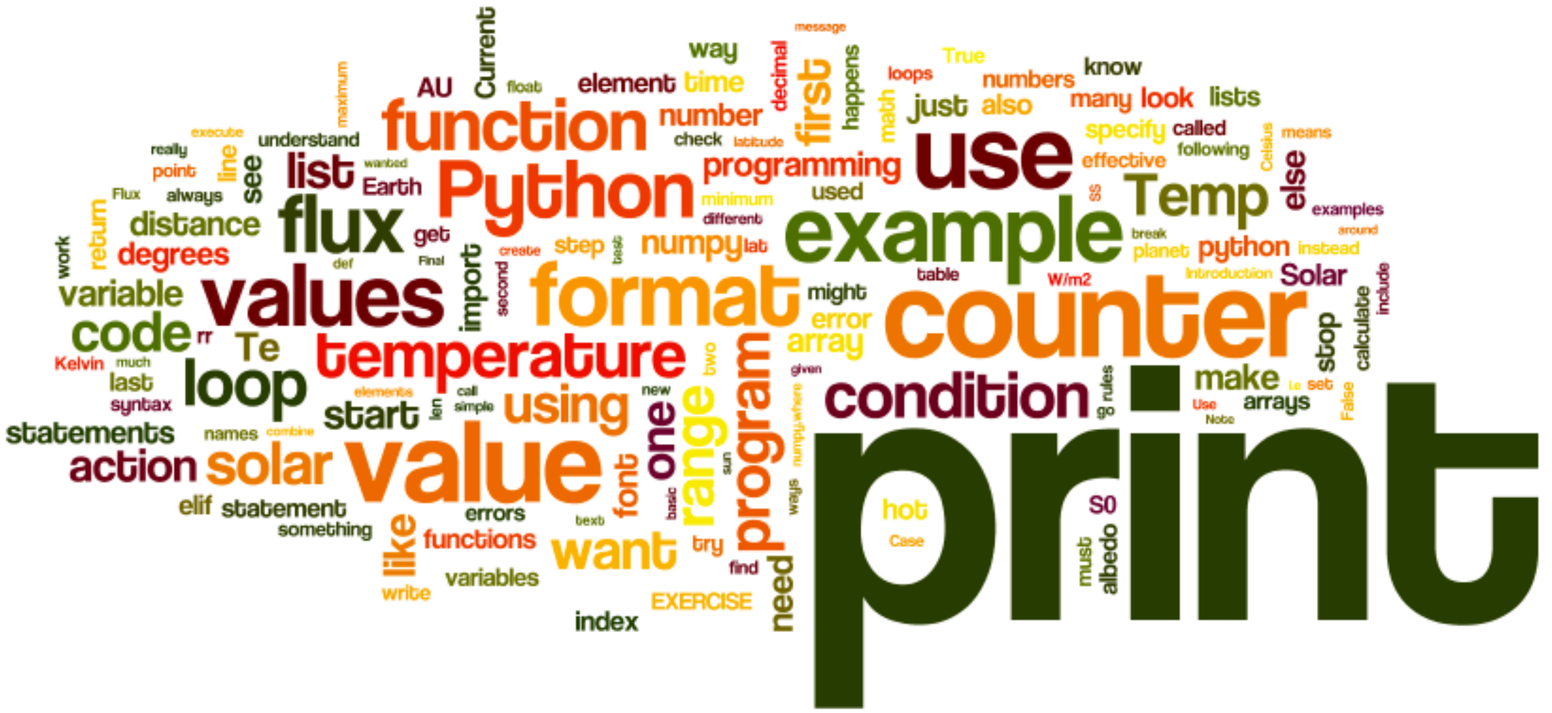
Computing and Modelling in 1st-Year Earth & Environmental Science



Jenny A. Fisher
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The Problem

Computing and programming skills are necessary for all scientists.

- large datasets
- 2D/3D visualisations
- numerical models
- complex statistics
- and more...

Traditional geoscience curricula do not teach these skills.

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Our Solution

Programming & modelling using Python now central to 1st year core curriculum in University of Wollongong School of Earth & Environmental Sciences

Embedded in practicals for *Earth's Interconnected Spheres:*

- **1 of 4 compulsory core subjects for all majors**
- **100-120 students**
- **no mathematics prerequisites and no assumed prior programming experience**

Why Python?

- **free, easy to install, and widely used**
- **easy to learn "natural" syntax (`print "Hello"`)**
- **simple but ultimately powerful, including geoscience integration (e.g. ArcGIS)**

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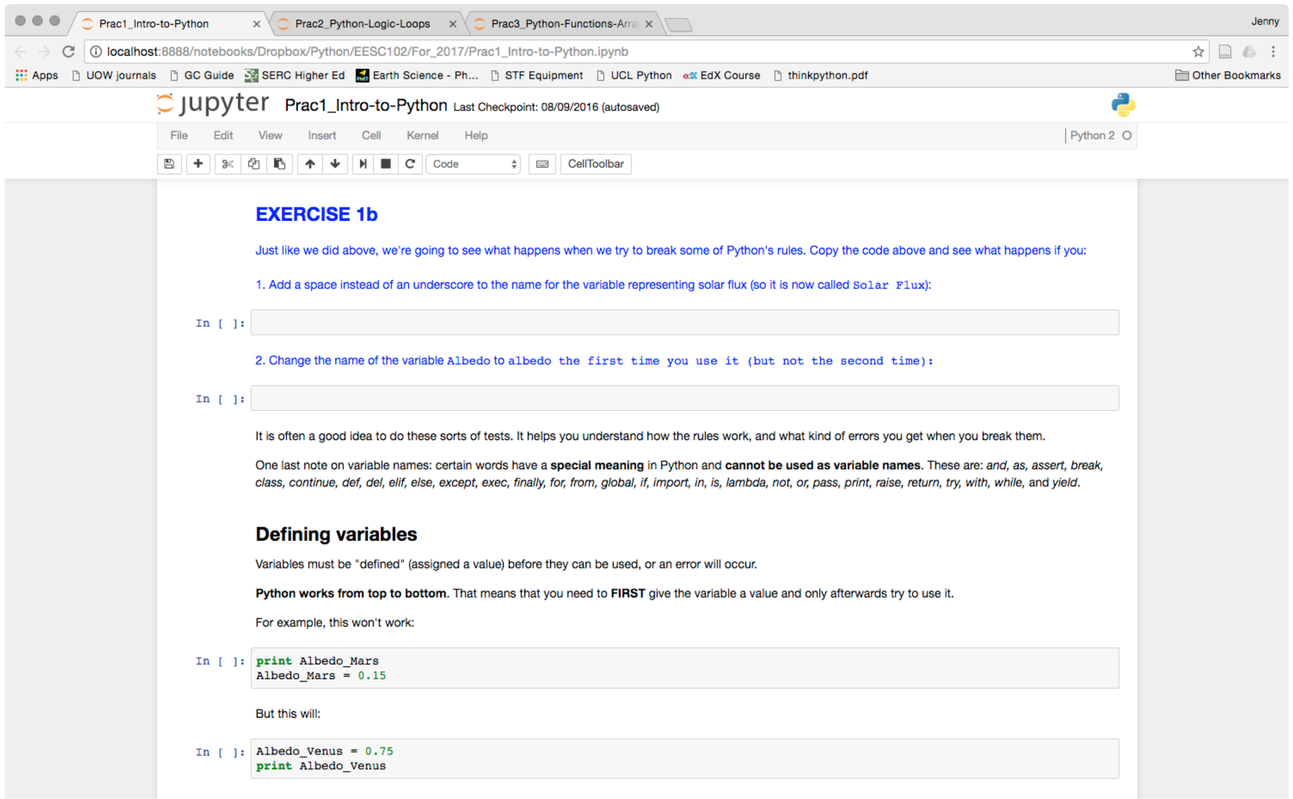
Implementation

Exercises in *Jupyter Notebook:*



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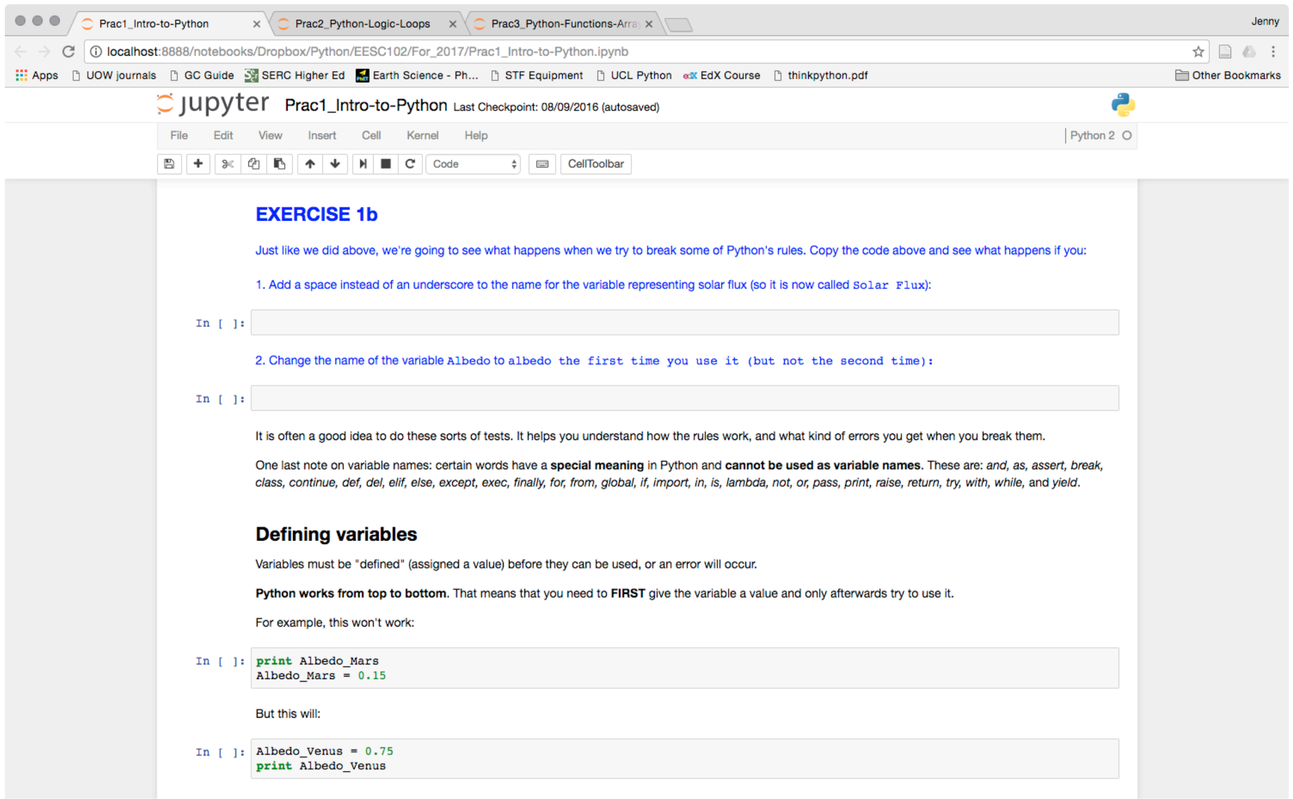

Weeks 1-4: computing fundamentals
5-8: simple box models
9-12: group projects

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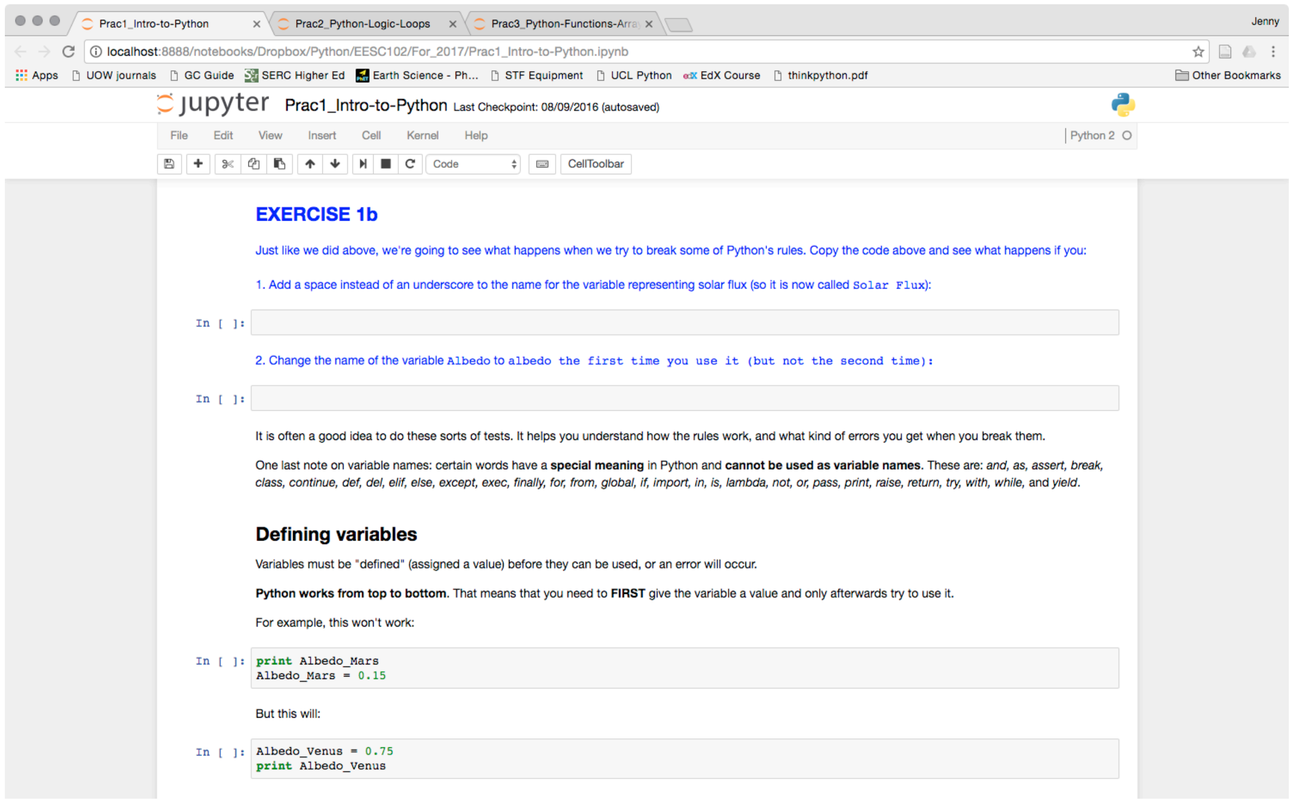

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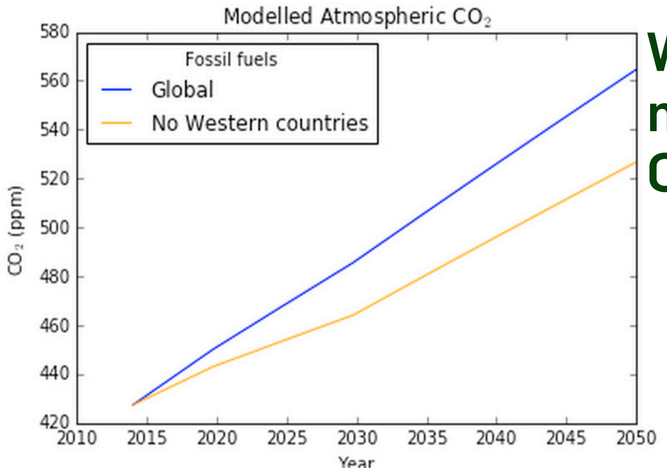
Examples:



Which countries most affect global CO_2 concentration?

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Implementation

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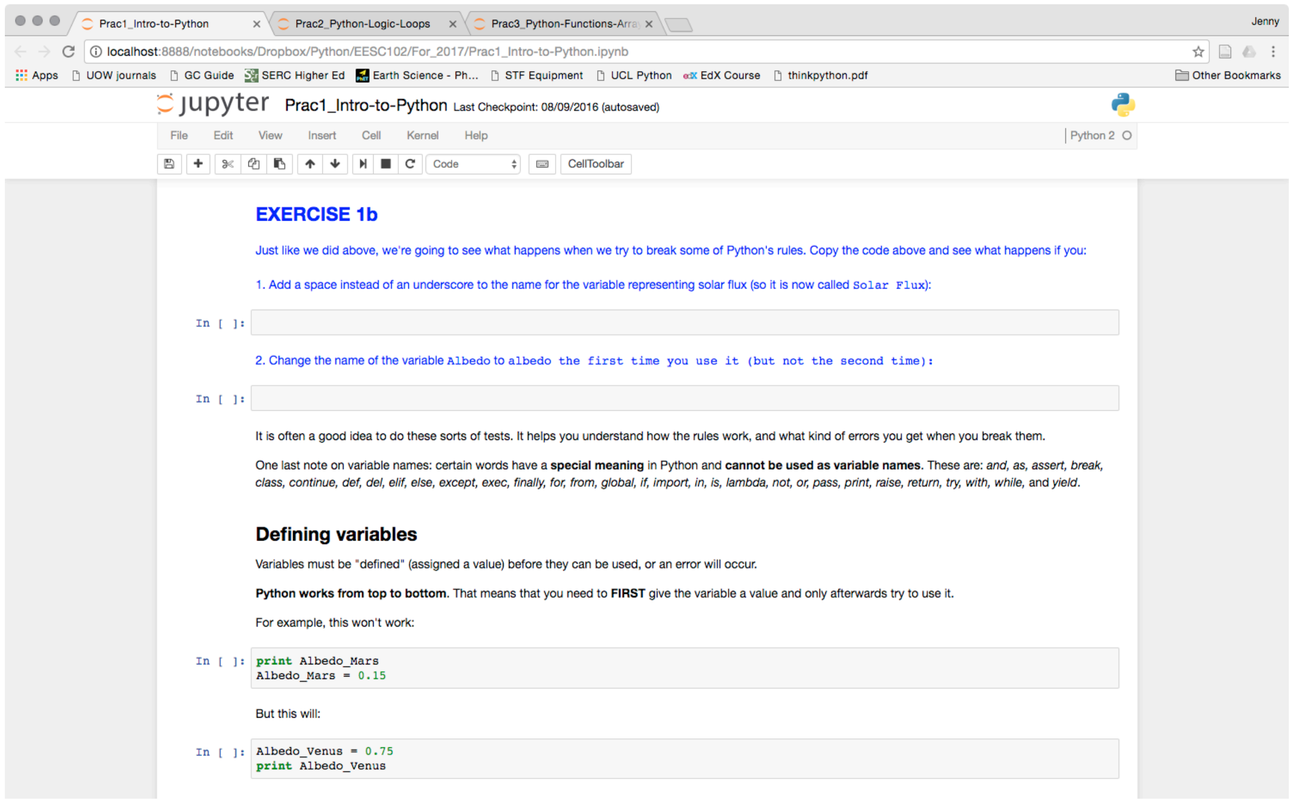

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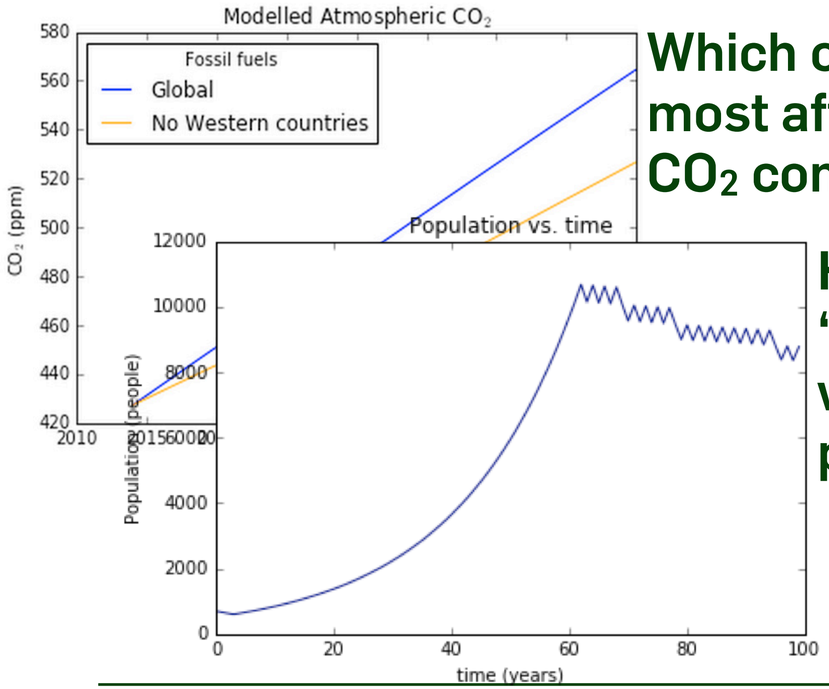

Which countries most affect global CO_2 concentration?

How might "resource wars" affect population?

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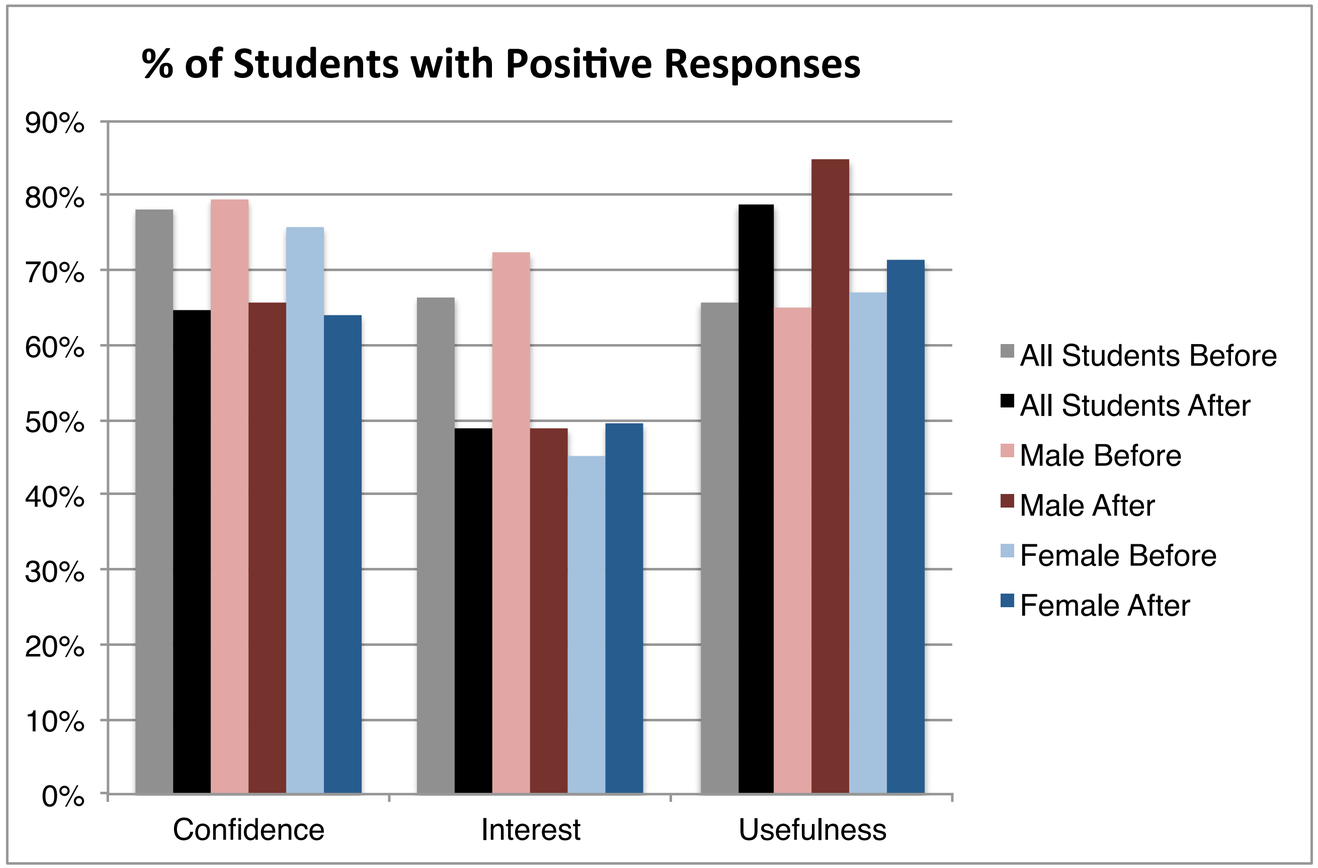
Impacts

Pre- and post-surveys of CONFIDENCE, INTEREST, & USEFULNESS showed mixed results:



Confidence ↓ for all students

Interest ↓ for men but ↑ for women

Usefulness ↑ for all students

Positive comments increased with time

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Lessons Learned

1. **Students DO develop proficiency but find process uncomfortable**
2. **Need incentives to come prepared (pre-lab readings & quizzes)**
3. **Need "stop-and-think" goalposts (modifications to existing exercises)**
4. **Need early & frequent positive feedback (alums as student mentors)**
5. **Need ongoing practice with new skills (continue in 2nd year curriculum)**

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