistry department provides support or service courses and provides courses for their majors and minors. The chemistry faculty continually review their curriculum with the goal of best meeting the needs of not only their majors/minors, but also their support of other majors/minors, and the general education program. The chemistry curriculum is broad-based and provides an excellent preparation for various post-graduate paths.

From the years 2005 to 2012, the number of declared chemistry majors had been fairly consistent at nearly 15 (freshman, sophomores, juniors, and seniors) each year which translated to about 4 graduates a year. However, from 2013 to 2015 the number of declared chemistry majors saw a major jump to an average of 27 per year, with 12 graduating on average during this same interval. This remarkable trend is due to the introduction in 2009 of the Biochemistry option of the B.S. Chemistry degree. The chemistry department is rightly proud of this accomplishment and they are to be highly commended. This reflects the trend nationwide that most chemistry majors are choosing to use their chemistry education in health-related fields and not graduate school. The chemistry department at UAM is appropriate to the size of the university and the population that it serves. The department recruits through local high schools and through specific events sponsored by UAM. They also work with the Office of Admissions that does an outstanding job of identifying qualified students, who are then sent personal invitations, from the chemistry faculty, to visit UAM. Advising for declared chemistry majors is a priority for the faculty. This advisement ensures proper course sequencing and discussions regarding post-graduation options.

The department runs a successful tutoring program that allows stronger students to assist their peers. The faculty also spend enormous amounts of time and energy providing help sessions, one-on-one assistance, and mentoring students.

III. Academic Support

The chemistry department provides two levels of support: service support and support for their majors. They work to recruit competent tutors who work in the tutoring center that services both the introductory and upper level chemistry courses. There is a commitment, which funnels from the faculty through the tutors, to helping all students achieve success in their courses.

Advising for chemistry majors is comprehensive. The faculty share the advising load and are able to ensure that students take appropriate courses in a timely fashion. A sequencing guide is provided to all majors, which is especially important since not every upper level required course is on a yearly cycle.

IV. Program Faculty

The chemistry department has five faculty distributed as one lab instructor, three associate professors, and one professor. No adjunct faculty have had to be used by the chemistry department for a long time. The qualifications of all faculty are appropriate for their rank and role within the department. The teaching load for faculty holding the rank of instructor is typically 15 credit hours per semester and for faculty holding the rank of Assistant Professor or higher is typically 12 credit hours per semester. The issue of appropriateness of their workload through the lens of best practices is difficult to gauge. Their current workload is within the range of similar institutions, but one needs to also consider types of courses (general education, major), class size, and university-wide expectations on service and scholarship. With that said, as a whole, the workload does seem appropriate.

New faculty participate in a university-wide orientation program (week-long prior to start of the fall semester) which provides a thorough introduction to UAM and policies and procedures on advising, technology, academic support, etc.

Faculty are evaluated annually and required to submit an annual self-evaluation. Peer visits to class and course evaluations by students are also required. The evaluation process appears to be adequate and appropriate.

The reviewer met with several students and asked their input on UAM and the faculty. Their comments are included below.

What the students like:

- The faculty care about us, they take interest in us as people
- The grades are returned promptly
- The faculty are organized
- The PowerPoint presentations are good and germane to the topic
- The grading systems are fair
- The syllabi are followed
- The final grade on the ACS standardized exams are calculated fairly

What the students would like to see in the future:

- More Organic drill (but the students acknowledged that the Organic professor is excellent and does not have an unlimited amount of time to accommodate such a request)
- Improvement in the labs (especially in Instrumental and Thermo, i.e., too many dry labs)
- New equipment (especially in Organic, mention was made of the old distillation kits and old heating mantles)
- Better classrooms, i.e., too many of them leak
- New instruments (the IR does not work properly and the NMR does not work at all)
- Better computer operating systems (too many still have Windows 98)
- Better pH meters
- Organic and Biochemistry Labs are understaffed and need more help

The reviewer also met with the chemistry faculty as well as several faculty in the various other disciplines represented in the School of Mathematical and Natural Sciences and asked for their input. Their comments are included below.

What the faculty like about UAM:

- Great collegiality, not just departmentally, but campus-wide
- Good boss
- Like having good lab instructors
- Low stress levels
- Don't feel they have to push a clock
- Look forward to coming to work

Faculty concerns:

- Strong gas smell in the building
- Low faculty pay yet high teaching load
- Condition of the building and the pressing need for a new building
- Very limited storage space in the building
- Miniscule office space
- Open enrollment is not liked, there is a need to have a minimum ACT grade to enroll in certain courses
- Funding from the legislature being based on retention (this ties in directly to the previous point)

V. Program Resources

The chemistry department provides funds for professional development and most faculty have attended and some have made presentations at both regional and national chemistry conferences. In addition, the Fred J. Taylor Library and Technology Center has an excellent interlibrary loan policy and works hand in hand with the faculty. In addition, there are rooms that are available for use within the library that supplement the Science Center space.

While the classrooms in the Science Center have been updated to include Internet connections and projection capabilities (both document camera and computer), the facility itself is showing

its age. All of the classrooms, although upgraded technologically, are aged. The building itself is in desperate need of repairs to correct roof leaks, mold, ventilation, and some of the outdoor cement stairs. The reviewer has provided comments along these lines below in relation to specific rooms in the Science Center:

ROOM	PURPOSE	CONDITION/COMMENTS
C2	Research Lab, Instrument Room (off lab room), NMR	Old but functional
C4	General and Introductory Chemistry Lab	Old but functional
C5	General Chemistry Stockroom	Old but functional
C6	Geology Lab	In acceptable shape
C16	Research Lab	Old and functional but leaking; leaking needs to be attended to as soon as possible
C20	Storage Room	Old and functional but vent in floor smells; vent needs to be attended to as soon as possible
C21	Melting Point Room, Storage Room (off main room)	Old but functional
C24	Molecular Modeling Room	In acceptable shape
C28	Analytical and Physical Chemistry Lab, Research Lab	Old and functional but chalkboard space needs to be freed up, hoods are too full of chemicals which can lead to safety hazards

ROOM	PURPOSE	CONDITION/COMMENTS
C29	Organic and Quantitative Stockroom	Old but barely functional (i.e., too small)
C30	Organic and Biochemistry Lab	Hoods are too full of chemicals which can lead to safety hazards, perchloric acid was spotted in one hood and the hood is not perchloric acid rated, this needs to be addressed immediately

VI. Program Effectiveness

As mentioned earlier in section II, from the years 2005 to 2012, the number of declared chemistry majors had been fairly consistent at nearly 15 (freshman, sophomores, juniors, and seniors) each year which would translate to about 4 graduates a year. However, from 2013 to 2015 the number of declared chemistry majors saw a major jump to an average of 27 per year, with 12 graduating on average during this interval. This remarkable trend is due to the introduction in 2009 of the Biochemistry option of the B.S. Chemistry degree. In addition, during the last decade, 24 UAM graduates applied to medical school and 22 were accepted, a 92% success rate. However, during the same time period, even this remarkable statistic is bested by the 97% acceptance rate into pharmacy school (33 out of 34). Not only are UAM graduates accepted at high rates in these two fields, but they assume leadership roles for their classes at these professional schools. This high acceptance rate also applies to those Biology-Biochemistry UAM students who pursue graduate school. The chemistry faculty share a common vision to do what they can to help students achieve an appropriate level of success and to create a community or environment that supports not only students but also the faculty. A dedicated faculty is a major strength for the chemistry department and one cannot dispute how effective the program has been in turning out successful graduates. In addition, the level of achievement of their graduates (see Appendix G in the *Chemistry Program Review*) is quite laudable and a "point of pride" for UAM. I highly commend them for their success.

The department has self-identified some need-for-improvement areas. There have been discussions about requiring a minimum ACT grade for General Chemistry. Also, a major concern is the condition of the Science Center and the need not only for repairs (in the short term) but a new building. The faculty have also expressed concerns about the heavy teaching load not being commensurate with their salaries. I agree with the faculty that these are areas of concern that need to be addressed by UAM in, I hope, the not too distant future. All of the faculty participate in student research and the faculty have been involved in making presentations at conferences. Although there have been very few publications recently in peer-

reviewed journals, the teaching load of the faculty, with no release time, makes this very hard to achieve. Thus, I feel that, under these conditions, the amount of research being conducted in the department is about right.

VII. Instruction by Distance Technology

The reviewer totally agrees with the sentiment of the chemistry department that chemistry, being a lab-based science, does not lend itself to instruction by distance technology. There is no substitute to face-to-face instruction in any chemistry course.

VIII. Program Research and Service

These areas have been addressed in sections I, II, and VI.

IX. Local Review Comments

These areas have been addressed in sections I, II, IV, and X (below).

X. Summary

The chemistry program is very strong, vibrant, and in good position to address the needs of the changing landscape of higher education. The program's primary strength is a caring and dedicated faculty which works to meet the needs of their students, through the general education courses, other service courses, and the chemistry major courses. One cannot argue with success. The Dean has an excellent relationship with the faculty and they are appreciative of the support that he has for their academic endeavors. The department has identified several areas that are in need of improvement and should move to address these as quickly as possible, pending funding. The reviewer was very impressed with the acceptance rate of UAM chemistry graduates into medical, pharmacy, and graduate school. Also impressive was the collegiality displayed among the faculty on campus. Many institutions of higher learning do not have this.

The paramount area of concern is the condition of the Science Center. The facilities are in need of major improvement and this should be a priority. Ultimately, a new Science Center must be built and new equipment purchased (especially an NMR). Not only will this improve the program, it will greatly aid in recruitment.

Overall, the chemistry department should continue what it is doing. They are having great success and I anticipate that this will continue in the future. UAM has every right to be proud of its chemistry program.

Bibliography

Chemistry Program Review, University of Arkansas at Monticello, School of Mathematical and Natural Sciences, Fall 2015

http://uam-web2.uamont.edu/pdfs/mnsciences/chem%20program%20review.pdf