

CASE STUDY: MIDDLESEX COUNTY COLLEGE

Instructor: Dr. Steven P. Rowley, Professor of Chemistry

Academic Objective: To foster continuing development of chemistry skills and understanding for introductory chemistry students.

To improve course pass and student retention rates.

Academic Background and Challenge:

Middlesex County College, located in Edison, New Jersey, is a two-year community college that serves approximately 13,000 students. A comprehensive institution, the mission of the College is to provide access to an affordable, quality education for diverse students and to promote lifelong learning opportunities to strengthen the economic, social and cultural life of the community.

Successful completion of general chemistry courses at many community colleges like Middlesex can be a barrier to student success. Approximately 500 Middlesex students are enrolled each year in CHM 121, General Chemistry I, the department's first credit-bearing course. CHM 121 has had a reputation for being one of the most difficult courses offered on campus, and there has typically been a high rate of attrition in sections of CHM 121. The biggest challenge for student success in CHM 121 has been student engagement in the course. Getting students to do the necessary homework outside of class has been a long-standing barrier to student success in the course. Anything that could be done to encourage student engagement in CHM 121 would help to achieve the goal of increasing both student retention and overall passing rates in the course.

Dr. Steven P. Rowley, Professor of Chemistry at Middlesex, identified his key strategy to achieve these academic goals as "implementing systems to increase student engagement, and forcing students to do their homework, without putting answers right in front of them."

Dr. Rowley and his departmental colleagues had previously piloted programs utilizing other electronic homework and course management systems like WebAssign, and Houghton Mifflin's Eduspace, in an effort to increase student course engagement. Dr. Rowley had also been delivering online course content for six or seven years, as the school had adopted the WebCT (now Blackboard) learning management system. However, these trials met with limited success, as he found the homework assignment functions unwieldy and time-consuming to implement, and students found the software difficult to navigate and use. Dr. Rowley's colleagues began using online homework in the spring of 2008, and found the content available to them limited in scope. While their desire was to continue using online homework, they also wanted a system that had more built-in content and was easier for both them and their students to use.

Introductory Chemistry with ARIS: Pilot Program History and Goals

In April, 2008, when the Middlesex chemistry department decided to switch textbooks and adopt the McGraw-Hill textbook *Chemistry* (Julia R. Burdge) for CHM 121 in the 2008 – 2009 academic year, Dr. Rowley was charged with reviewing all the online homework and course management solutions on the market, and to select the one that best met all of the department's – and students' – needs. After completing his review, Dr. Rowley and colleagues selected the ARIS system, for three primary reasons:

- It is a quick and easy homework assignment tool for instructors to use and implement

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- It offers a huge database from which instructors can draw homework assignments, mapped to textbook content – providing deep resources for experienced ARIS instructors
- Dr. Rowley noted that he completed a custom assignment, in which he composed his own questions, in 30-35 minutes with ARIS – versus the 3-4 hours required for the same assignment with WebAssign.
- It has a clean, easy-to-navigate student interface maximizing likelihood of positive student experience, and thus program usage

In the fall of 2008, Dr. Rowley developed and led a pilot program that infused the ARIS web-based homework and course management system into the College's CHM 121 course. In addition, Dr. Rowley implemented a student clicker response system for student usage in classroom lectures.

The College's objectives for the pilot program were:

- To evaluate the effectiveness of an ARIS-infused instructional approach to introductory chemistry as a tool to increase students' engagement in the course, and thus improve students' content mastery
- To assess causality, if any, between students' completion of ARIS online homework assignments and increased student learning achievement
- To raise course pass and student retention rates

ARIS has a quick and easy homework assignment tool for instructors – making it simple for new instructors to implement

Introductory Chemistry with ARIS: Pilot Program Design

- Fall 08 semester – Chemistry I, CHM 121, a 14-week one semester course – approximately 200 total students enrolled in all sections (CHM 121 is the first semester of the two semester general chemistry sequence)
- 39 students enrolled in Dr. Rowley's section of CHM 121
- 24 students – 61.5% – completed the course
- Instructional format:
 - Two lectures per week – Same as historical course format, but with the addition of student clickers.
 - ARIS Online Content – In addition to weekly lectures, Dr. Rowley also used ARIS to deliver online content.
 - ARIS Homework – 21 total ARIS online homework assignments were due in the semester. In the pilot, students were required to complete and submit homework online with ARIS. Dr. Rowley was able to post more assignments online because creating assignments in ARIS was fairly easy.
 - ARIS Online Tutoring and Virtual Office Hours – Using chat room and white board functions, ARIS enabled Dr. Rowley for the first time to host virtual office hours and online tutoring for students one hour per week.
 - ARIS Online Review – Students could also spend an unlimited amount of their own time on ARIS, reviewing course content and previously-submitted homework assignments.

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Pilot Program Results:

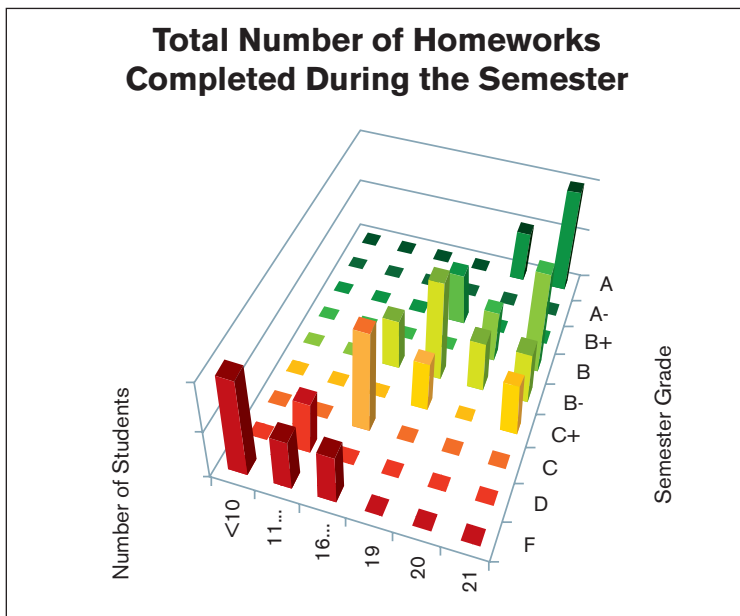
At the completion of CHM 121, Dr. Rowley conducted a thorough analysis of student course performance, using a variety of data points and sources, and compared fall 2008 student data against historical norms for the course. Dr. Rowley concluded that the ARIS program, combined with in-class student clicker use, delivered on its objective of increasing student learning achievement by “changing the culture of the classroom” to encourage (and even demand) student engagement. Highlights of Dr. Rowley’s analysis demonstrated:

Quantitative Impact:

81% of passing students (C or better final grade) completed 19 of 21 ARIS homeworks, while 80 % of failing students completed 15 or fewer ARIS homework assignments

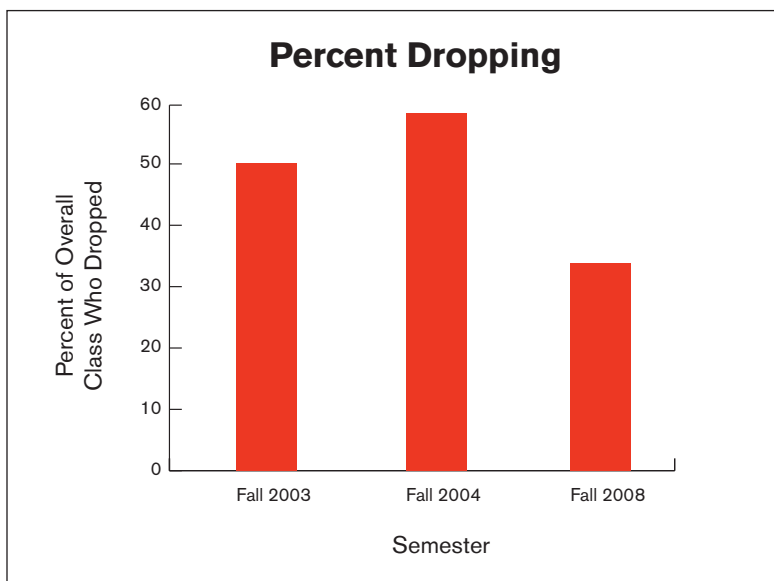
- **Increased Student Engagement**, as shown through the following metrics:
 - 71% of students completed and turned in at least 75% of homework assignments
 - Every week of the 14-week semester, 4-5 students participated in Dr. Rowley’s virtual office hours – delivered using ARIS for online tutoring. Dr. Rowley was very encouraged by this consistent student participation, especially since it was a totally new concept for students
- **Positive Correlation Between ARIS Homework and Student Achievement**
 - 81% of passing students (“C” or better final grade) completed 19 of 21 ARIS homeworks
 - 80% of failing students completed 15 or fewer ARIS homework assignments

Total Number of Homeworks Completed During the Semester



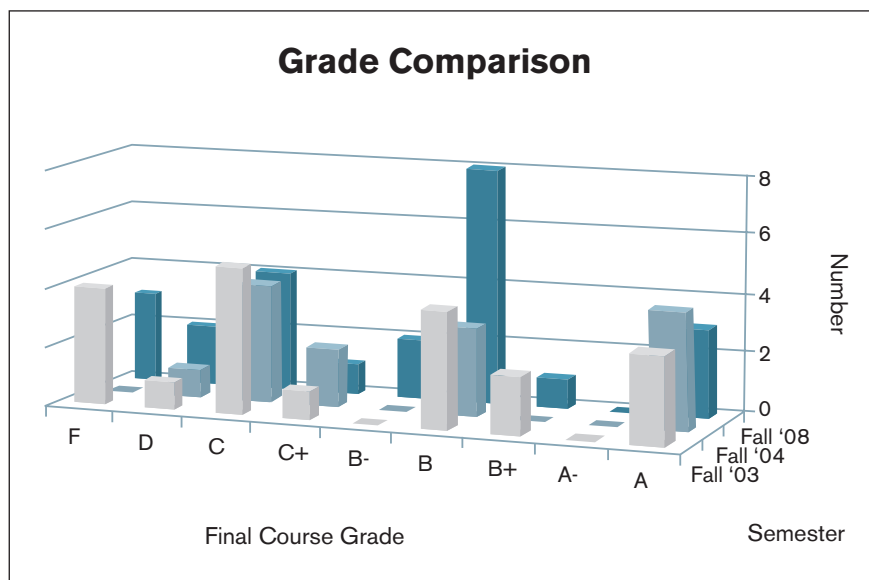
Course completion rate jumped to 67%, up from a historical 40-50% rate

- **Boost in Course Completion Rate**
 - Course completion rate jumped to **67%**, up from a historical 40-50% rate
 - Course drop rate declined to **33%**, from a 50-60% historical figure



- **Improved Student Achievement and Course Pass Rate**

- **31% of students got a B or better final course grade** – up from the typical 20-22%
- **49% course pass rate**, a dramatic improvement from historical pass rates in the low to mid 30% range.



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Prof. Steven Rowley**

Qualitative Impact:

- ARIS, combined with in-class student clickers, “changed the culture of the classroom” to demand greater student engagement, notes Dr. Rowley. “I’d walk into the room and hear students actually talking about chemistry, and how they’d approached the previous homework assignment. That’s a big change from what I’d been used to seeing – kids texting, or scrambling to finish their homework sheets.”
- Dramatic drop in student complaints about online navigation, or getting onto the ARIS program, versus previous online systems.
- End of course student evaluations showed that every single student liked online homework. One typical student comment: “ARIS forces me to do my homework, but it also gives me feedback as I do.”