Introduction

- Using evidence from an investigation to make an argument about a phenomenon is an important component of scientific literacy.
- Arguments from evidence are attempts to justify claims using both evidence and reasoning connected to a scientific model or theory. They stem from uncertainty about possible competing explanations of a phenomenon.
- The Carbon TIME curriculum provides students opportunities to conduct experiments, collect data and link evidence back to scientific models.
- Students often interpret the purpose of investigations differently than scientists (Dauer et al., 2014).

In this study we investigated how students:

1. Used evidence to explain a model of plant growth
2. Critiqued arguments from evidence about plant growth before and after instruction.

Methods

We coded and analyzed 52 pre and post instruction interviews of middle and high school students (n = 26) from six states who had completed at least three out of six curricular units about matter and energy (at least six weeks of instruction) from pilot versions of the Carbon TIME (Transformations in Matter and Energy) Curriculum. In the interviews, students were asked to explain and critique two students’ claims about how plants grow and their investigations that tested their claims about plant growth.

Karen and Mike Interview Cards

Students were asked:
1. Whose claim they thought was correct.
2. Explain how each of the claims was supported by the evidence.
3. Were there any weaknesses in Karen’s or Mike’s reasoning?

Results

- Students improved their ability to trace matter using weight evidence when explaining Mike’s experiment, and somewhat for Karen’s.
- Many students were already at a level 3 pre-instruction for explaining matter tracing using weight evidence in Karen’s experiment.
- Students did not improve in their ability to critique Mike’s or Karen’s arguments from evidence.

Conclusions

Students may need more explicit instruction on how to use mass data as evidence to support or refute a claim. Principles based instruction may be necessary, but not sufficient in preparing students to critique arguments from evidence.

Teaching Implications

Understanding purposes of investigations: Students need to interpret the hypotheses, procedures, and results of investigations in ways consistent with their scientific purpose and design. Design heuristics like Carbon TIME’s The Three Questions may be valuable, but must be used more explicitly throughout instruction.

Practice using data to inform arguments: Students need more experience with testing claims by doing their own investigations or by critiquing others’ investigations and arguments from evidence.

References


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