

## 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 speakers and attendees of the ITIG sessions, 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 “Teaching Tools” articles highlighting ITIG presentations.

### Using *Pillars of Immunology* Research Articles to Enhance Problem-Solving Skills Among Undergraduate Students



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Critical-thinking skills are the ultimate goal of science education. These skills, such as the ability to interpret data, synthesize information, and

evaluate results, are essential for most careers in science. However, there is often a gap between classroom-based learning and acquisition of these skills. To address this gap, I use *The Journal of Immunology* “Pillars of Immunology” articles to develop an in-class small-group exercise for undergraduate students enrolled in a 14-week elective immunology course for biology majors at Medgar Evers College, CUNY.

The *Pillars of Immunology* comprise over 200 research articles that have established paradigms in the field of immunology. Each article includes original data and an associated review of the topic. In this exercise, articles are chosen from a pre-selected list of articles<sup>1</sup> based on simplicity of approach and relevance to topics covered in the course.

Students are divided into groups of four to five people each, based on prior performance on exams and quizzes. This ensures the group members are comparable in academic ability.

Using white board and/or PowerPoint slides, student groups present their article to the class for 20 minutes and then allot an additional five minutes for questions. In their presentations, students interpret data in the article’s figures and present the findings in the format of a journal club discussion. This assignment addresses four course learning outcomes:

1. to design and evaluate the validity of experiments which test hypotheses of immunological principles
2. to interpret primary data that were generated using common immunological approaches

3. to develop skills in working with others as a member of a team and

4. to develop skills in oral science communication.

For this exercise, several smaller assignments are scaffolded before and after the presentation to support implementation. In Week 2, I discuss how to critique an article using published articles.<sup>2,3</sup> In particular, I use a short article by Yeh and colleagues that illustrates empirically the importance of critically assessing data for oneself, rather than relying on the author’s interpretation. In Week 5, I present a *Pillars of Immunology* article as an example and allocate it to the groups. In Week 6, I schedule 30-minute consultations with each group to address unresolved questions. In Week 7, presentations are scheduled after fundamental concepts have been covered in lectures, including cells/organs of the immune system, innate immunity, complement, V(D)J recombination, antigen presentation, T cell activation, memory, cytokines, and responses to infectious diseases. The overall exercise is graded based on a rubric that includes instructor and peer evaluation.<sup>4</sup>

After completing this exercise in my immunology course, students were more confident in their ability to interpret data (n=18, p<0.05; Paired Wilcoxon Test). Likewise, there was an increase in mean scores of analytical skills (from 39% to 56%, respectively; p<0.05). While post-exercise performance remained below mastery level (80%), the performance gain was statistically significant. To identify topics or subjects in which student learning needs improvement, I have subsequently included questions on the mid-term exam to assess both low and high levels of learning.<sup>5</sup> The results demonstrate that understanding methods was a key impediment to attaining high levels, indicating the likelihood that inclusion of additional activities focused on immunological methods would enhance learning.

Similarly, to assess acquisition of soft science skills, a one-page self-reflection essay was assigned. In this essay, students were asked to rate their performance using an established teamwork rubric.<sup>6</sup> Overall, their comments were insightful and self-critical. Frequently,

they mentioned being more self-reliant and apprehensive about group work prior to this exercise, whereas their opinion of group work became more positive afterwards. Experience indicates that use of this exercise can be

anticipated to bolster critical thinking skills among undergraduates in immunology while allowing them to take advantage of a valuable resource offered by *The Journal of Immunology*.

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- <sup>6</sup> <https://kyskillsu.ky.gov/Educators/resources/Student%20SelfAssessment%20and%20Reflection/TeamworkRubric.pdf>

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