

TABLE 1**Overview of the five POE activities.**

A&P topic	POE activity scenario
Unit 1: Overview of A&P and the cell (homeostasis overview, body systems, and levels of organization)	Glucose and insulin regulation in Type I diabetes
Unit 2: Histology, integumentary system, bone (bones, blood calcium, calcium and muscle and nerve function)	Calcium regulation and hypoparathyroidism
Unit 3: Nervous tissue (neurotransmitter dysfunction, membrane potentials, synapses, action potentials)	Botulinum toxin
Unit 4: Nervous system and connections (autonomic nervous system and special senses)	Nervous system branches and functions

TABLE 2**Unit 3 key points related to lecture material.**

Unit 3 lecture material	Unit 3 activity key points
Neuromuscular junctions	Botulinum toxin effect on NMJs
Nerve communication	Toxin disruption of nerve communication
Neurotransmitters	What neurotransmitters (NTs) are affected
Action potentials	Toxins' and NTs' influence on action potentials
Ion channels	Ion channel involvement in NMJs
Homeostasis	Homeostatic balance and toxin's effect on homeostasis

TABLE 3**Unit 3 class structure and timing.**

Class structure	Approximate time
Introduce the POE activity scenario and driving questions.	5 min.
Present PowerPoint slides (Online Appendix) and facilitate discussion.	10 min.
Students assigned to groups (about four per group) to work together analyzing the secondhand data and analysis questions section (Online Appendix) as well as recording their 10 observations.	20–25 min.
Students record group member names to give participation ratings (1 = poor to 5 = excellent) to their classmates.	Part of group work time
The instructor and TAs join various small groups to probe students about the data and scenario and answer any student questions.	Part of group work time
Students work with their small groups to respond to a Google poll related to the scenario and data section.	Part of group work time
Following the small-group session, a full-class discussion takes place, covering questions and final thoughts about the POE activity.	10–15 min.

TABLE 4**Student survey responses (n = 291).**

Survey questions	Strongly disagree (%)	Disagree (%)	Undecided (%)	Agree (%)	Strongly agree (%)
The POEs were related to the material from their corresponding units (i.e., POE 1 was related to the material from Unit 1).	5.7	0.4	3.1	39.0	51.8
The POE scenarios were interesting and engaging.	5.7	4.8	6.6	44.7	38.2
The POE driving questions were thought provoking.	5.8	1.8	11.9	42.5	38.1
The POE data and analysis sections were helpful for answering the driving questions.	5.3	3.1	5.7	36.4	49.6
The POE observation section was helpful for organizing the information throughout the POE activity.	5.7	4.4	13.6	39.0	37.3
The POEs all incorporated the overarching theme of homeostasis.	5.3	1.8	8.3	37.7	46.9
The POEs provided a useful example for applying the material learned in class to a real-world scenario.	5.3	3.1	4.8	39.0	47.8
The POE scenarios were application based and required using a combination of material from class, individual knowledge, and the POE data to answer the questions.	4.4	1.8	7.0	36.0	50.9
The POEs helped with connecting all of the units from class.	6.2	5.7	14.5	37.9	35.7
The POEs were comprehensive and built upon each other.	4.0	4.0	13.7	40.5	37.9

Example short-answer responses

I loved how each POE was connected and tied in somehow to what we have been learning in that week's unit. The only thing I disliked was how long the packed was... but that wasn't really an issue because I loved doing each POE.

I liked that the POEs related to what we were studying in class so we can see how it can be used in daily life. I also liked doing them in groups because it gave me a chance to engage with my classmates.

There was nothing that I disliked. What I liked about the POEs was they were very engaging and interesting.

I actually really liked the POEs overall. They made me understand the units better overall in a real-life situation. I think more time to work on them would be better.

I really liked the assignments. Some of them were harder than others, but it really helped me expand my knowledge on the topic and past topics we were learning.

I liked how the POEs applied what was learned in class to real-life scenarios. They are all step-by-step, making the POEs both easy to understand but also challenging at the same time. Overall, I loved the POEs and think they are a great learning tool!