

Improving Student Outcomes in Organic Chemistry through Action Research

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Spring 2010: Initial Impressions

Where I was Coming from

Background in Organic Chemistry and Science Education

New to Urban University (UB)

Had been teaching chemistry at a small, private college for 20 years

Organic failure/withdrawal rate at previous institution was 1-2%

Organic Chemistry at UB

Failure/withdrawal rate was > 50%

Department & administration were highly concerned

My New Role

Hired as Lecturer of Organic Chemistry

Had not previously taught Organic chemistry lecture

Spring 2010: Initial Impressions

Student Population

Students generally appeared serious, hard working

Many were immigrants/English language learners

Many held jobs, family responsibilities, long commutes

Many were first generation in family to attend college

The Situation in Organic Chemistry I

Students struggling to pass

Students generally seemed demoralized & fearful

Attempts to Help Students Improve

Held extra, weekly problem sessions

Met with students to review 1st midterm (29 out of 44)

Spring 2010: Initial Impressions

My Discoveries

Some students really changed their behaviors

- adjusted study habits
- began attending extra problem sessions

Most of students improved & ultimately passed

Preliminary Conclusions

Students who:

- sought help &
- were successful in getting help

improved & succeeded

Students who:

- were uncomfortable seeking or receiving help
- did not succeed at the same rates

Summer 2010: Planning for Change

Assigned to teach Organic I lecture for the Fall (~ 220 students)

Goals

- Create an atmosphere that encourages student help seeking
- Implement practices that encourage help seeking including: extra problem sessions, extended/communal office hrs, skype office hrs, post midterm meetings
- Find ways to better inform students of resources for help through: syllabus, website, in class announcements, emails, flyers/calendars

Fall 2010: Implementing Change & Studying Its Impact

Data Collection

Administered online mid-semester survey related to:

- help seeking behavior (office hours, problem sessions, etc.)
- midterm grades

Kept an electronic journal chronicling:

meetings, conversations, and interactions with students

Fall 2010: Implementing Change & Studying Its Impact

Survey Results

- Response rate to survey was 58%
- Students with a broad range of abilities were represented
- Attendance at Problem Sessions + Office Hours together explained **11%** of variance in reported midterm performance, $p < 0.001$
 - Perceived Need for Help explained **5%**, $p < 0.05$
 - Study Time not a significant predictor of midterm performance

Note

We were unable to control for prior chemistry performance, but the simple correlation between Gen Chem II grade and Organic I final grade was very strong ($r = 0.70$, $p < 0.001$)

Fall 2010: Implementing Change & Studying Its Impact

Barriers to Help Seeking: Survey Results

Students indicated that logistics often interfered with getting help

70% of respondents indicated a full course schedule

61% of respondents indicated family responsibilities

46% of respondents indicated job/professional responsibilities

Electronic Journal Data:

Certain students seemed more comfortable seeking help

some seemed more empowered or more entitled

others seemed ashamed, embarrassed or afraid

January 2011: Planning for Spring 2011

Strategies to Increase Participation in Help Seeking

Shorten length of problem sessions, but double their frequency

Change the time slots of problem sessions (utilize club hours)

Retain office hour time slots



Spring 2011: Increasing Participation

Data Collection

Administered mid-semester survey related to:

- help seeking behavior (office hours, problem sessions, etc.)
- midterm grades
- General Chemistry II grades

Collected my own data related to:

- student attendance at office hours & problem sessions
- General Chemistry II grades

Spring 2011: Increasing Participation

Survey Results (First Half of Semester):

- Response rate to survey was 45%
- Problem Sessions explained 7% of variance in reported midterm performance, $p < 0.05$
General Chemistry II grade explained 26% of variance, $p < 0.001$
- If A+/A (General Chemistry II) students were excluded:
Problem Sessions explained 15% of variance in reported midterm performance, $p < 0.05$
General Chemistry II grade was not a significant predictor

Spring 2011: Increasing Participation

Attendance Results (Entire Semester):

- Problem Sessions + Office Hours together explained **9%** of the variance in course grade performance, $p < 0.001$
General Chemistry II grade explained **38%** of the variance, $p < 0.001$
- If A+/A (General Chemistry II) students were excluded:
Problem Sessions + Office Hours explained **18%** of the variance in course performance, $p < 0.001$
General Chemistry II grade explained **11%**, $p < 0.01$

Spring 2012: Corroborating our Findings

Survey Results (First Half of Semester):

- Response rate to survey was 44%
- Problem Sessions explained **16%** of the variance in reported midterm performance, $p < 0.05$
General Chemistry II grade explained 11%, $p < 0.05$
- If A+/A (General Chemistry II) students were excluded:
Problem Sessions explained **18%** of the variance in reported midterm performance, $p < 0.01$
General Chemistry II grade explained **12%** of variance, $p < 0.05$

Attendance Results (Entire Semester):

In progress

Conclusions & Significance

Student Performance in Organic Chemistry at UB

- Academic help seeking does impact student performance
- Help seeking does not just benefit the stronger students

Student Performance in Gatekeeping Science Courses in General

Encouraging help seeking directly benefits student outcomes:

- This is about making resources available & getting the word out
- It is also about attitude, tone of voice, and going the extra mile

Many first generation college students need training and guidance in:

- developing better study skills
- becoming more successful Self Regulated Learners (SRL)
- learning how to study “smarter” not merely how to study “longer”

With proper training in SRL, students can overcome weaker academic backgrounds and be successful in gatekeeping science courses.

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