Introducing TurningPoint SRS for assessment of teaching and learning across connected classrooms

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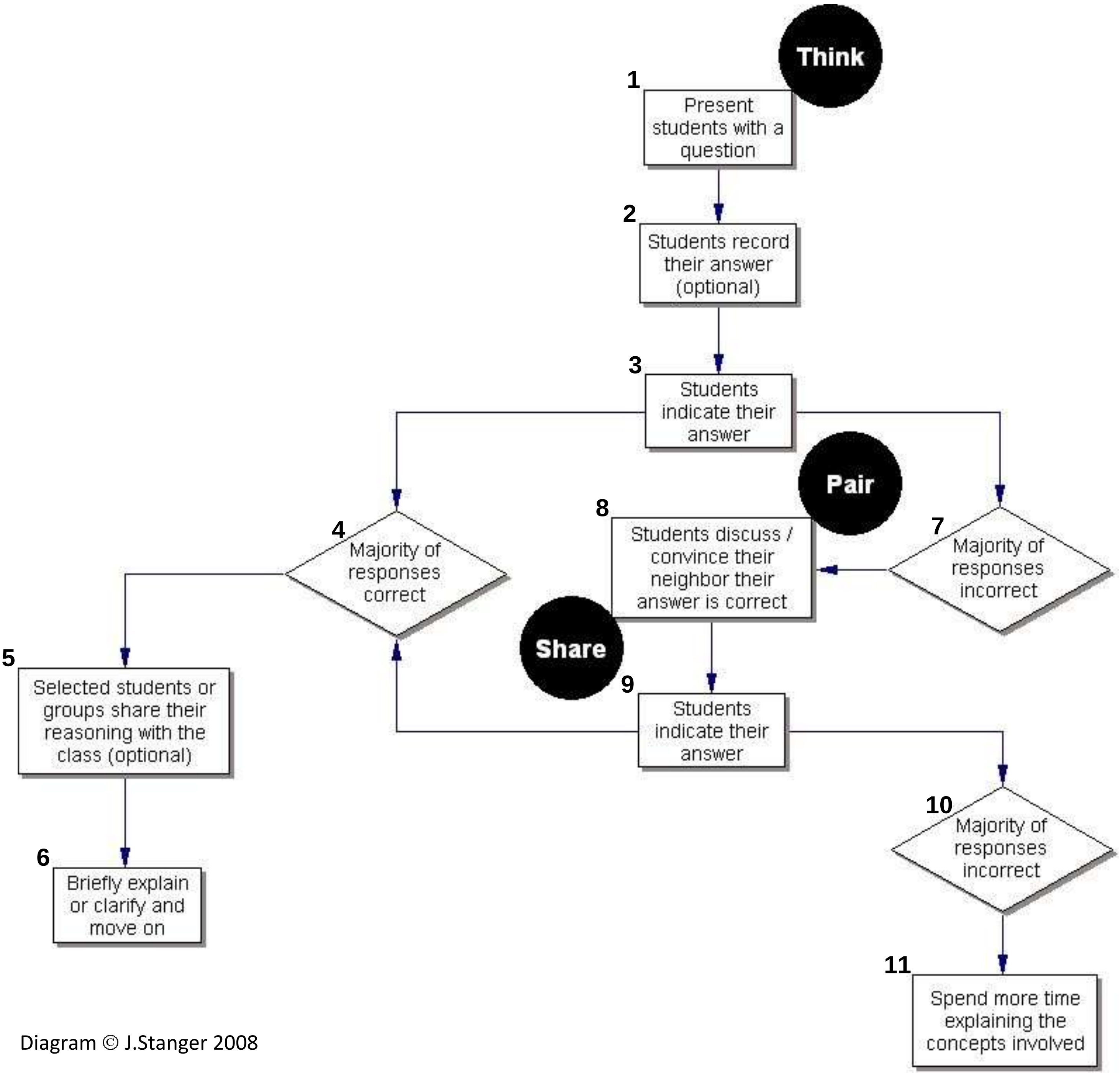
Peer Instruction based on Think-Pair-Share

Outline

Traditional instruction, especially in physics, involves students learning by rote how to plug numbers in equations to solve problems. One alternative to this is instruction that focuses on developing conceptual understanding through active engagement and social interaction. This has been shown to lead to significant gains over traditional methods and is more applicable with today's physics syllabus and the modern learner.

The teaching strategy used in peer instruction (PI) is based on the process of think-pair-share. The process is outlined in the flowchart below and encourages students to be actively involved in their learning. Students retain more of what they have learned and especially retain the key concepts that were targeted in the questions.



Outline of the Peer Instruction Process (think, pair, share)

The steps shown on the flow chart above are outlined below.

1. Questions used for PI are typically multiple choice questions (often called ConcepTests) that are written to test conceptual knowledge. These can easily be slotted into a lesson when a desirable amount of material or activities has been completed. These can also be used where course material has been covered by the student as set prior reading. It is important to give students enough time to recognise the key parts of the question and **think** about their answer.

2. Students can record their answers to questions to formalise the process or these could be collected to gain an understanding of students' initial understanding.

3. Students can indicate their answers in a variety of ways. Flashcards are a simple and low cost way of getting students to show you their answers. A set of cards with A to D in different colours seems to work best as this allows you to easily gauge the proportion of correct and incorrect responses at a glance. It is important to devise a way for students to vote anonymously as they will be more willing to share their answers and cannot be influenced by the responses of others. Electronic devices can also be used and these are commonly known as clickers. They allow you to record and display the responses to questions.

4. If the overwhelming majority of students answer correctly it is clear that further time on this concept is not needed. You can now move through steps 5 and 6 and on to the next activity.

5. Selected students could provide the class with their reasoning for their answer or the steps they went through to arrive at their answer. These provide valuable modelling of thought processes and could also assist those who did not answer correctly.

6. A brief explanation could be useful, especially for those who did not answer correctly.

7. If the number of correct responses lies somewhere between 50 and 80% **do not tell students the correct answer**. They can then be asked to work in groups of 2 or 3 and convince their group why their answer is correct (step 8). It would be most beneficial if students who gave different answers worked together at this stage. If significantly less than 50% of students indicate the incorrect answer then it may be wise to skip to step 10 as their may not be enough students who can lead the discussion for step 8 to be beneficial.

8. This stage is where students **pair** and **share** their ideas. In this step students work in groups of 2 or 3 and try to convince the group their response is correct. This is the process at the heart of **peer instruction**.

9. Students are asked again to indicate their answer as in step 3. If the majority of students now indicate the correct answer then you can proceed through steps 4, 5 and 6. If there is still a large proportion of incorrect responses then proceed to step 10 and spend some time going over the concept in question.

References

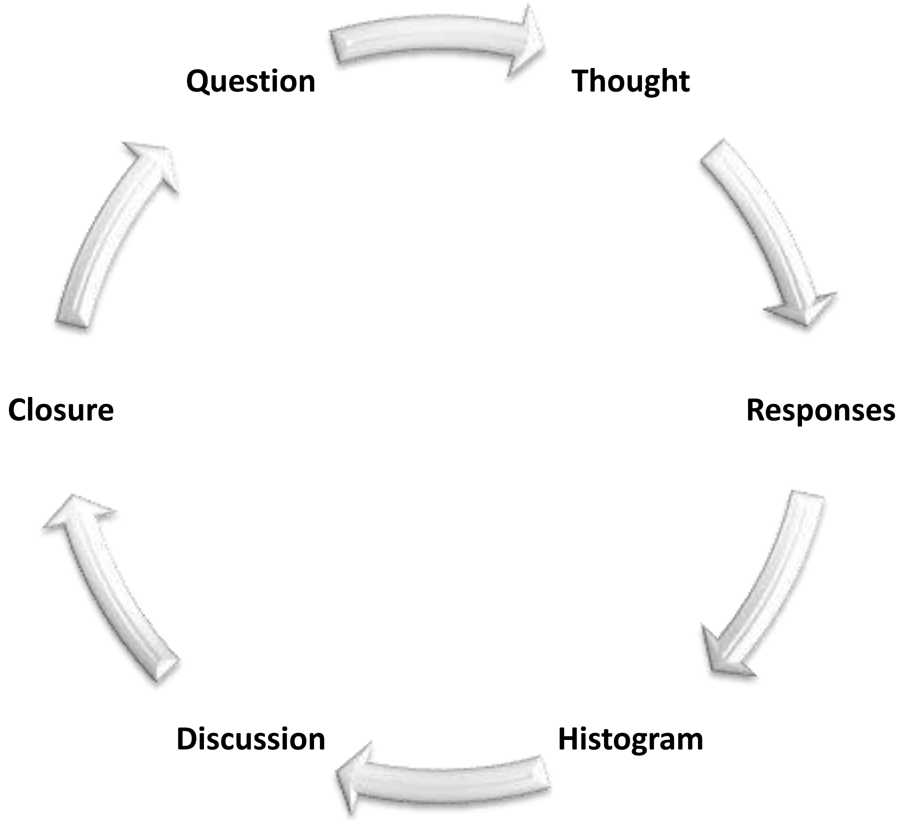
Green, P. J. (2003). Peer Instruction for Astronomy. Upper Saddle River, NJ: Prentice Hall.

Mazur, E. (1997). Peer Instruction: A User's Manual. Upper Saddle River, NJ: Prentice Hall.

Technology-Enhanced Formative Assessment using the Question Cycle

TEFA is based on four key principles and these are:

1. Motivate and focus student learning with question-driven instruction.
2. Develop students' understanding and scientific fluency with dialogical discourse.
3. Inform and adjust teaching and learning decisions with formative assessment.
4. Help students develop metacognitive skills and cooperate in the learning process with meta-level communication.



1. Pose a **question** or problem to the students, generally challenging, often multifaceted. (In TEFA, we do not teach first and then ask questions about what was taught; we ask questions first, and use them as a context for sense-making and direct instruction).
2. Have students wrestle with the question (**think**)—alone, in small groups, or both in succession—and decide upon a response.
3. Use a CRS to collect **responses** (even from students who are uncertain) and display a **chart** of the aggregated responses.
4. Elicit from students as many different reasons and justifications (**discussion**) for the chosen responses as possible, without revealing which (if any) is (or are) correct. In the process, draw out students' reasoning and vocabulary, expose them to each others' ideas, and make implicit assumptions explicit.
5. Develop a student-dominated **discussion** of the assumptions, perceptions, ideas, and arguments involved. Help students formulate their ideas and practice talking science, find out why they think what they do, and gently increase their understanding. (In practice, phases 4 and 5 usually blend together).
6. Provide a summary (**closure**), micro-lecture, meta-level comments, segue to another question, or whatever other closure seems warranted, informed by the detailed data just obtained on students' thinking. (The class should now be well primed to receive the message, appreciate its relevance, and integrate it with other knowledge).

References

Beatty, I. D. & Gerace, W.J. (2009). Technology-Enhanced Formative Assessment: A Research-Based Pedagogy for Teaching Science with Classroom Response Technology. J Sci Educ Technol 18:146-162.