STEM-NET Webinar "CSU Course-Based Undergraduate Research Experiences (CUREs)"

Questions from the webinar (02/06/2020 at 10:00am) attendees:

1.What funding mechanisms are there to support faculty who wish to redesign their courses?
- **Internal Faculty Incentive Grant** and **CSUPERB** grants.

2. How do you incentivize faculty to implement a CURE in their classroom? *- Faculty apply to be a part of our CURE Faculty Fellows Program. Their participation in the retreats and work to develop their course is paid.*

3a. How are CUREs supported and sustained at an institutional level? *- The Undergraduate Research Opportunities Center (UROC) has worked directly with the Provost to fund our non-STEM CURE Faculty Fellows. We (CURE Faculty Fellows Team) have also worked to build a CURE community of practice by paying faculty who are currently implementing CUREs to mentor faculty who are developing a CURE. Our (UROC) STEM Education Postdoctoral Scholar also facilitates a Teaching, Learning and Assessment (TLA) Cooperative for faculty that are interested in complex instruction within their CUREs.*

3b. How do faculty using CUREs assess and evaluate the effectiveness of this approach for student learning? - *We (CURE Faculty Fellows Team) are working with faculty to identify direct evidence of student learning of interest pre & post CURE. Check out the webinar from the CSUPERB CURE Network for more information (see question 11)*

4. Sources of funding exist to support CUREs. *-* **Internal Faculty Incentive Grant** and **CSUPERB** grants. See question 11.

5. How does one deal with grading in a CURE? *- Generally, CURE Faculty Fellows have put measures in place to grade more flexibility and there are more assignments that document effort and provide opportunities for feedback.*

6. How would I be able to participate more? Is there a list of contacts of the members of the interest group? - Here are the links to join Network Newsletter subscribe list and e-mail distribution list:

https://www.getrevue.co/profile/csuperb-cures

As well as the link to join Mighty Networks site to design effective ways to incorporate experiential learning for all STEM students across the curriculum.

https://csuperb.mn.co/share/dpMD7KgA4oNF_QGR?utm_source=manual

7. What are the workloads like with this type of course? *- This depends on if the entire course is a CURE versus several weeks and the number of CURE sections.*

8. Are faculty compensated with more WTUs? *No, typically the WTUs for CURE courses or modules are the same as for any other course.*

9. Have courses been able to maintain their CURE focus when others not in the project started teaching them? *- Sometimes. Instructor talk and style heavily influences any and every research experience.*

10. How does one best scaffold the CURE in a 15-week semester for effective use of time and developing the student experience in research? *- We suggest allowing plenty of time for and*

guidance with generating hypotheses and iteration. - This creates the opportunity for student engagement in authentic research.

11. What resources are available to support new curriculum development to incorporate research? - ***CUREnet*** *and the NSF Improving Undergraduate STEM Education: Education and Human Resources* ***(IUSE: EHR)*** *Grant.*

12. Are there any examples of CURES in health-related courses? Yes, there are examples within the Genome Education Partnership for research regarding Clinical Variants. Additional examples of Course Based Undergraduate Research Experiences include research supported by HHMI.

13. How can we include environmental sustainability courses in our curriculum? *One central concern of sustainability is resource consumption, especially the consumption of nonrenewable resources. One method to consider may be layering environmental principles and concepts with already existing courses as a best practice. Another opportunity may be connecting environmental sustainability with the mission of the department or program within the context of the major learning outcomes.*

14.   How does one assess the benefit of CURE? *We recommend using a pre and post mixed methods design where ideally you assess the current structure of the course and student knowledge gains prior to implementing the CURE. Alternatively, you could assess students prior knowledge in the course and then look at learning gains after participating in the CURE.*

15.   How do I get enough support related to develop and implement CURE? *Erin Dolan and Colleagues are currently working on the publication of a handbook for developing CUREs. We are hoping it will be published in the near future. We have found time in summer to develop the CURE and plan for course activities may allow faculty to envision offering the course in the fall or spring with opportunities to iterate and revise course design along the way.*

16a.   I'd like to hear about how to incorporate cures into both lower division and upper division courses. *We have found that many faculty who incorporate research into an upper division course are already including some components of CUREs. One of the biggest distinctions we have seen is the extent to which it is necessary for faculty to be explicit about CURE components for lower division courses. Bring explicit helps to build student identity as scientists. For example, describing science practices such as analyzing data and the inclusion of academic vocabulary helps students to create frameworks of knowledge and skills.*

16b.   I'd also like to hear about different degrees of implementation from entire course cures to maybe cure modules (3-4 weeks or so) within a course. Have both been done? *Yes, both have been done. There are great examples of whole CURE courses (David Rhoads provided an excellent example). CURE modules include an introductory biology course taught by Erin Standfield incorporating a field experience as well as an organic chemistry lab course taught by Crystal Gonzalez-Samano synthesizing esters. There are multiple whole course examples available at https://serc.carleton.edu/curenet/index.html*

16c.   Do the presenters have any advice on different levels of implementation? *One of the best strategies we have found for structuring implementation is to closely align goals and SMARRT (Specific-Measurable-Achievable-Revelant-Realistic-Time-bound) Learning Outcomes. Using learning outcomes to identify what the learner will know and be able to do by the end of a CURE course or module creates a structure for the course, which can then align to activities and feedback.*

17.   How are student learning outcomes assessed and how are CUREs supported?

When creating an assessment plan for CUREs, we aim to triangulate direct evidence of student learning with indirect evidence. For example, we analyze students constructed responses on a lab report for competencies as well as their self-reported gains in a student survey. Based on the analysis from the assessment, we use the conclusions to drive the next iteration or offering of the course. Typically supporting CUREs has been part of the College/Department budget.

18. What are takeaways for our students in STEM majors that emphasize importance/benefits of research at the undergraduate level? Undergraduate research experiences result in many *Positive outcomes for students, including increased engagement (Hunter et al., 2007), understanding of scientific processes (Seymour and Laursen, 2004), interest in science as a career (Eagan et al., 2013; Lopatto; 2007; Russell, 2007), and persistence in scientific fields (Graham et al., 2013). Course-based undergraduate research experiences (CUREs) enable more students to gain research experience, compared with the traditional apprenticeship model, in which a student works in a principal investigator's lab.*

Proposed Student Benefits	Citation
Increased student engagement	Hunter et al., 2007
Increased content knowledge	Kloser et al., 2013; Jordan et al., 2014
Increased technical skills	Jordan et al., 2014; Rowland et al., 2012
Understanding of scientific processes	Seymour and Laursen, 2004
Interest in science as a career	Eagan et al., 2013; Lopatto, 2007; Russell, 2007
Persistence in scientific fields	Graham et al., 2013; Shaffer et al., 2014; Jordan et al., 2014; Brownell et al., 2012
Increased self-efficacy	Jordan et al., 2014; Drew and Triplett, 2008; Lopatto et al. 2008; Kloser et al., 2013

19. What plans are there to try to integrate STEM-NET CURE work with other CSU CURE efforts, such as the CSUPERB CUREs Network? *Both the STEM NET CURE webcast as well as the CSUPERB CUREs Network have posted and advertised the respective webinars. CSUPERB CUREs Network offers both a newsletter and webinars as well as a community of practice.*

20. How is CSUMB integrating CUREs across the curriculum? *We are specifically integrating CUREs across biology and mathematics curriculum with an emphasis in sequential CUREs in lower division introductory courses for biology. Math has two pathways for students to experience at least two CUREs. -* A question for Lipika Deka, Peri Shereen and Jeffrey Wand for math?

21. How is Class organization, lecture vs. group work balanced? *-There is a greater emphasis on group collaboration. Significantly less focus on traditional lecture as a mechanism for transmitting information*

22. How do departments successfully finance the additional supplies arising from CURE activities? *We have found that additional costs are minimal compared to existing prescribed lab*

costs. Some departments have the ability to fund internally, sometimes it is supported through the Center for Teaching and Learning or the College itself.