

Going further as students develop expertise

Making these exploratory argumentation activities a low-stakes, easy-access experience for students is the top priority when they are new to scientific argumentation. However, after several units in which students experience scientific argumentation as a central process for building knowledge, they may be ready to do more than simply propose initial explanations and discuss the kinds of evidence they might need to test those explanations. If your students are ready to do more rigorous argumentative thinking, even when the science content is new to them, once they have proposed their initial explanations, you could consider a couple of options for taking the next step.

Asking critical questions: Plausibility based on existing science ideas

One of the strategies we recommend to support students in critiquing scientific arguments is the use of critical questions. Critical questions are questions students can ask of scientific arguments (their own or others') that embody particular criteria for quality (Nussbaum and Edwards 2011). When students are ready, you can use exploratory argumentation activities to introduce an important critical question asking about plausibility:

Is the explanation proposed in the argument *plausible*, meaning does it fit with ideas that we already know are scientifically accurate?

Once students have proposed initial explanations in an exploratory activity, you can ask them to consider the various explanations and decide whether all of them are plausible. Do they all fit with the ideas that the class has learned so far about how the natural world works? If any of them do not, what about them is inaccurate or unlikely? For example, students might say that the alien attack explanation of the dead city is perhaps possible but not plausible, because there are no known examples of aliens attacking humans.

Adding evidence to support or refute explanations

Another possible extension to the exploratory argumentation activities involves adding evidence. Once students have proposed initial explanations, you can introduce some additional, accessible information for students to consider as possible evidence. Based on their evaluation of that information, students can decide if it supports or refutes any of their initial explanations and what further evidence they might want to have available. For example, after students propose initial explanations of what happens when the alcohol and water are mixed, the teacher could perform the demonstration again, this time taking the mass before and after mixing.

Reference

Nussbaum, E.M., and O.V. Edwards. 2011. Critical questions and argument stratagems: A framework for enhancing and analyzing students' reasoning practices. *Journal of the Learning Sciences* 20 (3): 443–88.