Increasing the Scientific Literacy of Introductory Atmospheric Science Students: Course Redesign and Assessment

Dawn Kopacz[1] and Zachary Handlos[2]
[1]Department of Earth and Atmospheric Sciences - University of Nebraska – Lincoln
[2]School of Earth and Atmospheric Sciences – Georgia Institute of Technology

Motivation

- The development of scientific literacy, or the ability to apply scientific knowledge to real-world scenarios, has been recognized as fundamental to an undergraduate science education (1,3).
- Many general education courses stress content mastery (1,3), leaving minimal time for improving scientific process skills.
- Research has shown that active and repeated recall promotes meaningful, long-term learning (4).

Methods

- Reduced total course content covered during two semester-long general education introductory atmospheric science courses at two large U.S. universities (N = 72 and N = 17).
- Course designed using general education rubric and Atmospheric Science Literacy Framework (4). The following content and scientific skill areas were emphasized:

Content Area	Skill Type
Basic properties	Use scientific knowledge
Energy	Pose Questions
Moisture	Make predictions
Stability	Interpret data
Forces of motion	Evaluate Conclusions
Climate	

- Course redesign allowed for more time to apply course concepts and practice skills. This was accomplished through in-class active learning strategies (peer instruction, case studies, etc.) as well as out-of-class assignments.
- A scientific literacy assessment tool was created using a general education rubric as a guide. Student scientific literacy (i.e., content areas and skill types) was assessed using a pre-post-test.

Research Questions

Does reducing the total number of course topics within an introductory atmospheric science course improve:

1. Atmospheric science literacy
2. Science process skills
3. Confidence in understanding course material

Demographics

- Approximately 25% (100%) of UNL (GT) students took a previous science course, and 8% (70%) took a concurrent science course

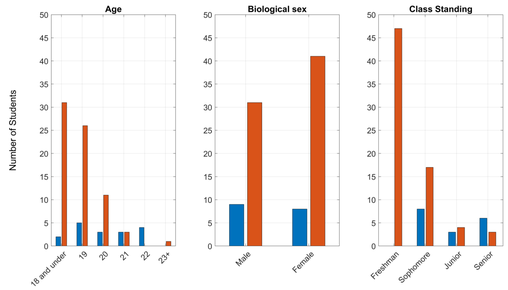

Fig. 1: Participant demographics from each University assessed.

Results

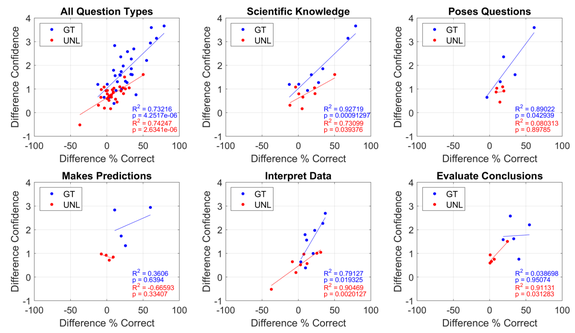

Fig. 2: Difference in percent of students answering each pre-post-test question correctly (abscissa) versus difference in pre-post-test confidence scores (ordinate) for all question types (top-left) and each of the five skill types. UNL (GT) data is shown in red (blue), with linear regression curves (solid lines) and correlation coefficient values shown. "Difference" refers to the average post-test value minus average pre-test value.

Results (cont'd)

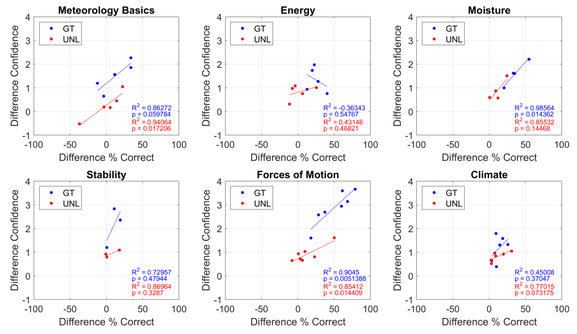

Fig. 3: Same as Fig. 2 but categorized by content type.

Conclusions

- Most categories show an increase in content knowledge and skill with increased confidence
- Skill and content areas that don't exhibit increase were identified as least emphasized during semester
- More test questions and additional studies needed to increase robustness of results
- Further developing scientific literacy assessment tool; proven valuable for identifying areas for improved teaching and learning

References

(1) de Caprariis 1997, *J of Geoscience Ed*: **45**: 207

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(4) UCAR 2007, Atm Sci Literacy Framework, https://scied.ucar.edu/sites/default/files/images/long-content-page/atmosphere_literacy_brochure.pdf

Contact info

Dawn Kopacz
Email: dkopacz2@unl.edu
Phone: (402) – 472 – 2638

Zachary Handlos
Email: zachary.handlos@eas.gatech.edu
Phone: (404) – 894 – 3991

Website:
https://unl.libguides.com/ASER

This research has been approved by the Institutional Review Board (IRB) at the University of Nebraska – Lincoln (IRB 20180918669) and the Georgia Institute of Technology (IRB H18311)