

Intellectual Humility: Mindsets and Behaviors of Introductory Physics Students

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Motivation

Students often enter the physics classroom with intuitive conceptions drawn from real life experiences or former coursework, and they may be hesitant or reluctant to forego these mindsets in favor of formally instructed knowledge. The scientific process requires one to be open-minded in terms of hearing evidence that contradicts his or her personal opinion, to be willing to discard any original misconceptions in the face of such alternative evidence, and to identify and pay appropriate attention to one's academic limitations during academic conversations. Such a mindset is indicative of the quality of Intellectual Humility (IH)¹, and entails not only a willingness to revisit misconceptions about the course content, but also being open to learning in different classroom environments.



Fig 1. Traditional course's lecture setting – a large, stadium-style classroom with focus on the instructor (Credits/Jason Hancock)

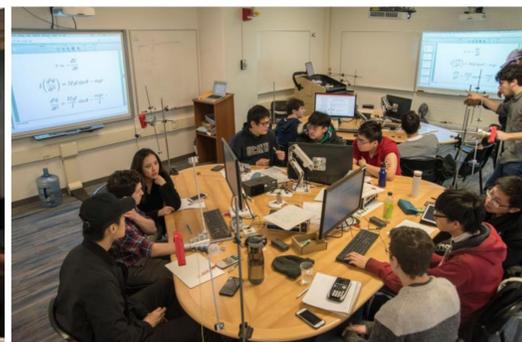


Fig 2. Interactive course's setting – triangular tables with shared computer screens (Credits/Garrett Spahn '18 /UConn Photo)

Study Purpose

The purpose of this study is to investigate: **What are the mindsets and in-class behaviors of introductory physics students?** through the lens of IH. Specifically, the research questions that guided the study are:

1. How do students' self-reports about their IH, under a limitations-owning perspective, compare for students enrolled in a traditional course format and those enrolled in an interactive course format?
2. How do students discuss and reflect on their learning experiences in either an interactive or traditional introductory electricity and magnetism course, through the lens of IH?

Study Design

To address the research questions, we used a mixed methods approach that relied primarily on qualitative data.

Sample size: Traditional, $N=30$; and Interactive, $N=24$

Data Collected:

- Observations of traditional and interactive classroom formats
- Pre- and post-surveys in both courses that measure 3 dimensions of IH²
- Student reflections at several points in the semester

Data Analysis:

- Quantitative: Standard statistical tests
- Qualitative: Inductive/thematic analysis³

Results: Self-Reported IH

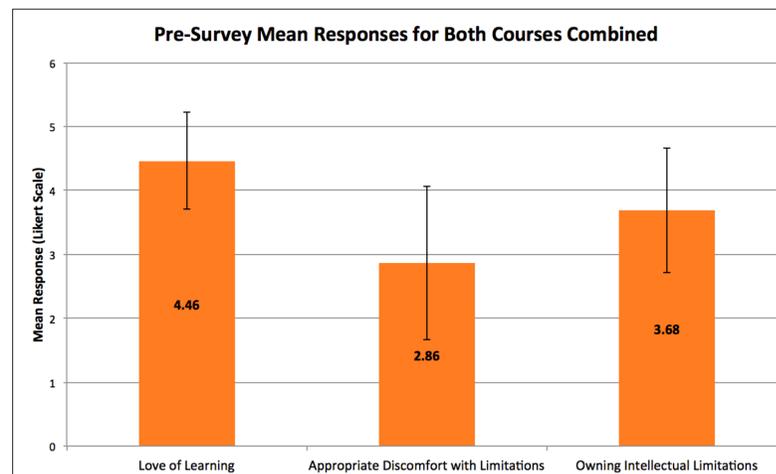


Fig 3. Mean pre-survey responses for all students, by IH dimension

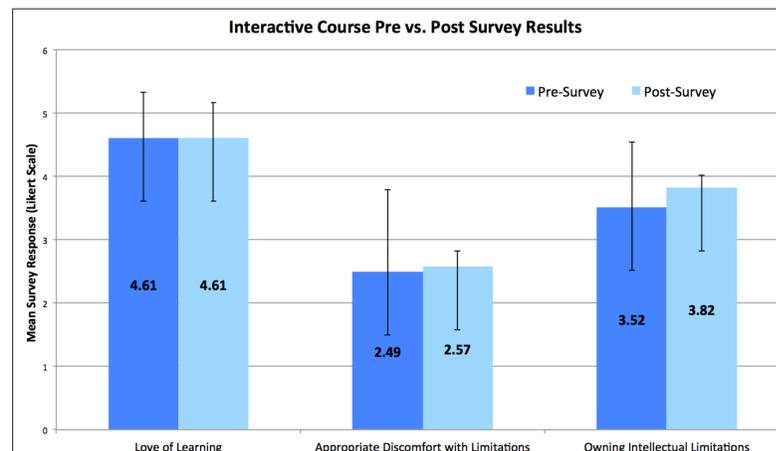


Fig 4. Mean pre- and post-survey responses for interactive course

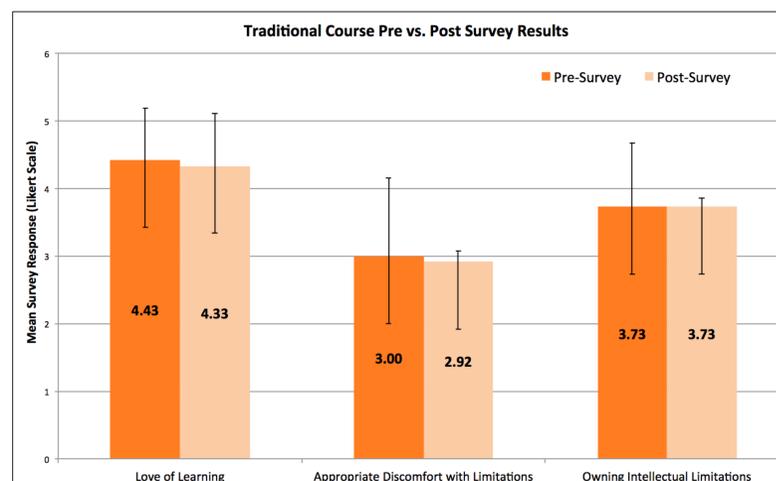


Fig 5. Mean pre- and post-survey responses for traditional course

Results: Reflections on Learning Experiences

The results of the qualitative analyses resulted in 27 codes related to RQ 2 that were further grouped together into 3 overarching categories: Mindset, In-class Behavior, and Course Component. See the table below for example codes and student excerpts.

Code	In the students' words...
Clarification Of Concepts	"Lab manual helps clarify concepts learned in lecture, as well as teach students how to properly apply said concepts when analyzing experimental data."
Correct Mistake	"The homework set up makes it extremely difficult to learn because it usually does not help you whatsoever when you get a question wrong."
Learning Community	"My group has been in the same classes for 3 semesters now so we work together really well and know what helps each other learn."
Question	"I like it when my peers ask questions that result from trying to build their physical intuition, but not if professors don't work to understand where they're coming from."
Peer Attitudes	"Peers who demonstrate passive and unmotivated attitudes toward presented physics concepts greatly discourage my participation in an academic conversation."

Limitations and Future Directions

Limitations:

- Small quantitative sample size
- Knowledge of participants: life experiences, values, educational background, etc.
- Instructors' perspectives

Future Directions:

- Replicate study addressing above limitations
- Design and implement IH intervention and investigate its implications
- Applications to other Physics courses and other scientific disciplines

References

- This project is supervised by Professor Fabiana Cardetti (Department of Mathematics, University of Connecticut).
- ¹Whitcomb, D., Battaly, H., Baehr, J., & Howard-Snyder, D. (2017). Intellectual humility: Owning our limitations. *Philosophy and Phenomenological Research*.
- ²Haggard, M., Rowatt, W. C., et al. (2018). Finding middle ground between intellectual arrogance and intellectual servility: Development and assessment of the limitations-owning intellectual humility scale. *Personality and Individual Differences*, 124, 184-193.
- ³Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. *American journal of evaluation*, 27(2), 237-246.