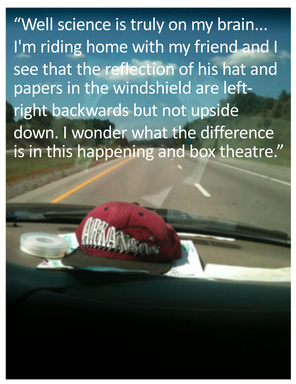
Adapting Transformative Experience Surveys to Undergraduate Physics

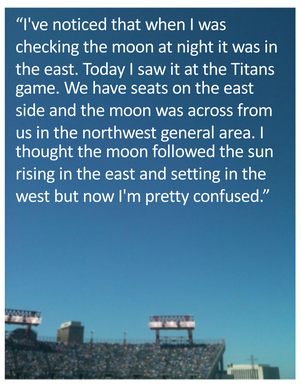
Brian W. Frank, Middle Tennessee State University, Department of Physics & Astronomy
Leslie J. Atkins, California State University Chico, Departments of Science Education and Physics

This work was supported by NSF grant #s 1140784 & 1140785.

What are Transformative Experiences?

"Experiences in which students actively use science concepts to see and experience their everyday world in meaningful new ways." [1]





HEY!!! Apparently something weird is supposed to be happening with the moon and 3 planets tonight... My mom just mentioned it to be bc she has heard a lot about our Moon Gazing experiences. Does anyone know what the heck she is talking about? We are going outside right now with SkyView to see what it says... (Brian Frank ???????)

Transformative Experiences (TE) Survey[2]

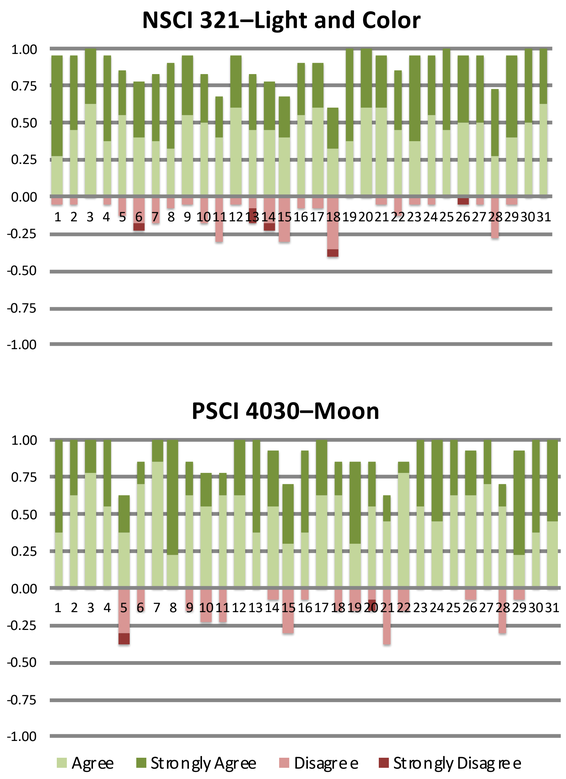
Student respond on a 4-point Likert scale to 31 statements. The stems below are modified to specify physics content and contexts.

1. During class, I talk about…
2. I think about…, when I see…
3. Outside of class, I talk about… — Talk
4. During class, I think about…
5. I talk about… just for the fun of it
6. Outside of class, I think about…
7. I find myself thinking about… in everyday life.
8. During class, I use the knowledge I've learned about …
9. Outside of school, I use the knowledge I've learned about… — Use
10. I use the stuff I've learned about…even when I don't have to.
11. I look for chances to use my knowledge of…in my everyday life
12. During class, I see things in terms of the laws I've learned about…
13. When I am working on a class assignment about… I tend to think of them in terms of…
14. If I see a really interesting situation (either in real life, in a magazine, or on TV), then I think about it in terms of…
15. I can't help but see situations in terms of the laws of…
16. During class, I notice examples of…
17. I notice examples outside of class of… — Notice
18. I look for examples outside of class of…
19. Learning about…is useful for my future studies or work.
20. Knowledge of…helps me to better understand the world around me.
21. Knowledge of… is useful in my current, everyday life.
22. I find that knowledge of…makes my current, out-of-school experience more meaningful and interesting.
23. Knowledge of…makes learning physics much more interesting.
24. In class, I find it interesting to learn about…
25. I think…is an interesting topic
26. I find it interesting in class when we talk about… in terms of…
27. I'm interested when I hear things about…outside of school
28. I find it exciting to think outside of school about…
29. The ideas we learned changed the way I see…
30. I think about…differently now that I have learned about…
31. I pay more attention to…now.

TE Profiles in Four Undergraduate Science Courses

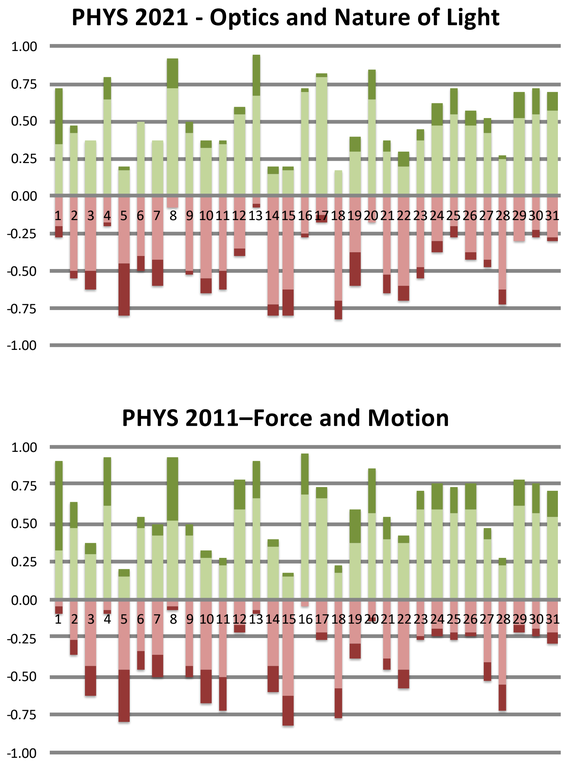
Student Generated Scientific Inquiry[3]

- Inquiry / Physical Science
- Responsive Teaching[4]
- Pre-service K-8 Teachers
- 24:1 Student Instructor
- Frequently Co-taught
- 5-6 Hrs in Integrated Setting
  - Small group Investigations
  - Presentations of Findings
  - Whole class Discussions
  - Peer Assessment
- Limited set of Topics

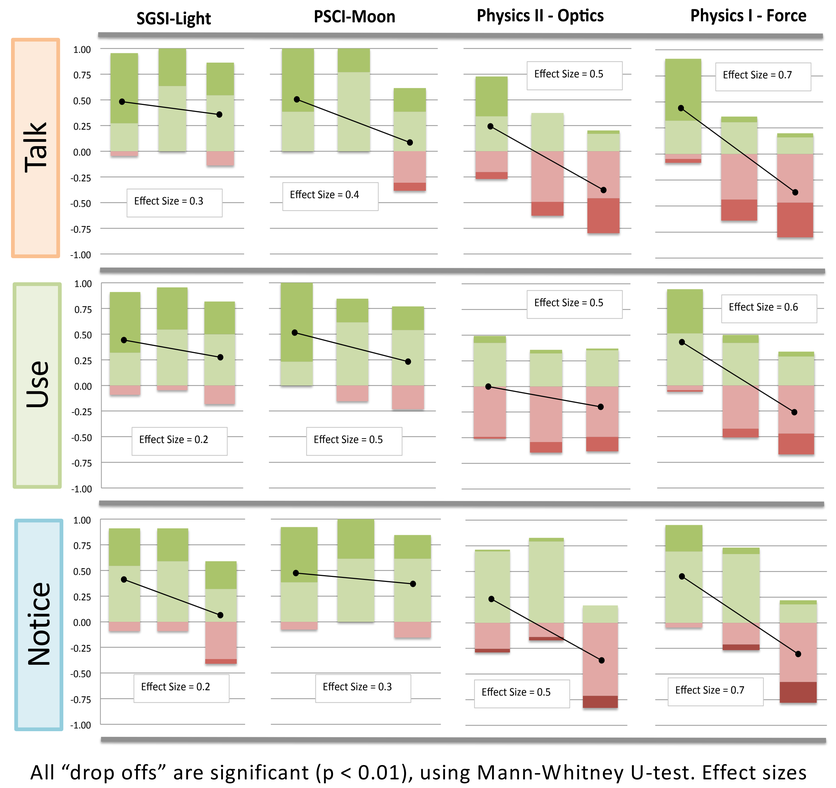


Reform-oriented Introductory Physics

- Algebra-based Physics
- Interactive Engagement
- Diversity of Majors, Gen. Ed.
- 32:1 Student Instructor Ratio
- Physics Majors as TAs
- 5 Hours in Workshop Setting
  - Collaborative Problem-solving
  - Interactive Demonstrations
  - Laboratory Investigations
- 1.5 Hours of Lecture
  - Peer Instruction
- Traditional Topics



Engagement Out of Class "Drops Off" Differently



All "drop offs" are significant ($p < 0.01$), using Mann-Whitney U-test. Effect sizes can be interpreted as the percentage of non-overlap. SGSI maintains high levels of engagement in and out of class, while the two physics show sharp drop offs.

Early Success at Identifying High-TE Courses

Our initial attempts to adapt TE surveys to undergraduate physics and physical science courses are promising. Not only does the survey seem capable of making discriminations using the overall measures of student agreement/disagreement, we find that much of the differences we observe across courses arise from particular patterns that potentially signify transformative experiences. That is, in each of the courses described in this paper, students show high levels of agreement to statements concerning *in class* engagement; so that what distinguishes them, for the most part, is the amount of engagement with content outside of class.

Interested in assessing TE in your own class?

We are interested in partnering with physics educators and researchers at other institutions as we continue to develop and pilot surveys and work to better understand how to promote TE. Contact us if you are interested.

Curious to know what might foster TE?

See Adjacent Poster, Features that Support Transformative Experiences in Physics Education, by Leslie J. Atkins and Brian W. Frank.

References

1. K.J. Pugh et al. *Sci. Ed.* **94**(1), 1-28 (2010).
2. Recent survey adaptations based on K.L.K Koskey, *Pers. Comm.*, August 14, 2012
3. I. Salter, I. & L.J. Atkins. *J. Sci Teacher Ed,* **24**(1), 157-177 (2013).
4. A.C. Maskiewicz & V.A. Winters. *J. Research in Sci. Teach.,* **49**, 429–464 (2012).