

AAI Education Committee Highlight: Teaching Tools

In 2016, the AAI Education Committee initiated a new session focused on improving immunology education: the Immunology Teaching Interest Group (ITIG). The ITIG is an informal group comprised of past ITIG session speakers and attendees, including current immunology educators spanning a range of institutions and levels. It serves as a resource for novel teaching tools and practices that can be implemented in courses to enhance immunology education. The session has grown from an audience of 20 in 2016 to more than 100 participants in 2019. Because of the great interest in this topic, the AAI Newsletter features occasional “Teaching Tools” articles highlighting ITIG presentations.

Tangible Content Maps: An Easy Way to Increase Student-Driven Learning in Your Immunology Course



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When implemented effectively, student-driven approaches to learning can improve learning outcomes and reduce non-pass rates in science courses.¹

Additionally, active questioning of how processes work and how content is connected improves retention of key concepts.² Importantly, encouraging students to be actively involved in their learning better prepares them for graduate school and the professional workforce.

However, developing and integrating approaches that require higher degrees of student engagement and investigation during class can be intimidating. Here, we share a simple strategy, which we have termed “tangible content maps,” that leverages pre-existing resources

and can be implemented incrementally. This strategy is appropriate for any immunology class regardless of student demographics, instruction level (high school, undergraduate,

graduate, or professional), type of course (lecture or laboratory), and course enrollment size.

Creating tangible content maps involves organizing related terms and processes into clusters or sequences and verbally explaining the relationships among them. The terms and processes are printed on slips of paper or written on index cards that students can then arrange to develop their maps. Students can work individually (but preferably in groups) to design their maps at their desks, on the floor, or even on the classroom walls if tape is provided.

A keystone of the activity is that although some terms may be involved in multiple processes or groups of terms, students must place each term at a single step in a process or with a single cluster of terms. Students discuss with their group why they placed the term at this particular position in the map.

For example, if “nucleotides” is provided once in the list

of terms for VDJ recombination, students will need to place it with “P-addition” or “N-addition.” If a term is involved in both VDJ recombination and class switch recombination, students will be pushed to differentiate between the processes as they discuss where to place the term in the map. Similarly, when learning about antigen processing



of viral proteins, providing “peptide” once would raise discussion of whether “peptide” should be placed with “immunoproteasome,” “TAP,” or “MHC class I.” For a lab

course using sandwich ELISAs, a single “antibody” card would elicit a discussion of where it should be placed within the list of procedural steps.

As students gain experience building the maps, the word lists can become more extensive. We use a 100-word list derived from the course learning objectives to review for the midterm exam. This list integrates many processes, meaning that discussions now focus on whether, for example, “MHC class I” should be placed with terms relating to T cell development, CTL activation, NK cell regulation, or antigen presentation. Term lists can be generated quickly from a textbook’s key terms, table of contents, or assessment questions.

Overall, the strategy increases content understanding and retention by:

- simultaneously incorporating multiple learning modalities (kinesthetic [movement], visual, discussion, auditory, etc.)
- requiring students to build meaningful connections among concepts and
- providing an opportunity for students to assess themselves and bridge gaps in understanding with their peers.

¹Freeman, S. et al. 2014. Active learning increases student performance in science, engineering, and mathematics. *PNAS* 111: 8410-8415.

²McDaniel, M. A., and C. M. Donnelly. 1996. Learning with analogy and elaborative interrogation. *Journal of Educational Psychology* 88: 508-519.

