The DoC IT: a Professional Development Tool to Support and Articulate Alignment of One's Course with the Five Dimensions of CUREs

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INTRODUCTION

Since their advent, course-based undergraduate research experiences (CUREs) have become widespread throughout biology curricula as a means to engage students in relevant scientific opportunities (1, 2). Consequently, the literature is now replete with descriptions of CUREs and evidence of their effectiveness in promoting undergraduates’ science reasoning and process skills development, attitudes, motivations, and persistence in STEM (3–9). Across each of these instances, students are tasked with addressing novel questions through use of scientific techniques to generate findings with relevance beyond the boundaries of the classroom. This process is both collaborative and iterative, reflecting the nature of scientific research (1, 2). While this is the case, the manner in which biology educators articulate how their courses align with the five proposed dimensions of CUREs (scientific practices, discovery, broader relevance, collaboration, and iteration), as described by Auchincloss and colleagues (1), varies widely. In turn, achieving a shared understanding of the ways in which members of the CURE community practically address the aforementioned aspects of CUREs, including similarities and differences in approaches between course contexts, remains challenging. We contend that this concern is especially relevant to the professional development of novice CURE facilitators (e.g., graduate teaching assistants), who may be unfamiliar with the language used to define and describe CUREs (10), as denoted in the literature.

In response to this need, we developed the “Dimensions of CUREs Informational Template,” or DoC IT. As described at further length below, the DoC IT is intended to provide CURE facilitators with a scaffolded and standardized approach to describe how various elements of their course (e.g., activities and assessments) align to the five CURE dimensions (1). We modeled our template after extant resources such as CUREnet, as this network is intended to be a centralized, interactive hub for CURE facilitators with diverse backgrounds, student populations, disciplinary foci, and institutional contexts—an inclusive lens that we likewise sought to adopt. Additionally, we leveraged the earlier work of Cooper et al. (11) regarding the backward design of CUREs to emphasize that one’s goals and the five dimensions of CUREs themselves need to be integrated into one’s course in a purposeful and meaningful manner.

DESCRIPTION AND APPLICATION OF THE DoC IT TEMPLATE

The DoC IT (see Text S1 in the supplemental material) consists of three majors sections: (i) identification of pedagogically- and research-oriented goals/objectives for one's course, (ii) description of each of the five dimensions of CUREs with prompts pertaining to how the stated dimension is addressed and assessed, as relevant, and (iii) a culminating prompt designed to prime the respondent to consider the cohesiveness between the five dimensions of CUREs, as they pertain to their course, and their stated goals/objectives. The DoC IT can be administered in a paper-and-pencil or online format and, based on our own experiences using the tool, requires approximately 15 to 20 minutes to complete for individuals with a moderate level of familiarity with CUREs. This time requirement may ostensibly need to be extended if working with facilitators less familiar with CURE terminology and/or design. Regardless, the DoC IT is amenable for use with CURE instructors (including graduate teaching assistants), developers, and evaluators, thus positioning it as a flexible and broadly impactful tool.

Beyond providing the DoC IT solely as an exercise to complete, we assert that its true value lies in the ability to
make use of participants’ responses as a foundation for internal dialogue regarding the fidelity of CURE implementation, sharing of evidence-based practices, and refinement of one’s CURE. Additionally, these responses can serve to address broader questions at the departmental, institutional, or community levels, for instance:

1. How can the scientific knowledge, skills, and practices that students acquire in the CURE support learning in other lower- and/or upper-division courses (whether in a lecture or laboratory context)?
2. How can assessment of CURE student learning be leveraged to promote the development of new CUREs or other high-impact practices?
3. If relevant, how will the work that students engage in during the CURE support the formation of new campus-community partnerships?

As stated previously, adoption of the DoC IT by CURE facilitators will also ideally offer a unified approach for engaging in cross-institutional discussions about the design, utility, and efficacy of CUREs.

SAFETY ISSUES

There are no safety issues associated with this activity, as it is solely a worksheet-based exercise.

CONCLUSIONS

Adoption of CUREs is now widespread throughout STEM curricula nationwide. Positioned as a means to increase student access to scientific opportunities, CUREs engage undergraduates in collaboratively and iteratively addressing challenges of real-world importance through use of scientific techniques and methods. Yet, despite this overarching goal, the nuanced ways in which educator-scholars describe the structure of their CUREs (with particular reference to the five dimensions of CUREs [1]) remains varied, thus reducing the extent to which we, as a community, can learn about and from the experiences of our peers as they relate to CURE development, implementation, and evaluation.

The DoC IT seeks to address this concern, offering a freely available resource requiring little, if any, prior knowledge or preparation to implement. CURE graduate teaching assistants (GTA) who made use of the DoC IT at our institution as part of a professional development experience noted, for instance, that “it [was] helpful to write down all the goals and activities of the course. It served as a good blueprint of what I plan to keep the same and presented an opportunity for me to take a closer look at things I may want to elaborate on or change in the upcoming semester” (see Text S1 for a sample DoC IT submission). Speaking of the perceived value of completing the DoC IT, a second GTA stated that “it will ensure that I encourage students to master each of the dimensions of a CURE in future classes. It also got me thinking about how I can create more activities and formative assessments to measure iteration.”

While we do not anticipate that CURE facilitators and educator-scholars will explicitly replicate the tables found within the DoC IT when disseminating information about their own CUREs (although see Fig. 2 in D’Arcy et al. [12] for a potential adaptation), we are nevertheless optimistic that the DoC IT provides an important step in achieving a more uniform means to communicate about CUREs, particularly among diverse CURE audiences.

SUPPLEMENTAL MATERIAL

Supplemental material is available online only.

SUPPLEMENTAL FILE 1, DOCX file, 0.03 MB.

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