Think-Pair-Share:
A Revised "How-To" Guide
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Background

After attending the Austin CAE Teaching Excellence Workshop in January of 2008, Amy Forestell, then a graduate student at UT Austin and now an Assistant Professor at State University of New York at New Paltz, decided to take a look at the Think-Pair-Share (TPS) Teaching Strategy on the CAE website and found that many of the important details we discussed and modeled during the workshop were not included in the basic how-to guide. Using Amy's notes on Think-Pair-Share from the workshop, we updated the how-to guide and highlight the key points that were missing in the previous version that we believe are essential to proper implementation of Think-Pair-Share. Since that time, we've had the opportunity to use TPS in some pretty unique instructional settings, from small groups of Tibetan Monks, to mega-courses of nearly 1000 students, and more, providing us with new insights into best practices in implementing Think-Pair-Share. Based on these insights, we've revised and updated our Think-Pair-Share How-To Guide.

This guide should be a useful reminder for those who have attended a recent workshop, and it will serve as a useful implementation update to those who attended a workshop some time ago. Additionally, it should be helpful for those who have not attended a CAE workshop.

Introduction

Faculty often ask us what they can do to "get out of lecture mode" in their classrooms. After completing a CAE Teaching Excellence Workshop, participants commonly report back that Think-Pair-Share is the technique they plan to try first. We agree it's a great place to start! So how do you effectively implement Think-Pair-Share in the classroom? Through years of classroom experimentation, we've come up with a set of steps and phrases we find motivate students to earnestly engage with your TPS questions and have meaningful and rich conversations with their fellow students. Here's the "how-to" guide:

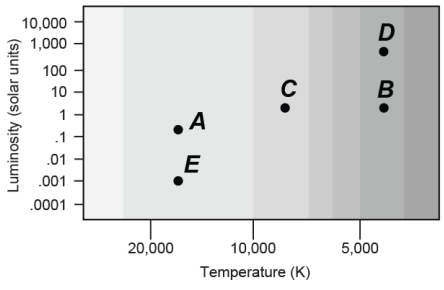
Writing Questions

- Determine the conceptual or reasoning difficulty your question will address. For example, "Students struggle to understand that just because two objects have the same temperature, or the same luminosity, does not mean they also are the same size."

- Create a multiple-choice question that would serve as a good vehicle to promote a cognitively engaging and conceptually rich discussion amongst your students related to that conceptual or reasoning difficulty. See example at right.

- Along with your correct answer choice, create distinct incorrect answer choices that are representative of the likely student conceptual and reasoning difficulties that real students have and so might actually vote for.

Which of the following is the correct ranking for the size of the Objects A-E, from largest to smallest?



A) E=A>C=B>D
B) D=B>C>A=E
C) D>B=C>A>E
D) E>A>C=B>D
E) None of the above

Example Think-Pair-Share Question

Implementing TPS

1) Present question to students with a prompt such as, "I've got a question for you." or "Here's a question I'd like you to consider."

   Note: Don't go into a lengthy introduction or description of the question—you just lectured on the topic where you provided the types of discipline representations they'll see in your TPS questions. Refrain from reading the question to your students. There are several reasons including: 1) Students will still need to read and interpret the question for themselves, and will be delayed from doing this until you finish. So you taking the time to read the question out loud will waste valuable class time; 2) When we read the question, we are likely to reveal information about which answer choices are incorrect/correct; and lastly, 3) Students will need to be able to read your questions, interpret the representations, etc., on their own on test day—now is the time for them to practice these skills.

2) Gauge the appropriate amount of time to let your students individually read through and reason about your question to find the right answer. To gauge the right amount of time:

   - Read the question to yourself slowly, as if you were a student reading it for the first time.
   - Do all the steps of reasoning necessary to determine why the incorrect answer choices are incorrect and the correct answer choice is correct.
   - If using ABCD voting cards (as demonstrated in our workshops), listen for the rustling of the paper as students start preparing their votes.

3) Ask students "Does anyone need more time?"

   Note: What you really want to know is if any students still need more time. Refrain from asking something like, "Everyone ready?" If you've gauged your time well, most students will be ready, so the overwhelming answer will be "yes"—who you really want to hear from are the students who have the courage to say they do need more time. By asking, "Does anyone need more time?" you'll be able to hear from the students who do.

   If even one student says "yes" turn back to the question and count slowly to ten.

4) End their private thinking by saying "Time!"

5) Have students anonymously and simultaneously provide their answer to the question as a class by saying, "Please prepare your vote. Lets vote on the count of three. One, two, three."

   Note: No matter what method you'll be using to have your students vote (cards, clickers, or fingers), you'll need to train your students how to vote and your expectations for their participation.

   To ensure anonymity and simultaneity of votes, when using cards train students to hold their card to their chest so that students can't see each other's votes.

   If using ABCD voting cards, in addition to the voting options "A," B," "C," and "D," show your students that to vote "E" they fold to the white square/back side of the sheet. Also show your students that for questions they are really stuck on and just feel like they are guessing, that they should vote with all four colored letter squares at the same time (Explain to your students that voting all colors is a legitimate vote and it's important for them to communicate to you their confusion.).

6) Determine whether or not you're going to have your students discuss their answers and reasoning with each other as the result of this first vote:

   IF >80% vote correct then there is no need for students to discuss their answers:

   a. Share the approximate correct answer distribution ("Awesome! About 90% of you have the correct answer." Or "Great! Only a couple of you are not voting with the correct answer.").
   b. Debrief the correct answer to your students using one of the following fill-in-the-blank prompts:
      i. The correct answer is ____?" or
      ii. "All of you voting [insert correct answer choice] are _____ (*the majority of the students will say "correct" while the remaining incorrect students will say "*wrong"). This can also be done by inserting the letter of the most common *incorrect* answer, which brings about a very interesting response as your students actually enjoy saying that a answer that you propose is “wrong.”

      Note: When the vast majority of the students are correct, and you have them say the correct answer in unison out loud, you convey to the students that the question is fair and that most students were able to get the right answer.

   c. Debrief the question with students: Challenge yourself to ask students fill-in-the-blank type questions that guide students through the various steps of reasoning required to rule out the incorrect answers and to determine the correct answer. Avoid "re-lecturing" on the topic.

   d. Move on.

   IF <80% vote correct then use the following prompt to direct your students to engage in a discussion with their peers on the reasoning behind their answer:

   a. "Turn to your neighbor and convince them you're right. Just because you both have the same answer does not mean that you're both correct. So make sure you explain your reasoning. You've got about a minute. Go! 59, 58, 57…"

      Note: It's important that you provide students with a set of instructions that puts them in the correct mindset to earnestly engage in discussing their reasoning, and we've found the above phrase works great. The "about a minute" is arbitrary, but along with the countdown, provides students with a sense that they need to get to work.

      Judge how much actual time you'll give them based on how on-task their conversations are. When the volume dies down in the room and/or you start hearing off-topic conversations, it's time to motivate students to finish up their discussions.

   b. Project that the time for discussions is ending soon by saying "You've got about ten more seconds."

   c. End their discussions by saying "Time!"

7) Have students vote a second time using the method described in Step 5.

8) Determine your next course of action based on the outcomes of the second vote:

IF >80% vote correct on the second vote, follow steps a-d from Step 6 for the >80% correct on the first vote.

Note: This is the most common outcome after the second vote because your students have converged on the correct answer as a result of engaging in a thoughtful discussion with their peers on their reasoning for this question.

IF <80% vote correct there can be a couple of issues with students' level of understanding of the background information needed to answer the question, or there can be a problem with the question itself.

Note: some common issues that contribute to this low correct second voting percent include: 1) students forgot a key piece of information from your lecture (the direction of redshift, for example); 2) students didn't notice a necessary piece of information in the question (the time of day, for example); or 3) there is something wrong with the question and/or answer choices (two answers are actually correct, a label is missing, etc.).

Prompts that can help you and your students resolve this lower second vote include:

a. "Hmmm. That didn't go as well as I thought it would. Is there a question about the question I could answer for you that would help?"

   Note: This conveys to your students that they are not at fault and that you are still wanting to help them. Also, it allows you to actually figure out what your students are really struggling with instead of guessing at their struggle and going back into lecture-mode. After answering a couple student questions you'll likely hear a group "Ah…" This is a clue for you to let them talk to each other again. You may want to use the following prompt:

   i. "Would you like to talk with your neighbor again?" You will likely hear a consensus “Yes” from your students. You can then start back with the prompt and process at Step 7.

      Note: It is very rare that you'll end up with a class vote that is <80% correct at this point. If students again vote <80% it is likely there is a mismatch between the material you presented in your lecture and the context or difficulty of your question. You may need to walk your students through each step of the reasoning of the correct answer for this question to bring closure to this problem.

Additional Resources

The Center for Astronomy Education website:
https://astronomy101.jpl.nasa.gov

Development and Application of a Situated Apprenticeship Approach to Professional Development of Astronomy Instructors (Prather & Brissenden 2008):
https://astronomy101.jpl.nasa.gov/files/Situated%20Apprentice_AER.pdf

Clickers as Data Gathering Tools and Students' Attitudes, Motivations, and Beliefs on Their Use in this Application (Prather & Brissenden 2009):
https://astronomy101.jpl.nasa.gov/files/Clickers%20as%20Research%20Tool_AER.pdf

Peer Instruction: Ten Years of Experience & Results (Crouch & Mazur 2001):
http://mazur.harvard.edu/publications.php?function=display&rowid=113

Teaching and Learning Astronomy in the 21st Century (Prather, Rudolph, & Brissenden 2009):
https://astronomy101.jpl.nasa.gov/files/Teaching%20and%20Learning%20Astronomy%20in%20the%2021st%20Century.pdf