

Western Piedmont Community College

Morganton, NC

- **IPEDS enrollment, Fall 2010:** 3,195 students
- **Type of community:** Rural
- **Number of campuses:** 1, with 2 specialized off-campus centers
- **Number of chemistry students, Fall 2011:** 165
- **Number of full-time chemistry faculty:** 3
- **Number of adjunct chemistry instructors:** 0
- **Structure:** Chemistry is part of the Science and Mathematics Department, which is within the Division of Science, Engineering, and Mathematics
- **Focus of chemistry program:** Transfer and technician education
- **Sections of the Guidelines used:** 3.2, 5.1, 5.8, 5.12

C. Nadine McGrady, head of the Science and Mathematics Department, used the *American Chemical Society (ACS) Guidelines for Chemistry in Two-Year College Programs* to

- Revise the curriculum for General Chemistry I and II
- Make laboratory exercises more investigative
- Advocate for a reduction in faculty contact hours

In 2006 and 2007, Western Piedmont Community College (WPCC) was trying to keep its Organic Chemistry I and II classes. So few students were completing General Chemistry I and II at the rural college that enrollment in the two-course organic chemistry sequence had dwindled to three or fewer students per semester. Whenever enrollment in any class drops below eight or so, the deans must scrutinize and justify running the class in order to ensure cost effectiveness. Organic Chemistry I and II were two of the classes that required justification and were in danger of cancellation.

Restructuring the Curriculum

“We just didn’t have the clientele,” McGrady said. Despite the low enrollments, she and the college’s two other chemistry instructors thought it was important to continue offering the two-course organic chemistry sequence for students who are pursuing chemistry degrees. To prevent the cancellation of Organic Chemistry I and II, McGrady and her colleagues restructured several aspects of the department to build students’ interest in chemistry

and encourage their persistence. The *ACS Guidelines for Chemistry in Two-Year College Programs* recommends that two-year colleges offer the full organic chemistry sequence for transfer students (when appropriate); the *ACS Guidelines and Evaluation Procedures for Bachelor’s Degree Programs* requires full sequence as needed.

McGrady asked John Kiser, the newest member of the department, to revise the curriculum of the general chemistry sequence (Chemistry 151 and 152). Because many of Western Piedmont’s chemistry students transfer to Appalachian State University, which has an ACS-approved program, he used the ACS Guidelines to set the goals for what the revamped courses should cover.

Kiser enjoys a unique perspective on what WPCC’s students need to succeed when they transfer. He attended the college himself and was so inspired by the quality of the instruction he received in science and math that he became a chemistry instructor. Having graduated from WPCC in 2002, Kiser transferred to Furman University, where he earned bachelor’s and master’s degrees in chemistry. In 2005 he returned to WPCC as an adjunct instructor. He also taught full-time at Isothermal Community College for two and a half years. In 2008 he was hired as a full-time instructor at WPCC. Kiser also currently teaches at Catawba Valley Community College as an adjunct instructor. Taken together, these credentials made him a good choice for tailoring WPCC’s general chemistry sequence to the needs of the students as well as the requirements of the curriculum.

For many years, North Carolina's public community colleges and universities have had common course numbering and seamless articulation for the general education core. The core includes Chemistry 151 and 152. Although the state system provides a brief description of what each core course should cover, it allows colleges to structure curricula, choose texts, and design laboratory exercises.

To Kiser, an atoms-first approach in General Chemistry I (Chemistry 151) seemed more appropriate than the traditional chemistry curriculum. He also thought that integrating thermodynamics throughout General Chemistry II (Chemistry 152) would improve students' comprehension and engagement. Basing his approach on knowledge he gained at a professional development workshop, Kiser added the student learning outcomes to the syllabi of the courses.

To follow through on the recommendation in the Guidelines to use "appropriate and substantial laboratory work," Kiser and McGrady have developed more hands-on activities and investigative laboratory exercises for both courses. They used the College Board's Advanced Placement (AP) course information to identify lab activities that provide the breadth and depth to prepare students for transfer and higher-level science classes. They referred to the online version of the AP Guidelines and Advanced Chemistry with Vernier. Students use Vernier probes in Chemistry 151 and Chemistry 152.

In 2010, the college was recognized by the system office as "Exceptional" for its performance on a number of measures. One of these relates to students successfully completing the chemistry classes. It measures the performance of transfer students at their receiving institutions. WPCC received extra state money in part because 89% of its transfer students achieved a grade point average of 2.0 or greater after 2 semesters in a University of

North Carolina institution. The Science and Math Department was awarded (and used) \$35,000 in additional state funds in 2010 and 2011 to purchase software, sensors, and other instruments to use in the redesigned lab activities.

"I have a wonderful faculty ... they are very 'in tune' with accountability. We are not afraid of it, but we are also very in tune to communicating to the students exactly what is expected and to be more student-centered than teacher-centered," McGrady said. Accountability measures from the state and the Southern Association of Colleges and Schools provided another nudge to clarify the course content and expectations to students. "You can't hit a moving target. And so if we set the target up front and say 'here it is' and don't move it ... it is just clearer focus for everyone involved," McGrady said.

Kiser added, "In general I think the ACS Guidelines are really helpful. I think they are good at giving ideas of what you should shoot for when you are planning out your chemistry program, your course offerings, your teaching load, the administrative support that you need." He feels that it is beneficial both to refer to guidelines from a professional organization and to share them with the administration, as when structuring or restructuring a program. Having recourse to professional guidelines can be particularly helpful when questions about effective practices arise.

Adjusting Contact Hours

Revamping the chemistry program also involved reducing chemistry faculty members' contact hours, in accordance with the recommendation in the Guidelines that "each laboratory contact hour should be equivalent to a classroom contact hour" and that contact hours should "not exceed 15 total hours per week." To accomplish this, McGrady has reassigned faculty to make better use of each person's strengths.

Western Piedmont Community College's official policy requires faculty to teach 18 work units in the fall semester and another 18 in the spring. Each lecture hour equates to one work unit and each lab hour equates to two thirds of a work unit. Chemistry and other science instructors at WPCC typically had to teach three courses in one semester and four during the next semester to average 18 work units per semester. Teaching four chemistry courses with labs accounted for 24 contact hours.

Once McGrady became department head in 2008 and initiated the curriculum revisions, she began advocating for a reduction in work load for the chemistry faculty. She started by informing Michael Daniels, dean of the Division of Science, Engineering, and Mathematics of this difference between the current college policy and the recommendation of 15 contact hours in the Guidelines.

Daniels' response provides a useful map for navigating the competing needs of institutions, students, and faculty. He first pointed out that the college workload policy was in line with those of other, similar community colleges in the region. Then, he indicated to McGrady that he understood her concerns. For the last three years, he has allowed the chemistry faculty to reduce their time with students to an amount a bit closer to 18 contact hours versus 18 work units.

In explaining how he found the middle ground, Daniels noted that the college gives deans (with vice-presidential approval) some discretion in the matter of contact hours. It allows the deans to consider the number of class preparations, new courses, and special projects with which the faculty members are involved. "The college is in the process of evaluating our teaching load policy, and I will refer to the ACS recommendations in my attempt to help us reach a more equitable solution," Daniels wrote in an e-mail.

Analyzing the Results of the Changes

By offering the same courses as before, but in fewer sections, the chemistry instructors have been able to focus on quality.

McGrady, who describes herself as an educator first, then a chemist, has taken on all the Chemistry 151 classes. She uses a lot of analogies and translates technical terminology into more commonly used words to “hook” students on chemistry.

“I tell them there’s a chemistry way of saying this and there’s the McGrady way of saying this. And so I just try to make chemistry more approachable, student friendly. Comfortable.” McGrady tells students, “It’s not a scary thing. It’s not magic. You, too, can learn it.”

Kiser teaches Chemistry 152 using a service learning project, along with the regional Science Olympiad competition, to increase students’ interest. Kiser’s master’s degree research and thesis focused on thermodynamics and equilibrium, the two topics covered extensively in Chemistry 152. Meanwhile, Stacey Johnson, whose master’s thesis was on organometallic chemistry, teaches Organic Chemistry I and II (Chemistry 251 and 252).

The revisions appear to be working. Although the college’s overall enrollment has declined slightly (due in part to a state-mandated program elimination), the number of students completing Chemistry 151 has climbed steadily from 40 students in 2005–2006 to 85 in 2010–2011. Eight students were enrolled in Organic Chemistry in Fall 2011, compared to 3 in Fall 2010.

The content of this case study was provided by C. Nadine McGrady. She has been a member of Western Piedmont Community College’s faculty since 1995. Before that, McGrady taught high school chemistry for 17 years. She earned her bachelor’s degree in

physical sciences and master’s degree in earth science—with additional hours in chemistry—from Emporia State University. (The university was previously known as Kansas State Teachers College.) In 1993, McGrady received the Distinguished Educator and Mentor Award from the North Carolina State University Physical and Mathematics Sciences Foundation. In 2005, McGrady received WPCC’s Excellence in Teaching Award.