Active Learning in General Chemistry: A Gateway Course Redesign Experience



BACKGROUND

- As part of the Gateway Science and Math Course Reform project, General Chemistry II course was redesigned using learner centered environments, by incorporating several active learning elements.
- The reform project was implemented in pilot courses at both UNM and CNM during Summer and Fall 2012.
- A wider implementation followed in Spring 2013 at UNM. The class sizes between the pilots varied minimally.
- Our poster will share our experiences teaching at UNM and CNM and hopefully provide insight into how these methods can be implemented in other classes.



This teaching method emphasized:

- Pre-class preparation
- ✓ Students read course learning outcomes, textbook and finish reading quizzes. This helps them understand what is important and they have already understood. Muddy points collect student feedback about what are more difficult topics on which will most class time be committed.
- In-class participation
- \checkmark In-class exercises and group discussions provide students opportunities to work on their problem solving skills and analytical skills. Upon completion of these activities, i-clicker questions are used to evaluate the quality of student learning. The instantaneously generated stats help decide proper class pace.
- After-class practice
- ✓ Students are encouraged to reorganize their notes and review class material in a timely manner. Online *MasteringChemistry* homework solidifies what they have learned in class and also serves as a self assessment tool.

More information on the specific implementation of these strategies is provided in the companion poster by Ho and Knottenbelt: Active Learning in General Chemistry: The Mechanics of a Gateway Course Redesign.

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Minute Papers, Free-Writing, Portfolios, Journals Synthesis of main ideas About the Subject and/or

DIFFERENCES IN CLASS FORMAT

FACE-TO-FACE (UNM)

- Three 50-minute class meetings per week
- Online resources such as WebCT and *MasteringChemistry* have been used along with some handouts
- Teaching team includes the instructor, teaching assistant and PLFs
- Requires student preparation before and after class
- Four hour-exams and a final exam are given in class

FACE-TO-FACE (CNM)

- Two 75-minute class meetings per week
- Extensive resources on Bb Learn (including streaming video lectures via Mediasite)
- Requires preparation before and after class (although less so than in the Hybrid)
- Five 75-minute exams and the ACS General Chemistry II Final given in class

HYBRID (CNM)

- 50% in class (1 75-minute class meeting per week) and the rest online in Bb Learn
- Extensive resources on Bb Learn (including streaming video lectures via Mediasite)
- Requires extensive preparation before and after class
- Exams (same as face-to-face) given in a Testing Center on Main Campus over a period of several days

SUCCESSES AND CHALLENGES

SUCCESSES (CNM)

- peers.
- the use of muddy points).
- class (through clickers), students attend class more regularly and build better relationships with their peers, resulting in larger numbers of study groups.

CHALLENGES WITH BOTH TYPES OF CLASSES (CNM)

- Room constraints The main lecture room is not set up for group work. While individual desks can be moved, sharing and collaborative space is minimal.
- used Mastering Chemistry (the online homework program) and clickers.
- While the students mainly bought into the active learning process the first day of format with which they were accustomed). As the semester progressed, more students found they enjoyed and thrived in the new format.

ADDED CHALLENGES WITH HYBRID CLASS (CNM)

- added applications that REALLY tested their knowledge.
- as the "fun stuff").

• Student performance on the current class material showed significant improvement. • Students appreciate the activity in class and the ability to relate more easily to their

Students also appreciated the focus on what they did not understand most (through)

• Because they are working with their peers and because assessment occurs every

• Expenses – While the students bought their books the previous semester, not all had class, many students initially felt that they would rather have lecture (as that was the

• Since the hybrid meets once a week, we were unable to get to the "fun stuff" – the

• To get through the material the students needed to know how to perform, we used exclusively clickers (which were also applications but were not as case study oriented

• While an unprepared student found themselves slightly behind in the face to face class, recovery was achievable. The unprepared student in the hybrid class found themselves extremely behind extremely quickly with minimal ability to fully recover.

SUCCESSES (UNM)

- class activities and assignments.
- major paradigm shift.

CHALLENGES (UNM)

- time teaching".

SUCCESSES AND CHALLENGES

• Students are given opportunities to learn new knowledge and apply it to solve problems. They are able to gain deeper understanding of basic concepts. • Students show improved critical thinking skills and are able to solve problems under different context and with more complexity.

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• Students are more willing to attend class due to many interactions between the teaching team and the students as well as amongst themselves.

• Students are more motivated to take ownership of their education inside and outside classroom as indicated by their active participation of pre-, in-, and after-

• Student concerns and feedback, expressed in muddy points, are quickly

addressed in class, which in turn help instructor focus on their difficult topics. • Feedback from both the students and instructors are very positive when the new course structure was evaluated but the learner centered classroom requires a

• Instructors concern about time pressure to cover important topics proved not an issue with the help of instantaneous feedback of i-clicker. This helps use class time more effectively and decide a proper pace of class.

• Student performance has seen significant improvement comparing to sections in the past taught by the same instructor and sections taught by traditional lecture.

 Course materials have to be prepared to complement different learning activities which in turn requires more time commitment for the instructors and experiences in effective classroom management.

• For big class sizes, a learning team, including the instructor, teaching assistants and PLFs, is needed to make sure every student in need get due attention.

• Active learning requires instructors pay much attention to student feedback, This means modifications to teaching materials as reflected by covering certain

material. Teaching preparation immediately before class is required for "just-in-

• This active learning environment seems to help most for B or C students but not much for A or failing students. There are always a few disinterested students.

RECOMMENDATIONS

• Instructors should clearly explain the course structure and help the students to get started with each course component by concrete examples.

• Instructors should introduce the purpose and expectation for each course

component and relate them to course learning outcomes as a concerted effort to obtain "buy-in" from the students.

 Course learning outcomes should precisely describe what students are going to learn and be reflected in all activities and assignments.

• Course assessment should be closely tied to course learning outcomes.

• It is important to have a well organized class structure with a significant amount of course material and a supportive network of faculty.

• Mentorship opportunities with more experienced faculty are a critical element for the success of student learning.

• The implementation of the active learning strategies is not particularly difficult when the above recommendations are considered..