**Strategy: Collecting Evidence of Student Understanding**

*Engineering effective classroom discussions, questions, and learning tasks which elicit evidence of learning*

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| **Technique** | **Description** | **Implementation Notes** |
| ABCD Cards or Clickers | Instructor asks or presents a multiple-choice question, waits an appropriate amount of time, then the students individually and simultaneously hold up one or more cards as their response, or vote with personal response systems or “clickers.” | Template for colored ABCD cards can be found here: https://ctd.ucsd.edu/wp-content/uploads/2013/09/ABCD- Voting-Card.pdf .Distractors should be designed based on common student misconceptions. |
| Thumbs up/down/sideways | Can be used to answer a true/false/I don’t know question, or a question that asks students to compare two different quantities (more/less/the same). | One of the easiest FA techniques to implement on the fly. Students should hold their thumbs close to their chests in case they are afraid of other students seeing their answer. |
| Entrance Tickets | Instructor asks a question at the start of a lesson, students write responses on index cards and hand them in. Instructor uses them to assess initial understanding of something to be discussed in that day’s lesson or as a short summary of understanding of the previous day’s lesson. | These tickets can be 3” x 5” index cards, small strips of paper, or something similar. The instructor usually places the question on the board or on the overhead so that students can begin to formulate an answer as soon as they enter the classroom. |
| Exit Tickets/Passes | Same as above, but at end of lesson. | Same as above. Some online clicker systems have exit tickets built in, for example Socrative: <http://www.socrative.com/> |
| Learning Logs/Reflection Sheets | Near the end of a lesson, students write summaries or reflections explaining what they just learned during the lesson. Students usually hand these in for review and response periodically or at the end of the lesson. | These summaries/reflections may be kept in a notebook, journal, online, or on individual sheets. These can be implemented as 1-5-minute “quick-writes.” |
| Muddiest/Murkiest Point | Same as above, but students write about what they understand*least well.* | Best implemented as 1-5 minute “quick-writes” students hand in at the end of a lesson. |
| White Boards (individual or group) | Instructor asks or presents a question, waits an appropriate amount of time while students write or illustrate responses on white boards, then the students individually and simultaneously hold up their boards for the instructor to see. | A white board can be made by inserting a white sheet of cardstock inserted into a clear, plastic transparency sleeve. It usually includes a dry-erase marker and a wiper tissue. For other purposes, a sheet of graph paper or a map of a region can be substituted for the plain white insert. Some online personal response systems, like Ubiquitous Presenter ([http://up.ucsd.edu/about/,](http://up.ucsd.edu/about/) free) and TopHat ([https://www.tophat.com](http://www.tophat.com/)/, $20/student, integrated with online HW system) also have sketch tools. |
| Strip sequence (individual or group) | Students arrange a series in a logical order. | Many online HW and clicker systems include the capability to ask ordering questions. |

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| Brainstorming (individual or group) | List as many answers as possible to a question. | Brainstorming can be augmented by categorization, in which students put their brainstormed responses into different categories. |
| Concept map (individual or group) | Instructor gives students a term or idea, or a central question, and students link terms to that central term/idea/question, using a given list of terms or their own. Students use arrows and labels links showing how and in what direction(s) they think terms relate. | Cmap Tools allows students to create and share digital concept maps, and provides tools to the instructor for analysis: <http://cmaptools.en.softonic.com/>There are many possible ways to look at concept maps. One can count the number of terms, links, and/or levels. One can also look at students’ link labels. |
| Statement correction (individual or group) | Determine what is wrong with a statement. Propose an alternative statement that is correct. | Statement corrections engage students in evaluating what concepts are misrepresented and in determining what information they need to correct it. |
| Scratch-off quizzes (individual or group) | Students scratch off their response to a multiple choice question on a scratch-card. The correct answer is revealed on the card. Students score themselves based on how many times it takes them to get the correct answer. | Information on creating and ordering IF-AT cards can be found here: <http://www.epsteineducation.com/home/about/> |
| Monitoring notes questions (individual or group) | Design one or more open-ended questions to ask students at prescribed points during the learning activity. Make notes of their responses on a log. | Works best for small classes, lab sections, or for large classes in which there are TAs. The instructor can organize the students into smaller group and ask the monitoring notes questions group by group, or the groups can sign up for a “check-in” with the instructor when they are ready (works best if there is an indication for when they should stop and check-in in the learning activity itself). |
| Traffic cups (individual or group) | Students have a set of red, yellow, and green traffic cups. The one they put on top indicates how in need they are of help (red= totally stuck; yellow = need some help; green = ok) | Other colors can be added for different purposes as well. For example, a blue cup could indicate students are ready for a check-in (above). In large lecture classes, ABCD cards can be used as traffic cups. |