Transforming an Atmospheric Science Curriculum to Meet Students’ Needs

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Heads and Chairs Meeting
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Impetus for Change

- 2008 State funding reductions eliminated all $ for TAs and non-tenure track lecturers from our budget.
- UofU funding model rewards departments for increasing SCH and penalizes them for decreasing SCH.
- Eliminating courses was not an option
  - All upper-division courses were required for the major
  - Eliminating lower-division GE courses would result in deeper budget cuts due to loss of SCH and would necessitate faculty furloughs
The Dilemma

The easiest solution to this problem would be to increase the teaching loads for all of the regular faculty and leave the curriculum intact. However, this would be counterproductive for the long-term health of the department which has grown dependent on the research productivity of its faculty.
The Response

Although the impetus for change was external, the faculty and students embraced the opportunity to reevaluate the curriculum from top to bottom.

A retreat was held in June 2008 so that faculty and students could brainstorm ideas for transforming the curriculum.
Retreat Goals

Brainstorm ways to meet the following goals while maintaining the GS-1340 Federal requirements for employment as a meteorologist.

1) Increase curriculum flexibility for students and faculty
2) Teach courses more efficiently to maintain existing teaching loads and SCH
3) Increase active learning opportunities throughout the program
4) Make courses more appealing to students from outside the department
## Curriculum Change Timeline

<table>
<thead>
<tr>
<th>Summer 2008</th>
<th>Fall 2008</th>
<th>Spring 2009</th>
<th>Fall 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty/Student Retreat</td>
<td>Create Rough Draft of New Curriculum</td>
<td>Revise Curriculum Rough Draft</td>
<td>Curriculum Changes Approved by Faculty, Students, College Curriculum Committee, Dean, and Undergraduate Council</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Fall 2010</th>
<th>Fall 2011</th>
<th>Fall 2012</th>
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<tbody>
<tr>
<td>New Curriculum Implemented</td>
<td>Curriculum Change Evaluation Performed by Impartial 3rd Party*.</td>
<td>BAMS-D-12-00115 Manuscript Accepted for Publication</td>
</tr>
</tbody>
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*Included separate, anonymous interviews of faculty, TAs, undergraduate students, and graduate students
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Increased Flexibility for Students

• Rigid course progression was eliminated by shifting emphasis from required courses to elective courses
• Increased overall number of courses available to undergraduate students by:
  – Splitting some existing courses into multiple ½ semester courses
  – Instituting joint courses with grads & undergrads in the first ½ of the semester and grads only in the last ½ of the semester
  – Creating new ½ semester courses
Increased Flexibility for Faculty

• Elective courses are just that and can be cancelled/rescheduled for sabbaticals, field experiments, or low enrollment

• Joint grad/undergrad courses can easily be team taught
  – One instructor for the first ½ of the semester (grads & undergrads)
  – Another instructor for last ½ of the semester (grads only)
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Teaching Courses More Efficiently

• Some courses were switched to a two-year cycle which automatically increases SCH each time it is taught.

• Instituted a policy to cancel low enrollment elective courses

• Increased overall course offerings for both grads and undergrads
  – Increased efficiency allowed faculty to teach grad-only elective courses that had been dormant
  – Undergrads were given access to the first \( \frac{1}{2} \) of some previously grad-only courses
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Increased Active Learning Opportunities
(Departmental Changes)

• Created a central instrumentation teaching laboratory which can be used by all faculty

• Instituted a Capstone Experience requirement composed of:
  – An undergraduate research project, or
  – An appropriate internship, or
  – A project completed in one of the senior-level courses

• Faculty buy-in has led to fruitful exchanges of ideas/discussions
Increased Active Learning Opportunities (Institutional Support)

- Undergraduate Research Opportunities Program
  - University pays students $1200 to perform research with a faculty mentor
  - Students must present results at a campus-wide symposium

- No overhead on undergraduate student wages

- Undergraduate Research Scholar Designation
  - A student completes two semesters of research with a faculty mentor
  - Student presents results at a campus-wide symposium, national conference on undergraduate research, or professional conference
  - Student receives recognition of the URSD on their transcript
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Broadening ATMOS Course Interest

- All course prerequisite requirements were reviewed and reduced to the minimum levels necessary for student success.
- New GE designations were added to lower-division courses where appropriate.
- Meteorological instrumentation course was transformed into an environmental instrumentation course with multiple, out-of-department, co-instructors.
- The applied math and statistics course was transformed into an environmental statistics course applicable to many majors.
Broadening ATMOS Course Interest

- Created an upper-division climate course with no ATMOS prerequisites
- Aggressively pursued cross-listing of courses with other departments
- Assigned best instructors to lower-division GE courses to increase student interest in the subject matter
- Advertised ATMOS minor across campus
Evaluation of Curriculum Changes

- Hired an impartial third-party researcher with expertise in education, instructional design, and qualitative research methodologies to conduct:
  - Individual faculty interviews
  - Teaching assistant interviews
  - Undergraduate student focus group interviews
  - Graduate student focus group interviews
Four Themes Emerged

- Learning
- Teaching Strategies and Challenges
- Program/Course Logistics
- Relationship Building
Learning Theme

How was Student Learning Impacted by the Curriculum Changes?

- 47% of all comments focused on this theme
- Faculty and students were equally concerned (Faculty = 44%, Students = 56%)
- Comments focused primarily on
  - Student perceptions of change
  - Format issues
  - Content issues
  - Learning level differences
Teaching Strategies and Challenges

How Can the New Curriculum Changes Best be Implemented?

• 24% of all comments focused on this theme
• Faculty were much more concerned than students (Faculty = 67%, Students = 33%)
• Comments focused primarily on
  – Trying multiple pedagogical techniques
  – Challenges of adapting to new curriculum
Program/Course Logistics Theme

What Barriers Exist for the Effective Implementation of the Curriculum Changes?

• 17% of all comments focused on this theme
• Faculty were much more concerned than students (Faculty = 68%, Students = 32%)
• Comments focused primarily on
  – Short teaching/learning time in ½ semester courses
  – Importance of timely and accurate student advising
  – Scheduling challenges
  – Recognition that changes in teaching strategies are necessary
Relationship Building Theme

How Have the Curriculum Changes Impacted the Classroom Learning Environment?

• 12% of all comments focused on this theme

• Students were much more concerned than faculty (Faculty = 21%, Students = 79%)

• Comments focused primarily on
  – Lack of interaction between grads and undergrads in joint courses
  – Unequal relationships with faculty between grads and undergrads
  – Undergrads unwilling to ask questions
  – Unequal workload distribution throughout semester for grads
Conclusions

Were the curriculum changes worth the effort to implement?

The majority view from faculty and students is that they were.

Students were very enthusiastic about the increased flexibility and the additional course offerings.

Faculty were enthusiastic about improving the overall student experience without increasing teaching loads.
Conclusions

What was the most surprising finding?

The vastly different perspectives of students and faculty regarding the importance of the classroom learning environment.

Faculty tend to be preoccupied with the logistics of a course while students experience a course on an emotional level.
Conclusions

What were the most significant barriers to the successful implementation of the curriculum changes?

- Increased need for individualized student advising
- Requires very effective time-management by faculty and students
- Need to develop new classroom management strategies to fully engage all students in mixed grad/undergrad courses
Acknowledgements

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