



## **A Framework for Disciplinary Learning Communities: Professional Development in Action**

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## Introduction

Several major research universities are collaborating on a new framework for establishing disciplinary learning communities (DLCs) at engineering schools and other science, technology, engineering, and mathematics (STEM) disciplines across the country. The DLCs will be an opportunity for beginning and future faculty to engage in learning about and critiquing discipline-based education research through formal workshops facilitated by faculty in the discipline. The framework will provide curricular resources to help faculty facilitate these programs, thus, lowering barriers to adoption.

The overarching goals are to 1) encourage adoption of research-based teaching strategies including those specific to the discipline and 2) develop a cross-institutional network of faculty committed to improving STEM education. To support the second goal, the American Society of Engineering Education (ASEE) joined the partnership to assist in facilitating cross-institutional networking opportunities for DLC participants from various colleges and universities.

A team of STEM faculty worked together to develop the instructional framework of the DLCs. This framework will be piloted in the 2018-19 academic year at three universities in five STEM disciplines such as engineering and applied math. Our goal for this paper presentation is to present the framework for critique by our peers so that we can incorporate their feedback during the pilot. We also hope to raise awareness of this project to encourage additional colleges to adopt the framework in the future.

We define research-based teaching practices as pedagogical strategies that have been tested using educational research methods and published in peer-reviewed literature. Future faculty are graduate students and post-doctoral fellows who aspire to faculty positions that include teaching responsibilities, however, current faculty will also be invited to participate in the DLCs.

The motivation for this NSF-funded project is that research-based teaching practices have been shown to improve student learning compared to traditional methods like lectures [1]. While research-based teaching practices have been shown to be more effective, their adoption is often limited. Research on how educational innovations diffuse suggest barriers to adoption [2]. These barriers can include lack of training, time constraints, institutional incentives, and department norms about teaching [3], [4].

The proposed instructional framework attempts to address several of these barriers. First, future faculty are motivated to engage in professional development in anticipation of entering a competitive job market. New tenure-track faculty are also motivated to become more effective and efficient teachers. While teaching is considered in promotion decisions across institutions, becoming a more efficient teacher can help faculty members at institutions that focus more on research output. A study by Feldon et al suggests that teaching professional development can improve research methodological skills, which can improve research productivity [5]. Faculty who engage in teaching professional development also need less time to prepare for class, and thus, can spend more time on other responsibilities like research.

Second, engaging in teaching professional development is linked to adoption of research-based teaching practices [6]. Future faculty, however, report a lack of structured professional development opportunities that prepare them for their future faculty careers [7]. Engineering disciplines are ideal spaces and communities of action to engage future faculty in professional development [8]. Disciplinary departments and colleges are important units of institutional change, and the natural location to house these professional development opportunities [2].

Last, the project leads have partnered with international organizations to encourage broad adoption of the framework. The STEM faculty developing the DLCs work at universities with membership in the Center for the Integration of Research, Teaching, and Learning (CIRTL - <https://www.cirtl.net/>). CIRTL is a consortium of 43 North American research universities committed to improving STEM undergraduate education by developing a national faculty committed to implementing and advancing research-based teaching practices for diverse learners. The second phase of piloting will include broader implementation across the CIRTL network schools. In addition, the authors are working with professional organizations such as the American Society of Engineering Education and the American Statistical Association to coordinate on program development and content integration.

### **DLC Draft Instructional Framework**

The team of STEM educators who developed the framework used the backwards design process to guide their work [9]. This process led the group to start by brainstorming and critiquing proposed learning objectives. Once identified, assessment strategies were defined that aligned with the learning objectives. The last stage was to develop the facilitation framework. This section will be structured by the workflow used by the group.

#### *DLC Learning Objectives*

The overall learning goal for the DLCs is to increase adoption of research-based teaching practices. The team felt it was important to encourage DLCs to explore different types of teaching practices. The team used three core ideas defined by the CIRTL community to guide the development of the learning objectives, which will encourage facilitators to work with their participants to identify different types of teaching practices. The core ideas that drive CIRTL programming are the following.

- Learning-through-diversity
- Learning communities
- Teaching-as-research

The six learning objectives reflect not only a commitment to teaching research-based practices, but modeling them. The development team wanted participants to gain experience designing and facilitating activities like an instructor. This is the inspiration for objective six under the category, engaging in discussion. The six DLC learning objectives can be divided into three categories based on leveraging research-based teaching practice, leveraging the literature, and engaging in discussion as described in Table 1.

|  |   |
|--|---|
| Leverage Research-Based Teaching Practices | Describe evidence-based instructional strategies for leveraging collaborative learning in a course.   |
|  | Describe evidence-based instructional strategies for capitalizing on the students' diverse experiences, backgrounds, and skills in a course.  |
|  | Summarize 3-5 evidence-based instructional strategies s/he will implement. At least one of these will be a discipline-specific instructional strategy relevant to the participant's field of study.                     |
| Leverage the Literature                    | Search relevant sources (e.g., journal articles, conference proceedings, book chapters, blogs, disciplinary communities of practice) to identify pedagogical best practices and discipline-specific teaching practices. |
| Engage in Discussion                       | Critique discipline-based education research or instructional case studies.   |
|  | Facilitate a group discussion of evidence-based instructional strategies.   |

Table 1 – DLC Learning Objectives

*DLC Assessment Strategies*

The second phase of the development process was defining the assessment strategies to align with the learning objectives. The team chose strategies that not only presented an opportunity to evaluate participants' work, but to support their future professional development and job application or promotion portfolios. For example, participants will write descriptions of the teaching methods in a format that can be incorporated into a teaching philosophy statement.

Rubrics have been drafted for each of the assessment strategies below. The team does not expect facilitators will formally grade participants in the DLCs. The rubrics will help assist the facilitator in providing feedback to the facilitators. The DLC Learning Assessment Strategies are summarized in Table 2.

|  |  |
|--|--|
| Leverage Research-Based Teaching Practices | Participants will write descriptions of teaching methods that can be incorporated into a teaching philosophy statement. Developing the teaching statement is optional.   |
| Leverage the Literature                    | Participants will search for several sources to identify description or articles about new teaching methods, and then come to class prepared to discuss the teaching methods they identified from those sources. |
| Engage in Discussion                       | Participants will submit memos critiquing articles they read on discipline-based education research or case studies.   |
|  | Each participant will facilitate a discussion on a teaching practice described in the literature.  |

Table 2 – DLC Assessment Strategies

*DLC Facilitation Strategy*

The graduate seminar model inspired the design of the DLCs. This approach presents several advantages. First, the familiarity of the small-group discussion format will encourage adoption of

by faculty facilitators and graduate students themselves. Second, the discussion format itself demonstrates best-practice by leveraging active-learning strategies like peer discussion, student-led presentations, and group critique. Last, the seminar format encourages the development of learning communities that we hope persist beyond participation. Our hope is learning communities focused on adopting research-based teaching practices will help advance a culture focused on teaching with departments or disciplines.

The DLCs will differ from a formal seminar course in several ways. First, the DLCs are meant to be modular and will not run as long as a semester-course. Institutions will have the flexibility to run 5-7 sessions – either weekly or bi-weekly. As described in the introduction, time commitments can be a barrier to adopting new teaching strategies or engaging in professional development. Course and research commitments can become more acute at the end of the semester. The modular structure allows faculty facilitators to implement the DLCs in a way that meets the professional development interests and needs of their community.

The modularity also encourages on-going participation. The research-based teaching strategies discussed can change each semester so participants can continue to attend without receiving redundant content. In addition, the first two sessions focus on orienting students to the DLCs and teaching them basic skills needed to succeed in the DLCs including how to critique an article, how to search the literature for discipline-based education research, and how to facilitate a discussion of an article. Students returning to the DLC could skip these sessions if desired.

The following lists the proposed outline of sessions as informed by the DLC learning objectives and assessment strategy.

- *Session 1 – Introduction:* The first session will provide an overview of the DLC, explanation of the learning objectives, and introduce participants to the discipline-based education research literature.
- *Session 2 – Engaging with Content:* The second session will present strategies for critiquing an article so participants will be prepared to engage in DLC discussions. Strategies for facilitating a discussion will also be discussed because each participant will be expected to lead a discussion of at least one article.
- *Sessions 3-6 – Discussion of Research-based Teaching Strategies:* These are the core modules of the DLCs in which the faculty facilitator and participants will lead discussions and critiques of articles identified by members of the DLC. The number of session will be defined by each local community.
- *Last Session – Conclusion:* The last session will be an opportunity to critique additional articles and/or summarize lessons learned. Participants could also have the opportunity to share for critique the draft narratives describing the research-based teaching practices they anticipate adopting.

While some non-discipline specific teaching practices will likely be discussed in the DLCs (e.g., general strategies on facilitating discussion, designing a class), the emphasis will be on

discipline-based education research (e.g., teaching engineering labs, capstone design courses). There are numerous professional development opportunities that cover general pedagogical best practices. The DLCs will act as complementary professional development opportunities to these more general pedagogical workshops. On this point, the development team is especially interested in obtaining feedback on the balance of discussing discipline-specific educational strategies vs. general pedagogical strategies in the DLC.

While the expectation is for the DLCs to engage with their discipline-based education research, the instructional framework is inherently discipline neutral. Members of each DLC – faculty facilitators and participants – will collaboratively identify the educational research articles and teaching strategies they discuss. This allows the STEM educators to develop facilitator guides for each session that can be used in any discipline. This is best exemplified in the discipline-neutral learning objectives and assessment strategies proposed above.

### *Implementation strategies*

The goal of this project is to develop an instructional framework to encourage the implementation of DLCs across various disciplines at various colleges. For this reason, the development team created facilitator guides that describe in detail how to facilitate the modular sessions outlined above. These guides include the proposed learning objectives and assessment strategies, rubrics to structure feedback, suggestions for additional resources, guiding questions and presentation materials.

The guides also include suggestions for how to leverage common resources found on most college campuses. For example, librarians are increasingly become instructional partners in the classroom [10]. The facilitator guide describes how they can help teach participants information literacy skills (e.g., search strategies, sources) specific to educational research, which are often different than strategies used for traditional research. Librarians can also consult with participants on their assignments. Similarly, staff from teaching and learning centers can also provide additional perspectives or complementary training.

The team also partnered with professional organizations like ASEE to assist with content development, building community among local DLCs, and diffusion of the instructional framework. ASEE leadership committed to offering space and time at the annual national meeting to allow DLC participants from different institutions to convene and meet in person after the pilot phase (i.e., 2020 ASEE annual conference). The purpose of these networking events is to reinforce relationships and forge community among new faculty and future faculty with interest in teaching as demonstrated by their participation in a DLC. The purpose is also to raise awareness of the framework to encourage faculty to establish DLCs at new institutions.

### **Conclusion**

The DLCs are opportunities for future and new faculty to engage in teaching professional development within their discipline. The authors will present an instructional framework for critique that guides the facilitation of the DLCs. The feedback provided by their peers at the ASEE conference will inform the pilots scheduled for the following academic year.

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