Request for Proposals - Department-Driven Course and Curriculum Improvement

The scope of knowledge about effective strategies to facilitate college learning in math and science has greatly expanded in the last decade. As a result, the College of Science **seeks proposals for projects to update instructional practices in science and math courses at the departmental level.** Projects should lead to the implementation of evidence-based practices that facilitate student-centered classroom experiences in multiple math/science courses. These practices focus on encouraging students to become active and collaborative learners in class. Improving the retention and success of students from diverse backgrounds in STEM courses is highly encouraged and explicit incorporation of practices that support the inclusive classroom should be described. *It is strongly recommended that teams read and discuss resources listed in the appendix prior to planning their proposals, especially if faculty members are unfamiliar with evidence-based instructional practices.*

- Grants are expected to range from about $50,000 to a maximum of $200,000 over two years; funding levels will vary depending on the scope of the project and the resources required to carry out the plan.
- Proposals should focus on multiple courses or a series of consecutive courses within a major sequence.
- Preference will be given for proposals focused on lower division and/or major core course sequences, especially those that traditionally have high D/E/W rates or that are correlated with student success in subsequent courses.
- Course improvements in upper division classes will be considered, but must be clearly linked to impact on degree completion and student achievement.
- Proposals may focus on transforming lecture format classes and/or laboratory curricula.
- Formative and summative assessment plans that use multiple metrics beyond student course evaluation forms are required.

Allowable budget expenses

Nationally, faculty describe the greatest barriers to the implementation of evidence-based instructional practices as the time required to learn and implement these pedagogical tools. To address these challenges, this program offers support to offset these time commitments and provide mentoring for teaching development. Justification for the requested funds must be provided and linked to the project.

- **Salary support**: Up to 1 month of faculty summer salary (max. $12k per individual – no limit on number of individuals) may be requested for course development.
- **Co-teaching**: There are pro-active, positive benefits to co- and team-teaching (e.g., see chapter 3 of Shelton et al. in appendix). In the context of this project, co-teaching means that both faculty members are present and engaged with ***every*** class session. Co-teaching requests must be reviewed and approved by the Dean's office; buy-out costs can be requested as part of the budget.
- **Post-doctoral fellow support**: Post-docs interested in teaching careers are especially well-suited to collaborate on these projects by splitting their time between research and instructional responsibilities. Partial support of a post-doc is encouraged. Submission of a professional development plan for the post-doc that clearly delineates how time-sharing between research and instructional time is required.
- **Teaching assistants, undergraduate learning assistants, graders and peer-instructors:** Funding for graduate TAs may be considered with strong justification. However, undergraduate learning assistants and peer instructors (LAs/PIs) have been shown to be particularly helpful in facilitating group work and project-based instruction in class. For more information about the Learning Assistant model, which includes a focus on teacher preparation, please see the University of Colorado's LA program website (link in the appendix). Costs associated with training and paying for LAs/PIs are encouraged.

- **External consultants:** Funds can be requested to pay external consultants to help develop, implement, and/or evaluate projects. The Center for Science and Mathematics Education is available to help recruit appropriate consultants.
- **Other expenses may be allowable with justification.** Please consult with the Dean's office if you have questions or concerns as you build your budget.

Sustainable Change and Alignment with Institutional and Departmental Priorities:

- Student-centered instruction and effective implementation of evidence-based practices should play a central role in projects.
- Project elements that lead to the mentoring of instructors who are new to evidence-based instructional strategies are highly encouraged.
- Applications should explicitly address the issue of sustainability after completion of the 2-year funding such that effective course reforms remain in place even as teaching assignments rotate and new personnel take over teaching assignments for the target course(s).
- Proposals are expected to align with departmental, college and university strategic plans and curricula. Therefore, the department chair and chair(s) of the undergraduate affairs or curriculum committee (or its equivalent in your unit) must be involved in the project and approve of the proposal.

University- and College-wide Resources Available to all Teams

The Center for Science and Mathematics Education (CSME) can provide the following resources and services to support the development and implementation of course/curriculum transformation projects:

- Consulting on best practices in STEM course reform, pedagogical practices, assessment metrics and tools, educational research literature, and other resources.
- Assistance developing materials for dissemination in reports, articles, presentations, etc.
- Assistance developing strategies for sustaining the course and/or curriculum transformations.
- Liaison assistance with other campus resources such as CTLE, College of Education, etc.
- Facilitating site visits for project-specific internal or external consultants.
- Hosting a series of project-specific professional development workshops and/or lectures to assist project teams.
- Coordinating and facilitating a faculty learning community (FLC) comprised of grant awardees that will meet monthly to share ideas, resources, and strategies.
- Assistance with attitudinal survey development or implementation and/or institutional review board (IRB) approval process.
- Assistance coordinating interdisciplinary projects between multiple departments.

The campus-wide Center for Teaching and Learning Excellence (CTLE) offers a wide range of resources and services to the campus community, including:

- Classroom observations and confidential teaching assessment consultations.
- Workshops on how to develop and implement student-centered pedagogical approaches.
- Boot camps on how to effectively integrate technology into instructional practices.
- Online resources for course planning: syllabus design, articulating learning outcomes, etc.

If specific additional resources would be helpful, please contact a member of the College of Science course/curriculum transformation support team:

- Diane Pataki, Associate Dean for Student Affairs, College of Science
- Jordan Gerton, CSME Director
- Holly Godsey, Director of Student Success, CSME

Required Proposal Elements

A. Cover Sheet and Project Team

List the personnel who will work on this project and how they will collaborate effectively on the project. Briefly describe the skills that each individual brings to the team and the project.

B. Course Transformation Plan (limit 3 pages)

- Identify the course(s) are you targeting for reform and why the project is a high priority for your department or program.
- Identify the current course objectives and how you anticipate they will change as a product of the project. Also indicate how these align with the overall major or program.
- Identify the current pedagogical strategies used in this course (these courses) and what evidence-based practices you expect to incorporate into the course design and why.
- What support do you need to implement the changes to your course(s)?
- What baseline data about your students and their learning would help inform your design efforts (e.g. example pass rates or DEW rates, success in subsequent courses or progression towards graduation)?

C. Implementation and Continuous Improvement (limit 1 page)

- Describe the prospective milestones and timeline of your project.
- Identify the most significant challenges to the implementation of your project and how you anticipate overcoming them.
- Describe your plan to collect and monitor student learning and faculty teaching effectiveness during the project. For example, will you compare pretests to posttests to monitor learning semester-to-semester? If you will conduct peer observations in the classroom, what metrics will faculty use to evaluate effective teaching practices? Various chapters within Shelton et al. in the appendix describe approaches for evaluating teaching and learning in STEM that go beyond student evaluations.

D. Institutionalization (limit 1 page)

- Describe how you will ensure that the revised curriculum is sustainable.
- For example, how will new instructors be mentored to maintain the reformed teaching approach?

E. Budget (limit 1 page)

Provide a description of requested expenses related to your project in table and narrative formats.

F. Letter of Support from Department Chair

Provide a letter from the department chair addressing how the project advances departmental priorities for student success.

Due Date: October 17, 2016

Proposal submission: Please submit a single PDF including all proposal elements to Diane Pataki, Associate Dean of Student Affairs, diane.pataki@utah.edu

Appendix – Background Reading on Evidence-Based Instructional Practices

Primary Reading:

Ambrose S.A., Bridges M.W., DiPietro M., Lovett M.C., Norman M.K. 2010 *How learning works: Seven research-based principles for smart teaching*. Jossey-Bass: New York.

Fairweather J. 2014. *Linking evidence and promising practices in science, technology, engineering and mathematics (STEM) undergraduate education*. National Research Council, Board on Science Education.

Freeman S.A., Eddy S.L., McDonough M., Smith M.K., Nnadozie O., Jordt H., Wenderoth M.P. 2014. *Active learning increases student performance in science, engineering, and mathematics.* PNAS 111, 8410-8415 DOI. 10.1073/pnas.1319030111

Handelsman J., Miller S., Pfund C. 2007. *Scientific teaching*. W.H. Freeman: New York.

Holdren J.P., Lander E. 2012. *Engage to excel: Producing one million additional college graduates with degrees in science, technology, engineering, and mathematics*; President's Council of Advisors on Science and Technology: Washington, D.C.

Malcolm S., and Feder M, (eds.) 2016. *Barriers and opportunities for 2-Year and 4-Year STEM degrees*. National Academies Press: Washington, DC. http://www.nap.edu/read/21739/

Other Useful Resources:

Bybee R.W. 1995. Science curriculum reform in the United States *in* Redesigning the Science Curriculum. Colorado Springs, Colorado: Biological Sciences Curriculum Study, 1995. Eds. Bybee and McInerney. Retrieved from http://www.nas.edu/rise/backg3a.htm

Classroom Observation Project: Understanding and Improving our Teaching using the Reformed Teaching Observation Protocol (RTOP).
http://serc.carleton.edu/NAGTWorkshops/certop/interpret.html

Hake R.R. 1998. Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. Am. J. Phys. 66(1): 64-74.

Handelsman J., Ebert-May D., Beichner R., Bruns P., Chang A., DeHaan R., Gentile J., Lauffer S., Steward J., Tilghman S.M., Wood W.B. 2004. Scientific teaching. Science 304(5670): 521-522.

Mintzes J.J., Leonard W.H. (eds). 2006. Handbook of college science teaching. Arlington. National Science Teachers Association.

Nelson C. E. 1996. Student diversity requires different approaches to college teaching, even in math and science: Amer. Behav. Sci., 40(2):165-175.
Pedagogies of Engagement Resource Collection: http://serc.carleton.edu/sp/pkal/index.html

Sanchez I.M. 2000. Motivating and maximizing learning in minority classrooms. New Direct. Com. Coll., 112:35-44.

Saul J.M., Beichner R.J. 2005. Teaching activity-based introductory physics in large classes: The SCALE-UP project, in J.A. Chambers, ed., Selected Papers from the 16th International Conference on College Teaching and Learning: Florida Community College at Jacksonville.

Shelton R.N., Rawlings H.R. et al. 2015. Searching for Better Approaches: Effective Evaluation of Teaching and Learning in STEM. Research Corporation for Science Advancement: Tucson.
http://rescorp.org/gdresources/publications/effectivebook.pdf

Sellers S.L., Roberts J., Giovanetto L., Friedrich K., Hammargren C. 2007. Reaching all students, a resource for teaching in science, technology, engineering, and mathematics (2nd ed.). Madison. University of Wisconsin Center for the Integration of Research, Teaching, and Learning.

SERC Starting Point: What is studio teaching? http://serc.carleton.edu/introgeo/studio/what.html

Seymour E., Hewitt N. 1997. Talking about leaving: Why undergraduates leave the sciences. Boulder, Westview Press.

Smith M.K., Jones F.H.M., Gilbert S.L., Wieman C.E. 2013. The classroom observation protocol for undergraduate STEM (COPUS): A new instrument to characterize university STEM classroom practices, CBE Life Sci. Educ.12(4): 618–627.

Tobias S. 1990. They're not dumb, they're different: Stalking the second tier: Tucson. Research Corporation.

University of Colorado Learning Assistant Program: https://laprogram.colorado.edu/node/8

Wieman C. 2007. Why not try a scientific approach to science education? Change 39(5): 9-15.

Wieman C., Perkins K., Gilbert S. 2010. Transforming science education at large research universities: A case study in progress: Change 42(2): 8-14.