

Using Analogical Learning in Science to Improve Conceptual Understanding

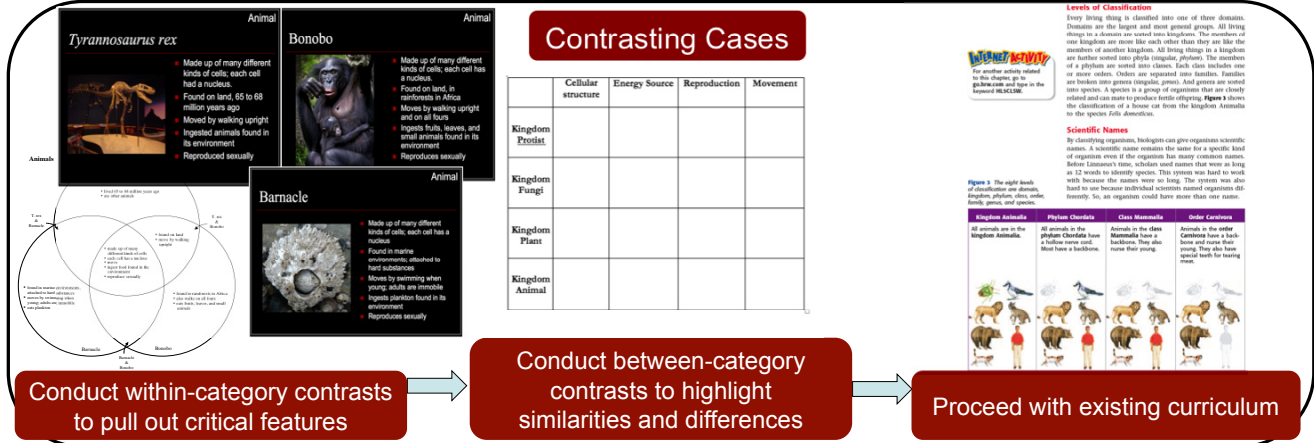
Introduction

Research Questions

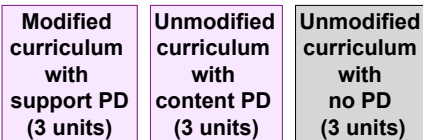
- What are the learning and transfer effects of pairing within-concept and between-concept comparisons?
- How can the principles of analogical comparison discovered in the laboratory be translated into classroom pedagogy?
- Does learning through contrast improve preparation for future learning?

Prior Work

- Multiple analogs, restatement of principle support schema acquisition (Gick & Holyoak, 1983)
- Guided comparison better than instructions to compare only (Gentner, Lowenstein, & Thompson, 2003)
- Contrasting cases before direct instruction are more beneficial (Schwartz & Bransford, 1998)
- Analogies used in classrooms, often without cognitive supports (Richland, Zur, & Holyoak, 2007)



Project overview



End of Unit Test

Unmodified Units

Eighth Grade Science State Assessment

This research was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305C080009 to 21st Century Partnership for STEM Education. The opinions expressed are those of the authors and do not represent views of the U.S. Department of Education. We would like to thank our collaborators: Donna Cleland, Gary Cooper, Jennifer Cromley, Laura Desimone, Christine Massey, Joe Merlino, Nora Newcombe, Andy Porter, Kalyani Raghavan, and Mary Sartoris.

Dependent measures

End of Unit Test

Contrasting Case questions

Targets content covered in curriculum and highlighted through contrasting cases

- 7) You are learning about a multicellular organism that has cells containing nuclei. It doesn't eat; instead, it uses digestive juices to break down substances in its surroundings and absorb nutrients. In what kingdom does this organism belong?
- Plant
 - Bacteria
 - Fungi*
 - Protist

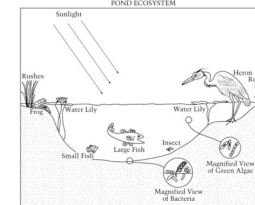
Transfer questions

Targets content covered in curriculum and NOT contrasting cases, but contrasting cases should prepare students to learn

- 11) Today, what would scientists do if they encountered an organism that fit none of the four kingdoms?
- Destroy the organism
 - Create a new category*
 - Ignore the organism
 - Change the organism

Curriculum-aligned questions

Targets content covered in unmodified curriculum



- Which of the following living things in the pond system uses the energy from sunlight to make its own food?
- Insect
 - Frog
 - Water lily
 - Small fish

Eighth Grade Test

State science assessments

Targets long-term knowledge retention and alignment of instructional content to state assessments



8. How is this fish adapted for weedy areas in freshwater lakes?
- The upper fin of the fish looks like waves of water.
 - The lower fins of the fish look like the legs of a turtle.
 - The stripes of the fish look like plants in the water. *
 - The front of the fish looks like the surface of a rock.