

CENTER FOR CURRICULUM MATERIALS IN SCIENCE

CCMS PARTNERS

AAAS
Michigan State University
Northwestern University
University of Michigan



MISSION

To improve science curriculum materials design, selection, and use through

- Research
- Leadership Development
- Teacher Development

PROGRAMS

- Doctoral Program and Postdoctoral Fellowships
- Research Program
- Teacher Development Program
- Communication Program

GUIDING PRINCIPLES

- Centrality of science learning goals
- Importance of pedagogical supports
- Value of student investigations
- Usefulness of learning technologies
- Need to serve diverse learners
- Attention to teacher learning
- Awareness of policy context

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Centers for Learning
and Teaching Program

PREPARING NEW LEADERS

DIVERSE AND HIGHLY QUALIFIED SCHOLARS

CCMS supports 17 graduate students and 8 postdoctoral fellows:

- Graduate students have strong backgrounds in the natural sciences (many with master's degrees).
- Postdoctoral fellows have Ph.D.'s from highly respected institutions in science education, the learning sciences, and the natural sciences.
- All have teaching experience in K-12, university, or informal education settings and in urban, suburban, or rural areas
- Students and fellows come from the U.S., Japan, Ireland, and Cyprus
- Presentations in 2004 at NARST, AERA, AETS, and ICLS.
- Upcoming presentations at NARST, AERA, AETS, and NSTA.

CCMS graduate students and fellows move on to leadership roles:

- Darlene Slusher, from Northwestern postdoctoral fellow to assistant professor of chemical education at Coastal Carolina University
- Felicia Moore, from Michigan State University postdoctoral fellow to faculty member at Teachers College, Columbia University
- Eleni Kyza, from Northwestern graduate student to postdoctoral position at the University of Cyprus

A RICH RESEARCH ENVIRONMENT

- Access to world-class faculty, research capabilities, and connections
- Opportunities to participate in regular cross-campus discussions about research projects and science education issues
- Annual Fellows' Retreat and Knowledge Sharing Institute to share research projects and findings within and beyond the CCMS community
- "Greenhouse sessions" at the Knowledge Sharing Institute focus on current research projects and interests
- Special interest groups to explore important issues (e.g., diversity)
- Inter-institutional graduate seminars: Spring 2005 seminar focuses on historical perspectives on science curriculum materials design
- Access to a variety of curriculum development and related teacher professional development projects as contexts for research

BEYOND THE CENTER

- Visiting scholars provide access to a wide range of expertise
- Early Career Research Affiliates program to attract scholars interested in contributing to the CCMS research mission
- Upcoming Knowledge Sharing Institute brings together science curriculum materials developers from EDC, BSCS, CIPS, SEPUP, and FOSS to share tools and frameworks for science curriculum materials R&D

INNOVATIVE RESEARCH AND METHODS

CCMS research addresses questions related to curriculum materials for all children, teacher learning and educative materials, the curriculum development process, assessment, and policy.

Current research projects and methods are highlighted below (for more details, see handout).

CURRICULUM MATERIALS FOR ALL CHILDREN

Research questions include how curriculum materials can scaffold learners in complex practices and motivate all students to engage in and learn from activities. Research also seeks to identify attributes of curriculum materials that support local adaptation and attend to the learning needs of all students.

Supporting Students in Constructing Scientific Explanations

An instructional framework to support students in writing evidence-based scientific explanations was implemented in a project-based inquiry unit. Classroom studies identified the kinds of scaffolding and teaching practices that supported learning.

Students Constructing and Defending Scientific Explanations

Analyses of students' evidence-based explanations in an inquiry unit revealed the need to support students' efforts to explain a phenomenon under study and to construct an evidence-based defense of that explanation.

Integrating the Nature of Science into Inquiry Teaching

Ongoing research is exploring how to foster students' understanding of the nature of science within the context of their own inquiry projects.

Students' Developing Understanding of Data

This study considered whether students performed differently when analyzing firsthand and secondhand data and offered possible reasons for differential findings.

Scaffolding Systemic Understanding in Genetics

A pilot study of high school biology students' use of an inquiry-based unit on genetics found that students improved in their understanding of key genetics concepts and gained a more systemic understanding of genetic phenomena.

A Multidimensional Perspective on Engagement in Inquiry Practices

A study using project-based curricula found that teachers support students along three dimensions of inquiry practices—cognitive, social roles, and linguistic. Researchers developed a theoretical model characterizing tensions and synergies between these dimensions of teacher support.

Restructuring School Physics Around Real-World Problems

Interviews with experts and novices demonstrate that solving ill-defined problems—such as those encountered in the real world—requires additional cognitive skills beyond those required to solve the kinds of well-defined problems that are typically provided in traditional curricula.

Collaborating with Students and Teachers to Develop Science Curriculum Materials

The design team for a high school unit is benefiting from student feedback and from the input of an experienced urban classroom teacher who is involved in defining the problems that the materials address, developing the instructional approach and assessment, and testing the activities.

TEACHER LEARNING AND EDUCATIVE MATERIALS

Research questions focus on how teachers interpret and use curriculum materials, what qualities of pre-service education and professional development can best help teachers to successfully use and adapt high-quality materials to serve the diverse needs of students, and how curriculum materials can take into account the diverse needs of teachers who will be enacting the materials.

The Role of Curriculum Materials in Teaching and Learning to Teach Science

Exploratory studies suggest that teacher-educators differ about the role and use of curriculum materials and point to implications for both materials design and teacher education.

Practice-Based Professional Development

Ongoing studies are exploring professional development approaches that situate teachers' learning of science and pedagogy in the context of planning, enacting, and analyzing their teaching of a project-based inquiry unit.

Preservice Teachers' Critique and Adaptation of Science Curriculum Materials

Pre-service elementary teachers who critiqued and adapted existing science curriculum materials in their science methods course increased their attention to how the materials promoted inquiry-oriented science teaching.

Educative Curriculum Materials

Drawing on the work of multiple research groups, researchers have developed a set of design heuristics for educative science curriculum materials that promote teacher learning, with the goal of moving the field toward principled design of materials.

METHODS

Characterizing Participation and Engagement in Project-Based Learning Environments

Researchers have developed a theoretical framework for examining the ways in which classroom contexts and individual students' knowledge and beliefs influence participation and engagement in project-based learning environments.

Assessment Analysis Procedure

Researchers have refined a procedure for analyzing more precisely the alignment of individual assessment items to content standards and for making judgments about what students do and do not know.

Categories and Criteria for Video-Analysis of Classroom Practice

To improve classroom observation tools, researchers are developing criteria that characterize dimensions of teaching—as well as the quality of the science content being taught—that may contribute to student learning of specific ideas and skills.