

Oct. 10, 2006

To: Science & Math Faculty

From: Trish Ferrett, HHMI Grant & CISMI Director
Fernán Jaramillo, CISMI Co-Director
John Ramsay, Associate Dean of the College

Re: **Call for HHMI Interdisciplinary Curriculum Development Proposals**

You are invited to submit a proposal for interdisciplinary science and math curriculum development work to be carried out in the summer of 2007 leading to new curricular experiences for students in 2007-08. This work will be funded from the curriculum development "flexible fund" in our HHMI grant. "Interdisciplinary" work is very broadly defined as we experiment with a variety of approaches in courses rich in science and math. Faculty working full time on a summer project can receive stipends of \$1000/week, up to a maximum of \$5000. Proposals involving several faculty can be larger than \$5,000. Proposals can be submitted by individuals or groups. Curriculum development is invited in these areas:

1. In existing courses or shared in small to large ways between existing and new courses: labs, case studies, modules, projects, computational or modeling experiences, problem-based learning experiences, etc.
2. New interdisciplinary courses or experiences, including pilot projects for interdisciplinary comps or courses for nonmajors (including first-year seminars).
3. Adaptation of existing interdisciplinary materials developed by others for use in new or existing courses.

Proposals should be 1-2 pages in length. Please be specific about the nature of the activities to be undertaken with grant support and about the student learning goals for the curriculum to be developed. Preference will be given to projects that:

1. Come to completion by July 2008.
2. Align with some of the student learning goals for scientific inquiry and interdisciplinarity articulated in summer 2005 by Carleton science and math faculty (see below).
3. Result in concrete products that can be shared with others on our new CISMI web site (models for interdisciplinary learning, modules, case studies, projects, labs, problem-based approaches, integrative learning "tools" and strategies, assignment types, etc.)
4. Aim to create course-embedded tools to assess outcomes for student learning that are aligned with course goals. Current and past HHMI course developers and other Carleton faculty can be of assistance in thinking about these issues as your project develops. You will be expected to pick one student learning goal that is important to you and assess it using assignments or activities embedded in your course.

The HHMI/CISMI Advisory Committee will review proposals in January. You will receive notification about funding by late January 2007.

Submit a copy of your proposal **via email** to Trish Ferrett by **Dec. 15, 2006**. If you have questions of any sort, please contact Trish Ferrett (tferrett@Carleton.edu, x 4408).

HHMI Student Learning Outcomes (a work in progress)

There are various contexts within which these student learning outcomes arise that can influence their appearance and the demonstrated level of mastery. Possible contexts include problem solving in an introductory or higher-level courses, our new Science Scholars winter break workshop, problem sets, inquiry-based projects involving lab/field/computational/modeling work, research projects, research papers, student summer research, and comps.

Problem Solving/Inquiry Skills

1. Engaging, approaching the problem
 - Willingness to engage problem, ask appropriate questions
 - Recognition/awareness of ambiguity (may not be a single, unique solution)
 - Recognize complexity and complex systems, breaking complex problems into parts
 - Restating the problem
 - See patterns, determine which are “real”(relevant, meaningful)
 - Choosing what to focus on, define scope of inquiry, what you focus on
2. Contextualizing, modeling, and working on the problem
 - Understanding limitations – when a solution is applicable
 - Who audience is, who are you communicating with
 - Design an experiment or research project
 - Moving back and forth between simple and complex ideas and approaches
 - Working with models (conceptual, numerical, mathematical, visual)
 - Scaling the problem up or down (in time, in place, from individual to group or vice versa) so that you can choose the appropriate methods to solve it
 - Approximation – ability to approximate some factors needed for solving a problem, knowing when you can approximate and when you need to find the exact value
 - “Black box the problem” – knowing what you can ignore when solving problem, what you need to really know in order to solve a problem
3. Evaluating the solution, next steps
 - Analyze situation, data, information and draw conclusions
 - Does a solution describe or does it solve?
 - Questioning the results, taking a critical stance
 - Reflecting on process and product
 - Confidence, risk-taking
 - Moving back and forth between the problem and the solution, an iterative process

Multiple Perspectives (Interdisciplinary) Skills:

- Ask "integrative" questions that are rich in discussion possibilities, acknowledge a range of data/answers, show a willingness to explore
- Becoming aware of and asking what other areas/disciplines are or can be involved, including developing a critical perspective on the relevant disciplines.
- Developing the confidence to seek knowledge without being deterred by disciplinary boundaries.
- Using tools, concepts and/or methods from two or more disciplines to solve or address a problem (problem-based approach).
- Engage in effective, critical, civil discourse about a problem or issue, across disciplines. Includes development of listening skills, reflecting back and digesting verbal skills, and "translation skills" from technical and expert language to broadly accessible language.
- Active searching for relevant disciplinary approaches
- Recognition that there is natural tension among perspectives (research methods, what is knowledge, underlying theories/epistemologies, units of analysis, what counts as evidence, etc...)
- Conceptual innovation: integrate perspectives to produce new understanding and insight for the student. Includes generating and applying disciplinary-crossing concepts, extending these concepts, theories and methods in a discipline beyond their normal bounds in a fruitful way.
- Use of integrative tools that allow travel from "home" discipline to outside disciplines and back again (including metaphors, analogies, bridging concepts, compound concepts)
- Moving from simple to complex and multi-causal explanations for a complex phenomenon
- And more!

Key literature article on assessing student interdisciplinary work:

Mansilla, Veronica B. (2005). "Assessing Student Work at Disciplinary Crossroads", *Change* 37 (1), pp. 14-21.

<http://www.pz.harvard.edu/interdisciplinary/pdf/AssessingStudentWork.pdf>

Ideas above from Carleton math and science Faculty at a retreat in August 2005, and from a summer 2006 study by Kim Smith (Political Science and ENTS) for ENTS.