Reading Group Selections and Discussion Prompts

Source: Carl Wieman Science Education Initiative
PDF and editable Word version: https://pressbooks.bccampus.ca/seihandbook/chapter/supplemental-documents/

Everyone involved in the SEI, particularly the DBESs, had some need to stay current with the existing literature in science education. A 'Reading Group' was established as a required activity for the DBES group, but interested faculty were invited to participate as well. This document describes the topics and format of those reading group meetings.

Reading group format

The typical approach for discussing a paper would be: post the reading (link or attachment; may include the abstract in the post text) a week in advance on the group's mailing list/coordination forum (Basecamp) and post a reminder a day or two prior to the meeting with some questions for the reader's consideration. Those questions would form the basis of an hour-long, in-person discussion for everyone on the list (in practice, the list grew but the discussion group remained around 10-15 people in the busier years). The questions would help start the discussion and would serve as a back-up for the facilitator to help keep it going if needed. Discussions were usually informal, though in some cases the facilitator would prepare a brief summary of the paper, especially if there were some technical aspects to review.

Depending on the way that your group is organized, you may be able to share PDFs directly (if this is classified as a form of research group, for example; this will vary by jurisdiction/country) or instead use links to journal sites. For in-house items you will likely distribute the file directly.

On weeks where the group might not meet (e.g., around end of term) and other papers come up that are of interest to the group (including publications from members of the group that you can't fit in your schedule), the mailing list can serve as a tool to keep people informed.

Types of papers

There were a few different types of papers, and selections were made based on the interests of the existing cohort and opportunistically depending on what had come out recently in journals. Selections in the SEI included:

- **Must-reads on foundational topics**, which would be brought back every few years (either the original paper or a suitable update) for new cohorts; these are listed as "Recommended Papers" on the website: http://www.cwsei.ubc.ca/resources/papers.htm.
- **New results that are accessible and sufficiently interesting to a range of science disciplines**. These could be based in a particular discipline (e.g., biology education) and the discussion group might explore how the ideas could be adapted in their own department. These might also describe a measurement tool that would be useful within the group (a particular attitude survey or protocol) and/or provide helpful examples of certain kinds of analysis that the group was interested in learning about.
- **Pre-publication drafts or recent publications from among the group's members**. As projects progressed and reached a stage of publishing articles in journals, Reading Group selections also included the occasional article draft (either pre-submission or under review), and feedback was sought from the group. This had the benefit for the group of seeing a preview of results and having discussions about how to write a paper for an education-focused journal. It was common to make sure that one or more of the authors could attend the in-person discussion session when scheduling one of these meetings.

Example readings and discussion prompts

Fixed mindset instructors can demotivate students by comforting them

"It's ok—Not everyone can be good at math": Instructors with an entity theory comfort (and demotivate) students, by Aneeta Rattan, Catherine Good, and Carol Dweck

Abstract: Can comforting struggling students demotivate them and potentially decrease the pool of students pursuing math related subjects? In Studies 1–3, instructors holding an entity (fixed) theory of math intelligence more readily judged students to have low ability than those holding an incremental (malleable) theory. Studies 2–3 further revealed that those holding an entity (versus incremental) theory were more likely to both comfort students for low math ability and use "kind" strategies unlikely to promote engagement with the field (e.g., assigning less homework). Next, we explored what this comfort-oriented feedback communicated to students, compared with strategy-oriented and control feedback (Study 4). Students responding to comfort-oriented feedback not only perceived the instructor's entity theory and low expectations, but also reported lowered motivation and lower expectations for their own performance. This research has implications for understanding how pedagogical practices can lock students into low achievement and deplete the math pipeline.

Questions for discussion:

- How much do you think these same factors/assumptions apply in your discipline?
- Are you aware of this type of comfort-oriented feedback happening in your department?
- If you observed a faculty member using comfort-oriented feedback such as described in this paper, how might you discuss this with the faculty member?

Multiple choice tests exonerated

"Multiple-Choice Tests Exonerated, at Least of Some Charges: Fostering Test-Induced Learning and Avoiding Test-Induced Forgetting" by Jeri L. Little, Elizabeth Ligon Bjork, Robert A. Bjork, and Genna Angello

Questions for discussion:

- How would you summarize this paper for a prof in your department?
- Looking at the types of questions asked, how would this relate to the questions in your subject?
- "Properly constructed MCQ" is an important phrase.
    - How do people develop MCQ tests in your dept?
    - How long do they spend on each question?
    - How could you encourage them to do better and use plausible alternatives?
    - How does an expert know if an alternative is plausible?

Enhanced memory as a common effect of active learning

"Enhanced Memory as a Common Effect of Active Learning." Markant, D. B., Ruggeri, A., Gureckis, T. M. and Xu, F. (2016), Mind, Brain, and Education. Available online at http://onlinelibrary.wiley.com/doi/10.1111/mbe.12117/full

The authors "focus on a principle shared by nearly all definitions of active learning: that students should have the opportunity to exert control over the learning experience, including the selection, sequencing, or pacing of new information. We review a broad range of experimental evidence showing that such active control can lead to improvements in various forms of memory (including episodic memory) relative to passive conditions that lack the same opportunity for control, suggesting that enhanced memory may be a common outcome of active learning. Moreover, we show that these enhancements can arise from a number of distinct mechanisms, depending on the kinds of control afforded by an instructional activity."

Questions for discussion:

- How do these described mechanisms and results match up with your own experiences (probably as an instructor) of active learning in classrooms?
- How would the instructional choices you've made (e.g., activities developed for use in class) include examples of 'active control' for students?
- When designing an activity or assignment, are there other goals/expectations that you have for active learning that might complement or be at odds with incorporating active control?

Clickers in smaller classes

"Student Perspectives on Using Clickers in Upper-division Physics Courses." Perkins, K. K., Turpen, C., Sabella, M., Henderson, C., & Singh, C. (2009). (pp. 225–228). https://doi.org/10.1063/1.3266721
"The Benefits of Using Clickers in Small-Enrollment Seminar-Style Biology Courses." Smith, M. K., Trujillo, C., & Su, T. T. (2011). CBE—Life Sciences Education, 10(1), 14–17. https://doi.org/10.1187/cbe.10-09-0114

Questions for discussion:

- In both of these papers, the students are quite positive about using clickers in upper-level courses, but the authors caution that these students had experienced interactive engagement using clickers in previous courses. Do you think this might make a big difference (vs. if students didn't have previous experience)? Have any of you used clickers in upper-level courses (or know of people who have)?
- Are there non-clicker approaches that you think could be as effective in these settings? If so, are they easier to implement or harder?

Here is a list of some of the benefits that the students perceived:

- Increases the chance students will do the required reading before class;
- Helps engage all students in the class;
- Gives students a focused opportunity to share thinking and to learn from their peers, see other perspectives;
- Gives students custom feedback and enables them to check/monitor their thinking.

Enhancing student motivation

"Enhancing Introductory Student Motivation with a Major-Managed Course Blog: A Pilot Study." August, A. A., Bretey, K. C., Cory, B. T., Finkley III, E. R., Jones, R. D., Marshall, D. W., … Lane, W. B. (2011). ArXiv:1108.1591 [Physics]. Retrieved from http://arxiv.org/abs/1108.1591

Questions for discussion:

- Is there enough CLASS data to be convincing?
- Might the biweekly surveys influence the CLASS result?
- Is the upper-level student involvement critical or would any old blog do?
- Any general comment on blogs stimulating personal interest and/or improving motivation?

Teaching evaluations

"How to Improve Your Teaching Evaluations without Improving Your Teaching." Neath, I. (1996). Psychological Reports, 78(3_suppl), 1363–1372. https://doi.org/10.2466/pr0.1996.78.3c.1363

Some discussion questions:

- Neath's article points to a problem in academic process, i.e., in using scores of subjective teaching evaluations as proxies for quantifying good teaching. Can any ideas or tools from evidence-based learning be practically adapted to support evidence-based teaching?
- A number of Neath's suggested tips for improving teaching ratings are (intentionally) facetious (e.g., "be male"). Are any of his tips worthwhile means of legitimately improving teaching?

- The closing paragraph contains what Neath believes are sufficient conditions for teaching evaluations to be legitimate means of evaluating teaching. Do you agree with his assertion? Are any of the conditions necessary conditions as well?

Effective tutors

"The Role of the Lecturer as Tutor: Doing What Effective Tutors Do in a Large Lecture Class." Wood, W. B., & Tanner, K. D. (2012). CBE—Life Sciences Education, 11(1), 3–9. https://doi.org/10.1187/cbe.11-12-0110

Questions for discussion:

- If you had to choose a tutor strategy/behavior to implement into a large lecture class, which one would you choose? Why? How would you integrate this strategy into a large class? What are the caveats that might affect implementation?
- Some of these tutor strategies might require a very large shift in teaching style, and would involve asking (some) instructors/faculty to make large changes in habit (e.g., using Socratic responses to student questions, or "cognitive coaching" approaches under the Indirect category). Can we think of ways to help people who are interested in tutor strategies make these changes?
- Although this paper deals with implementing tutor strategies in large classes I'm also very interested in applying these ideas to a tutorial setting where TAs have a large impact on student learning. Not all the TAs assigned to a course are considered experts in the field, so how can we support TAs to be tutor-like without expertise?

Lack of impact of active learning

"Active Learning Not Associated with Student Learning in a Random Sample of College Biology Courses." Andrews, T. M., Leonard, M. J., Colgrove, C. A., & Kalinowski, S. T. (2011). CBE—Life Sciences Education, 10(4), 394–405. https://doi.org/10.1187/cbe.11-07-0061

Questions for discussion:

- What are the take home messages you got from this paper do they impact your view or practice of implementing active learning methods in your classes (or the classes you support), and measuring the effectiveness of these methods?
- What parts of the data did you find the most (and perhaps the least) compelling? What would you change if you were to repeat this study in your discipline?
- If you encounter low learning gains how do you determine (or could you determine) if curriculum is negatively impacting the effectiveness of active learning methods?
- How can we measure true effectiveness of the teaching and use of active learning methods (beyond the end-of-term post-test)?

Draft paper for review

(In this post, a draft paper written by Reading Group members is shared with the group)

We are excited to share this draft with you. Our request to you as you read the manuscript:
Please put yourself in the position of reviewer when reading this manuscript–it is a work-in-progress, we're both new to the wacky world of pedagogy paper publishing and we welcome any and all constructive criticism. We've used a Doc file so you can use track changes if you wish. A .pptx file with the figures is included in case they do not display properly (we've had some trouble with that). Our target journal is [target journal]. Also attached are the Journal's guidelines to authors, in case you'd like to look these over.

Questions for discussion:

- Overall, do you find the manuscript clear and easy to follow? Do you feel you can easily extract the key results?
- Do the tables/figures provide useful information? Are any included tables and figures unclear or redundant? Are we missing any figures?
- Is there any content missing that you expected to see (i.e., intro topics, data analyses, discussion points)?

- Are there references that we have left out that you believe are relevant?

Effect size analysis

"The Other Half of the Story: Effect Size Analysis in Quantitative Research." Maher, J. M., Markey, J. C., & Ebert-May, D. (2013). CBE—Life Sciences Education, 12(3), 345–351. https://doi.org/10.1187/cbe.13-04-0082

A line from the paper:
"Thus, metrics of effect size and statistical significance provide complementary information: the effect size indicates the magnitude of the observed effect or relationship between variables, whereas the significance test indicates the likelihood that the effect or relationship is due to chance."

Questions for discussion:

- How would you interpret results that had:
    - a large effect size but low significance?
    - a medium effect size and significant
    - a small effect size and significant
- Do you have data of your own for which you could calculate an effect size? If so, what was recommended when you followed the key presented in Figure 1? Do you agree with the recommendation?
- Are there common issues you face when trying to measure significance, or effect size, in your educational research? What are the issues? Were any of them resolved by this paper?

Invention activities

"Invention Activities: A Path to Expertise." Day, J., Adams, W., Wieman, C. E., Schwartz, D. L., & Bonn, D. A. (2014). Physics in Canada, 70(2), 81-83.

Questions for discussion:

- Using the tips in the article, can you create your own invention activity? Sketch out an idea, and bring it to the reading group.
- In the second paragraph of the section entitled "The difference between experts and novices", I count four explicit contrasts between experts and novices. Can you come up with specific examples in your discipline for each of these contrasts?
- Which of the expert/novice differences do invention activities hit, and why?
- How would you facilitate an invention activity in the classroom, to promote the type of engagement we want? (i.e. How to present it to the class? What if a student is engaging in 'equation hunting'? What language to use in the follow-up?)

Instrument validation

"Development and Initial Validation of the Beliefs About Reformed Science Teaching and Learning (BARSTL) Questionnaire: The BARSTL." Sampson, V., Enderle, P., & Grooms, J. (2013). School Science and Mathematics, 113(1), 3–15. https://doi.org/10.1111/j.1949-8594.2013.00175.x

Discussion prompt: A really useful direction for our discussion would be (a) to gather some opinions about this instrument, and (b) to discuss any other surveys/methods people have used to measure some aspect of grad student/TA professional development-please feel free to bring along anything you have been working on or have used in the past.