The Energetic Transfers activity was taught at ISEE's WEST program for incoming undergraduate UCSC transfer students. This three-day course taught 21 biology students how to model energy flow throughout two local ecosystems by depicting the arrangement, abundance and production of primary producers, consumers, and carnivores. The concept of energy flow through organisms and environments is fundamental to biology, and representing natural phenomena with models is used by all STEM fields. After completion of this activity, students understood trophic transfer efficiency and developed their identities as scientists.

Learners also engaged in the practices of "developing and refining models" and "generating hypotheses," during this activity. Both of these skills are necessary when completing research, and they mimic the real refining process scientists complete when modeling their data. These are needed skills that the students will use in their future classes and careers.

Learners were presented with two ecosystems local to UCSC, the sea otter/kelp forest and the barn owl/grassland ecosystem, in order to familiarize themselves to research opportunities and habitats in Santa Cruz. A raising questions activity provided learners with museum specimens and prompted learners to ask questions on how energy was flowing through the ecosystem. The learners then developed initial hypotheses, and they were provided a species portfolio to develop a model that could help them refine their hypotheses. Throughout the activity students were provided with more information and data to revise their models and hypotheses, including a data spreadsheet and food web thinking tool. After a jigsaw and synthesis review, students completed a culminating assessment task (CAT) worksheet for individual assessment with the given prompts: a) Draw a schematic of your final model and list what changes your model underwent after incorporating new evidence introduced in Part 2 of the inquiry. In your model, make sure to account for all energy pathways and label these pathways. b) What was your original research question and what is your final hypothesis based on this model? c) What do you notice about trophic transfer efficiency and how can you explain it?

This helped students summarize their models and express their understanding of trophic transfer efficiency. Our rubric awarded a maximum of six points, two points for each of the three knowledge statements. Thirteen students scored 5-6, seven students scored 3-4, and one student scored 1-2 points. Overall, our students scored well and demonstrated a solid understanding of the energy flow through an ecosystem, which is a key content item for undergraduates in biology.

In addition to assessments on understanding of content, we had two metacognition timeouts where students would reflect on their experiences with the activity and how that translated into their view of themselves as a scientist. Between the two timeouts, there was a common shift in learners viewing themselves as lacking the background or skills to complete a scientific project, to a state of higher confidence in identifying as a scientist while understanding obstacles each student faced are part f being a scientist.