



## Stephen Z. Goldberg — Ph.D.

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### OWL Triggers a Positive Reaction in Chemistry Students (and Their Instructor)

If asked where chemistry fits on a spectrum of “easy to learn” to “difficult to learn” disciplines, most would place it at or near the “difficult” end. Professor Stephen Z. Goldberg certainly would, and he should know, as he has taught the subject since 1975 at Adelphi University on Long Island, New York. For three years, Stephen has used the OWL learning and assessment system for homework assignments and for gradebook tools that allow him to monitor his students’ performance. OWL (Online Web Learning) was developed by chemistry instructors specifically for teaching chemistry, and has been used successfully by hundreds of thousands of students.

#### COURSES AND PARTICIPANTS

Stephen uses OWL in his first-year general chemistry course, which is taken by virtually all science majors. He typically teaches one or two sections per semester; each section has a maximum enrollment of 57 students. Most are full-time students fresh out of high school, although a few are in a post-baccalaureate degree program. Students’ performance on OWL represents 10% of the course grade.

Stephen has used another online tool, but prefers OWL. “I found the OWL interface to be extremely user friendly,” he says. “I have always found the OWL support staff, and actually the entire Cengage Learning operation, to be incredibly good. One of the reasons we are enthused about continuing with the next edition of Zumdahl and Zumdahl is that we’ve had so much good support from Cengage Learning.”

#### THE CHALLENGES

Stephen’s biggest challenge is students’ insufficient mathematical background for chemistry. “Many students are weak mathematically, and that impacts not only on their success with the mathematics, but also on their approach to analyzing a problem. They don’t analyze problems in a systematic way,” he says.

Another concern is motivating students to keep up with assignments. “Based on what I hear from other instructors and students, chemistry seems to be one of the most challenging disciplines. Even students who are excellent in other areas find the material to be difficult. They have not encountered a course that has the rigor of a first-year college course in chemistry, and are not aware of how important it is to keep up with the course material.”

Years ago, Stephen determined that hand-graded homework assignments were not useful. “It was very time consuming, and students tended to work together. I got papers on which either everybody had the right answers or everybody had the same wrong answers, so it was not a constructive use of anybody’s time,” he says. “The idea that I could assign homework for students’ benefit while not having to spend the time grading was attractive.”

#### CHALLENGES

- **Chemistry is difficult to learn; in addition, many students are not proficient in the mathematics** required in the course.
- **Students tend to procrastinate**, which puts them at risk of falling behind and/or failing.
- **Hand-graded homework assignments are time consuming**, and make it easy for students to compare their work.

#### SOLUTIONS

- OWL (Online Web Learning)
- Zumdahl, Steven S. and Susan A. Zumdahl, Chemistry

#### RESULTS

- **Problem-specific feedback aids students’ understanding**, while offering practice in problem-solving and mathematical calculations. Simulations help students visualize chemistry and videos offer mini-lectures on important concepts, reinforcing what students learn in class.
- **Assignment timeframes motivate students**, making it possible to adapt instruction to students with different backgrounds and levels of mastery.
- **Answers to questions are accurate**, to keep up with their course work. Gradebook tools allow instructors to easily identify at-risk students.
- **Students have significantly improved their performance**, which is critical to the progress of their academic careers.
- **Instructors save time** with auto-graded homework.

“OWL enables me to encourage students to keep up with the course material, to monitor performance to see which students are doing well or not so well, and to use homework as a graded component of the course. Those are all big plusses.”

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## THE RESULTS

Stephen says that OWL has been a “motivator” in getting students to do their homework, in part because he can set assignment availability timeframes. “Students can work with OWL whenever they want, but they only get credit when they work within the timeframes that I specify,” he says. “In a course that covers as much material as mine, you don’t want students trying to do all of the work the night before the exam. They need to keep up with it on an ongoing basis. By opening and closing OWL assignments on specific dates, I can encourage that.”

OWL offers a variety of assignments that allow students to work at their own pace as they practice their problem-solving skills. Videos offer mini-lectures on important topics, while simulations reinforce conceptual learning by helping students visualize chemistry. When students answer a question incorrectly, they get feedback that guides them through the solution using the same values as the original problem. Terms and values in problems are parameterized, so each time a student attempts a question, he or she gets a different version.

“A former secretary of defense once said that there are three kinds of information: information we know we know, information we know we don’t know, and information we don’t know we don’t know,” says Stephen. “OWL is very useful for students in terms of the first two, which are the ones that are relevant. When they use OWL they get feedback right away as to what they know. They also get feedback as to what they don’t know.”

In addition to saving Stephen time on grading, OWL offers flexible reporting tools that give him access to overall class performance, individual student scores, and assignment statistics. “The student risk report allows me to see right away which students are having trouble, and I can contact them if warranted,” he says. “I also like the ability to monitor how much time students spend on OWL. Certainly a student could log on and leave to have dinner, but on the other hand, when I see students answering questions successfully in a relatively short period of time, I know that they have mastered the material. If they are working for an excessively long period of time and having poor results, I know that they are having problems.”

Says Stephen, “OWL enables me to encourage students to keep up with the course material, to monitor performance to see which students are doing well or not so well, and to use homework as a graded component of the course. Those are all big plusses.”

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