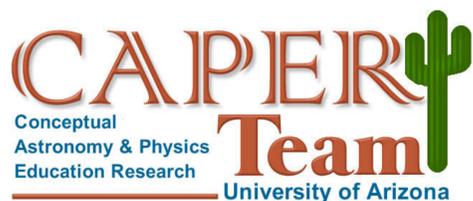


THE CONCEPTUAL ASTRONOMY AND PHYSICS EDUCATION RESEARCH (CAPER) TEAM

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An overview of the research done by the Conceptual Astronomy and Physics Education Research (CAPER) Team is presented. CAPER conducts rigorous educational research into student understanding and learning difficulties in the areas of astronomy, astrophysics, physics, planetary science, and earth & space science. The results of this research are used to inform the development, evaluation and dissemination of innovative instructional interventions and public outreach activities that promote learners' intellectual engagement through collaborative learning strategies. Additional targeted areas of effort include conducting systematic evaluation of educational projects, exhibits and programs, providing professional development programs for elementary and secondary science teachers, conducting teaching excellence workshops for university faculty, and partnering with museums and science centers to effectively bring science to the general public. Work is primarily supported by the US National Science Foundation (NSF), NASA, and the US Department of Education.



WHAT IS CAPER?

CAPER is the Conceptual Astronomy and Physics Education Research Team at the University of Arizona in Tucson. CAPER consists of more than 20 active researchers that include faculty, postdoctoral fellows, and graduate students. CAPER is involved in fundamental research focused on improving the teaching and learning of astronomy, astrophysics, physics, planetary science, and earth & space science. This work is also informed by research from the fields of science education, cognitive science, educational psychology, and a variety of science disciplines.

WHY DOES SCIENCE EDUCATION RESEARCH MATTER?

Educating students and the public about science and technology is of prime importance for improving scientific literacy. Astronomy is an ideal vehicle for engaging and educating the public because of the intrinsic interest people have in the universe. Research into students' beliefs and reasoning difficulties, teaching methods, and the effectiveness of educational materials can be used together to vastly improve our understanding of how people learn science. It is from this deeper understanding that we can create instructional strategies that make the teaching and learning of science a more meaningful, efficient and enjoyable process for both students and instructors alike.

WHAT DOES CAPER TEAM RESEARCH?

CAPER has four main areas of research. While the schema below may suggest some separation between these different areas of research, in reality they continuously overlap and influence each other. In this way research from each area together is part of an interactive process in which feedback is used to inform practice.

◆ FORMAL EDUCATION

CAPER's formal education research focuses on students' pre- and post-instructional beliefs and reasoning difficulties about science concepts in both a traditional classroom and the online course context. The investigation of these student-learning difficulties is being conducted in the K-12 (primary and secondary education) setting as well as in non-science major classes at the college level. Results from this formal education research have been used to inform the design, field-testing, and evaluation of various teaching strategies and instructional materials used to help students elicit, confront, and resolve their alternative conceptions. These include novel methods for using electronic responder devices to engage students in large lecture classrooms, the *Lecture Tutorials for Introductory Astronomy*, the *Life in the Universe Activities Manual*, *Lerner-Centered Astronomy: Strategies for Teaching ASTRO 101*, *Astronomy Online*, and the Astronomy Ranking Tasks.

◆ INFORMAL EDUCATION

For many people, a science museum or science center provides one of the few places where they can experience something about science first-hand. It is critical that exhibits and demonstrations are scientifically accurate and pedagogically sound, while also engaging the audience in a stimulating and memorable experience. CAPER assists in developing educational materials for museums and science centers that are based on these constraints. In addition, CAPER assists in designing and delivering summer camps for students in the areas of physics, mathematics, meteorology, and astronomy.

◆ TEACHER PREPARATION AND ENHANCEMENT

CAPER is involved in mentoring, teaching courses, and providing professional development opportunities for pre-service and in-service science teachers at the primary and secondary education level. These interventions are focused on both improving classroom practice and on supporting teachers in an effort to reduce the high teacher turn-over rate among science teachers at all levels. Much of this work is done through internet-delivered courses. In addition, CAPER conducts teaching excellence workshops sponsored by the NSF and NASA at professional conferences that provide college faculty with the tools and instructional framework needed to promote a learner-centered classroom environment.

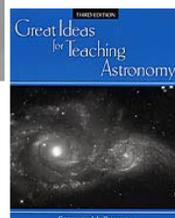
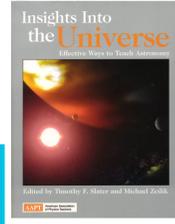
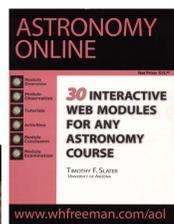
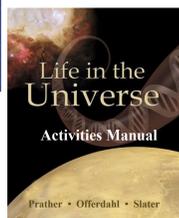
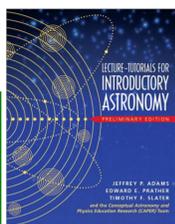
◆ DEVELOPMENT & EVALUATION

The CAPER team is working with numerous Education and Public Outreach (EPO) programs to assist in the development of stand-alone research-based instructional materials, curriculum supplements, museum exhibits, engaging online courses, as well as handbooks and best-practice manuals, all designed to promote the understanding of science. These courses and materials have been designed for use with K-12 students, non-science major college students, pre-service and in-service teachers, and the general public. In addition to helping EPO efforts through the development of support materials, CAPER is also involved in designing and implementing systemic external evaluation of third party EPO programs to assess educational effectiveness and impact.

Astronomy Education Review

<http://aer.naoa.edu>

Although a wide variety of journals exist which publish the work done by science education researchers, until recently a journal did not exist that exclusively catered to astronomy education research. With the introduction of the "Astronomy Education Review" online journal (<http://aer.naoa.edu>), supported by the NAOO, ASP and AAS, there now exists a forum in which results from this content specific field are widely shared.



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