

Constructing Ideas in Physical Science

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What is CIPS?

Constructing Ideas in Physical Science is a yearlong, inquiry-based physical science course designed to engage students in constructing meaningful understanding of foundational concepts and skills in physical science. Extensive hands-on, minds-on activities are presented using a learning cycle teaching strategy consisting of four phases:

1. Elicitation of initial student ideas.
2. Development of new or modified ideas.
3. Support of consensus ideas based on evidence.
4. Application of consensus ideas to new situations.

The CIPS project is supported by the National Science Foundation and aligned with state and national science education standards.

What topics are addressed in CIPS?

CIPS has 5 units. Each unit consists of 2 or 3 cycles of carefully crafted activities designed to help students master a clearly defined set of concepts and skills. Scientists often assume that their observations of nature can be explained in terms of interactions or energy transfers between objects. The CIPS course therefore, is focused around these themes.

- Unit 1:** Measurements and Interactions
- Unit 2:** Light Interactions and Energy
- Unit 3:** Mechanical and Gravitational Interactions
- Unit 4:** Interactions and Conservation
- Unit 5:** Interactions and Substances

Why CIPS?

Advances in science and technology are changing the skills required of workers throughout the modern workplace. Science and technology education must not be limited only to those who are preparing for careers in science, engineering, and related fields.

Two national projects¹ have identified the scientific knowledge and skills that students should have the opportunity to learn at various stages in the K-12 science curriculum. In addition, recent research on learning indicates that inquiry-based teaching strategies can be useful in engaging students in the process of developing a deeper conceptual understanding of these fundamental ideas in science. The CIPS physical science curriculum was developed using this research base and the standards and benchmarks identified as appropriate for middle-school students. In this way, CIPS strives to improve scientific and technological literacy for *all* students.

How do CIPS students experience science?

The CIPS classroom may be different than the traditional science classroom where experiments are frequently used to confirm the correct answer previously presented by the textbook and teacher. In the inquiry-based classroom, students are continually engaged in doing investigations and discussing the meanings of their investigations in small and large group formats. In CIPS, discussions are focused on the activities and students are always required to support their claims and explanations with evidence and reasoning rather than appealing to the authority of the teacher, textbook or scientists. Thus, CIPS engages students in science activities where they think, write, and reason about the physical world and how it works. This is demanding work that requires learners to become part of a scientific learning community where cooperation, evidence, and reason are prized.

In addition to the laboratory activities, CIPS provides a companion book titled Chronicles of the Wandering Star. The entertaining story line introduces the concepts that are explored in the cycle activities and serves as a motivational tool while improving language skills and literacy.

¹ National Science Education Standards and Benchmarks for Scientific Literacy, Project 2061

How are students evaluated?

Because the CIPS learning environment values deeper conceptual understanding, students will have many opportunities to demonstrate their mastery of the concepts and skills introduced in the curriculum. In addition to the traditional cycle quizzes and performance-task unit tests, a record book is provided for each student to keep an ongoing account of his or her observations and explanations of the phenomena explored. Each cycle includes several practice and application activities that can be assigned as homework. Furthermore, each cycle has Consensus Idea Forms where students summarize important ideas and conclusions developed by individuals, small groups, and in large class discussions.

How do students react to inquiry-based instruction?

Students react very positively toward an activity-based science curriculum. However, this program also asks students to assume more responsibility for their own learning, therefore, some may find the lack of authority-based answers disconcerting. Often these students just need the opportunity to build confidence in their own ability to think like a scientist. Research indicates that once students develop the idea that they are capable of scientific thinking, they begin to appreciate the inquiry approach where they construct and evaluate their own explanations rather than memorize the conclusions of others.

How can I find out more about CIPS?

For more information check the web at:

<http://cipsproject.sdsu.edu>

or contact the publisher

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