

Do Action Research-Informed Reforms Increase Undergraduate Retention in Gateway Science Courses?

Abstract

Action research is research used as the basis and motivation for reform. Basing consultations on action research can be an effective strategy for teaching centers to improve teaching and learning and inform institutional change (Cook et al. 2007).

Nationally, approximately 40% of undergraduates intending to major in the sciences ultimately decide to major in something else (Astin & Astin 1993, NSF 2003, Seymour & Hewitt 1997, Strenta et al. 1994). This poster describes: (1) an action research project regarding the factors influencing undergraduate retention and attrition in the sciences in two gateway science courses at a large Midwestern university; (2) recommendations for course reforms generated from the data and implemented by the department chair; and (3) an evaluation of the impacts of these changes on retention and attrition.

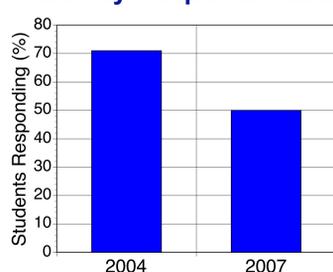
Data Collection

At the end of their gateway course, what are the major factors influencing students' decisions to stay in (retention) or leave (attrition) the sciences?

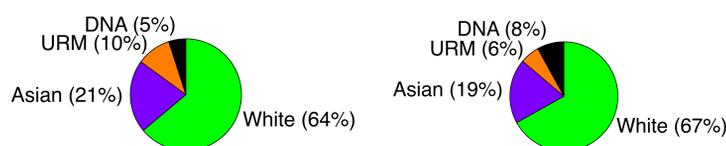
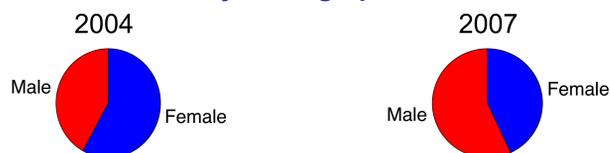
Two Online Surveys, January 2004 and 2007:

- Recipients: all undergraduates enrolled in 2 gateway science courses during Fall Terms 2003 and 2006
- Survey questions asked students to self-report:
 - Plans to major in the sciences before and after the semester
 - Which factors influenced their interest in the sciences
 - Whether their TA increased or decreased their interest in a science career or major, and why

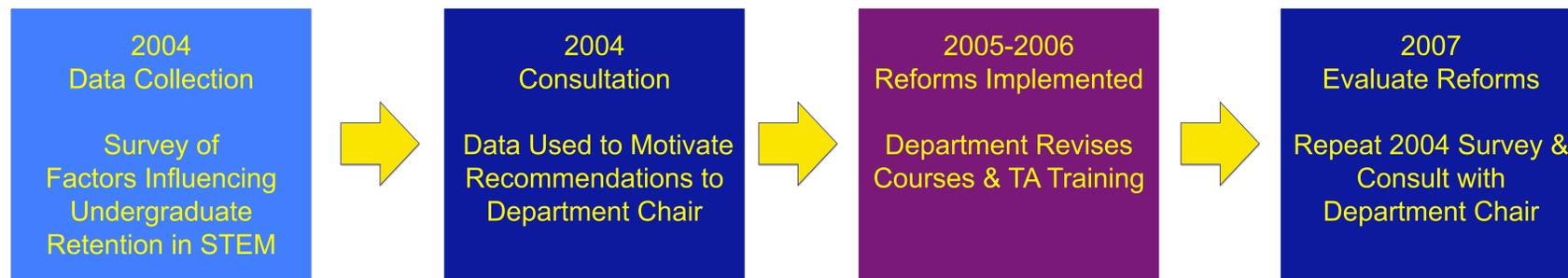
Survey Response Rates



Survey Demographics

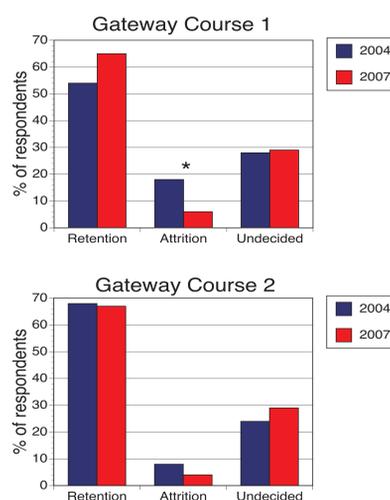


Action Research Timeline



Data Used to Motivate Consultations & Evaluate Reforms

Retention Data



Factors Influencing Retention and Attrition (Based on Quantitative & Qualitative Analysis of Survey Data)

| Factor | Retention | | Attrition | |
|------------------------|-----------|------|-----------|------|
| | 2004 | 2007 | 2004 | 2007 |
| Professor | | ✓* | | |
| TA | | | | |
| Lecture climate | | | | |
| Lab climate | ✓* | ✓ | ✓* | ✓ |
| Course grade | ✓† | ✓ | | ✓ |
| Math Grade | ✓* | ✓ | | ✓* |
| Learning about careers | ✓† | ✓* | | |

* Significant at the $p < 0.05$ level in logistic regressions of the above factors on retention or attrition
† Significant at the $p < 0.10$ level in logistic regressions of the above factors on retention or attrition

Instructional Practices Associated With Retention (Qualitative Data):

- Grading:**
- Implemented clear, objective grading policies
 - Provided frequent verbal and written feedback
- Learning About Careers:**
- Used "real world" examples
 - Explained applications of concepts
 - Highlighted career options
- Classroom Climate:**
- Demonstrated commitment to student learning
 - Modeled professional behavior
 - Treated students with respect
 - Show enthusiasm for the subject & teaching
- Presentation Skills:**
- Clarity of explanations
 - Ability to solve problems
 - Ability to answer questions

Reforms Implemented

Teaching Assignments and Instructor Collaboration:

- Increased the number of faculty teaching lab sections
- Increased scheduled communication between faculty and TAs
- Created Wiki to document effective teaching strategies for labs

Curriculum Reform:

- Replaced or refurbished outdated lab equipment
- Revised lab modules & lab report requirements
- Implemented more objective grading rubrics

TA Training and Monitoring:

- Graduate Student Mentors (experienced TAs) hired and trained to mentor/train TAs
- 4-day departmental training with additional sessions during term, sessions include:
 - Grading
 - Professionalism and ethics
 - Effective presentation skills
 - Inclusive teaching and classroom climate
 - Practice teaching (microteaching)
- Formative early evaluation and mentorship of TAs by Graduate Student Mentors using:
 - Midterm student evaluations
 - Classroom observations

Conclusions

- TAs did not directly impact retention or attrition, but may have substantial influence over other factors affecting retention and attrition.
- Focused action research allows departments to target funds and resources on factors (e.g., TA training) most likely to positively influence student retention.
- Anecdotally, our data suggests that interventions are most effective earlier in the course sequence (e.g., Gateway Course 1), but more research is needed.

Best Practices for Action Research (Cook et al. 2007)

- Focus research on issues central to a teaching center's mission
- Focus research on questions relevant to both national issues and local problems
- Obtain buy-in of both administrators and faculty stakeholders
- Communicate results in a way that generates support for improvements without alienating stakeholders who will implement reforms
- Enhance credibility for recommended reforms by modifying any of the teaching center's relevant programs or practices
- Stay involved in the change process after the research is complete to facilitate, guide and evaluate reforms