Developing Scholarly Teachers Through an SoTL Faculty Fellowship

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Abstract

The increasing interest in incorporating evidenced based teaching in higher education has created a pronounced need for faculty to learn the theory and practice of the Scholarship of Teaching and Learning (SoTL). This article describes a program designed to prepare faculty to (a) draw on existing SoTL studies when designing and implementing evidenced based teaching methods, (b) design SoTL studies to test the effectiveness of those methods, and (c) integrate their new knowledge of SoTL into the practice of "scholarly teaching." This program has proven to be a successful model for incorporating evidenced based teaching into undergraduate science, technology, engineering, and mathematics (STEM) courses at our university.

Keywords: faculty development, Scholarship of Teaching and Learning, fellowship

Recent calls for the widespread adoption of evidence based teaching methods underscore the need for faculty to learn about these methods and the literature demonstrating their effectiveness, as well as to develop knowledge about how to implement and evaluate these methods in their own teaching (Crutcher, O'Brien, Corrigan, & Schneider, 2007; President's Council of Advisors on Science and Technology, 2012). As more and more faculty become interested in incorporating evidenced based teaching, there is an increased need for faculty to be informed about, and prepared to practice, the Scholarship of Teaching and Learning (SoTL). This article describes the development of a SoTL faculty fellowship program into a central component of faculty development at our research intensive university. In this program, an SoTL

project is developed and implemented through collaboration by a project team comprising a faculty fellow, a graduate student or postdoctoral intern, and Teaching Center staff. This program has led to increased integration of evidenced based teaching in science, technology, engineering, and mathematics (STEM) courses.

There is a long history of discipline based research on education in STEM. Building on this history, a new focus on broadening the involvement of STEM faculty in research on teaching and learning has emerged as a result of the increasing emphasis on evidenced based teaching by major funding agencies such as the National Science Foundation (NSF), the Howard Hughes Medical Institute (HHMI), and the Association of American Universities (AAU) (Calkins & Drane, 2010; Coppola & Jacobs, 2002; Laird & Ribera, 2011; Witman et al., 2007). Because SoTL work often lies outside the typical reward structure for faculty positions, however, faculty members who are interested in SoTL can be understandably reluctant to dedicate time to developing, implementing, and evaluating evidence based teaching (Coppola & Jacobs, 2002; Fisher & Frey, 2011; Huber, 2002; Hutchings & Shulman, 1999; Middendorf & Pace, 2008; Wankat, Felder, Smith, & Oreovicz, 2002). Furthermore, in order to evaluate the new methods they are incorporating, faculty members need training in SoTL research methods and in current knowledge about student learning (Gayle, Randall, Langley, & Preiss, 2013; Marquis, Healey, & Vine, 2014; McKinney, 2007).

Graduate students and postdoctoral trainees who are preparing for future faculty positions also need to learn about how to incorporate and evaluate evidence based teaching (Austin et al., 2009; Cohen, Fast, & Barton, 2000; Kreber, 2001; Sagendorf, 2008). During the past two decades, the integration into doctoral training of formalized professional development programs focused on teaching has gone a long way toward meeting this need (von Hoene, 2011). One logical next step is the development of formalized structures that can help graduate students learn the philosophy and methodology of SoTL, so that they are prepared to implement SoTL projects in future teaching (Hutchings & Clarke, 2004; Shulman, 2004). Several universities have begun to develop programs that introduce graduate students to different modes of education research, including SoTL. While such programs are a product of broader reforms in graduate education, they also represent a potential to improve undergraduate learning *and* to broaden participation in SoTL by faculty, who can be paired with graduate students during the design and implementation of a SoTL project (Austin et al., 2009; Hutchings & Clarke, 2004; Pfund et al., 2012).

The primary goals of our SoTL faculty fellowship program are (a) to increase the incorporation of evidence based teaching in undergraduate STEM courses and (b) to develop structured, practical opportunities for faculty to gain knowledge of how to develop and implement an SoTL project, and to draw on the findings of that project to further refine their teaching in ways that can improve student learning. An important secondary goal is to increase the number of future STEM faculty who understand SoTL concepts and methodologies. This approach builds on and extends the work of centers for teaching and learning (CTL) in creating structures for faculty to begin to practice inquiry on teaching—whether that inquiry involves classroom assessment techniques, “action research,” or SoTL (e.g., Adams, 2009; Middendorf & Pace, 2008).

The development of a pilot version of our faculty fellowship program was supported by the university's multiyear grant for improving life sciences education from the HHMI, which provides a modest stipend for participating graduate students and postdoctoral trainees. More recently, the program has been developed into the Center for Integrative Research on Cognition, Learning, and Education (CIRCLE) Faculty Fellowship, a program that includes faculty stipend support from the university's grant from the AAU initiative on improving STEM education. Support from these different sources has enabled us to create a structured inquiry SoTL program that has broad applicability across institutions and disciplines. Furthermore, it has led to the implementation of evidence based teaching methods by eight faculty members teaching five different introductory STEM courses, including—most recently—a large enrollment, introductory biology course that enrolls nearly half of our first year undergraduate students. In fall 2014, it will expand to include the first semester of General Chemistry, another large enrollment course that enrolls a majority of our first year students. The CIRCLE Fellowship is a joint program of the

Teaching Center and CIRCLE. While this article emphasizes the current role of the Teaching Center in this program, the recent expansion of the program into introductory biology and chemistry courses will lead to greater future involvement by CIRCLE—specifically, in the analysis of the large sets of data that will be at the center of the formal evaluation of the curricular innovations in the introductory chemistry and biology courses.

Philosophy

The philosophy behind our program is grounded in a definition of SoTL as involving four key steps: "framing questions, gathering and exploring evidence, trying out and refining new insights in the classroom, and going public with what is learned in ways that others can build on" (Huber & Hutchings, 2005, p. 20). Discussions of SoTL have clarified distinctions between SoTL and "scholarly teaching." Hutchings and Shulman (1999), for example, argue that the latter does not involve the development and implementation of a publishable study, but rather encompasses "certain practices of classroom assessment and evidence gathering, … informed not only by the latest ideas in the field but also by current ideas about teaching in the field, [and inviting] peer collaboration and review" (p. 13). The design of our SoTL faculty fellowship reflects our belief that the relationship between scholarly teaching and SoTL is not necessarily (or exclusively) a linear and progressive one, where an instructor *initially* practices scholarly teaching and then *later* (potentially) becomes a practitioner of SoTL, as described, for example, by Gayle et al. (2013) and Witman et al. (2007). Instead, our fellowship is designed according to an assumption that developing and implementing a SoTL project is part of a cyclical process through which faculty develop knowledge about SoTL that they can then "take back" to a practice of scholarly teaching (Figure 1). Although a publishable study should be an eventual product of this process, the faculty member's first foray into SoTL is likely to produce a "pilot" version of this study, which may be refined in later semesters before being submitted for publication, even as the faculty member uses the results of the pilot project to refine the course.

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Figure 1. The Relationship Between Scholarly Teaching and the Scholarship of Teaching and Learning (SoTL)

We believe that the process of designing and implementing a SoTL project, in other words, helps faculty to develop a conceptual understanding of the theory and practice of SoTL. In this sense, we are applying an approach that we have presented elsewhere in relation to the incorporation of cognitive science research into faculty development programs; this approach is informed by an assumption that when faculty gain a conceptual understanding of SoTL, they are better equipped to transform their knowledge of research on teaching and learning into what Bransford, Brown, and Cocking (2000) describe as "useable knowledge"—or knowledge that instructors can transfer, adapt, and modify as they work to improve and refine their teaching over time (pp. 9, 37). In addition, learning about research on teaching and learning helps faculty make what can otherwise be a challenging leap—to become scholars of teaching and learning, who

understand research on learning and how it is conducted and who are equipped to develop and assess instructional methods informed by this research (Fisher, Dufault, Repice, & Frey, 2013, pp. 40 41).

The CIRCLE Faculty Fellowship is therefore designed to produce a pilot project—the first stage of a publishable study—which can be further developed and refined in subsequent semesters. More importantly, it is designed to produce scholars of teaching and learning—faculty who are well prepared to (a) read, understand, and think critically about SoTL methods, approaches, and terminology; (b) design and incorporate curricular innovations based on this scholarship; and (c) contribute new scholarship to expand current knowledge on teaching and learning.

Learning through mentoring is a crucial element of our program. As described below, the program applies to the development of SoTL, a model of multidirectional "networking mentoring," which has been described as an effective model for mentoring students as well as faculty (Haring, 1999; Wasburn, 2004). This is a nonhierarchical model involving small groups, rather than dyads, in which all participants learn from one another. In her description of networking mentoring as a model that is especially suited for faculty mentoring of undergraduates from underrepresented groups, Haring (1999) remarks:

> … the central characteristic of networking mentoring [is] the expectation that each person in the network can and must contribute something to the others' success. Thus, each person in networking mentoring may sometimes serve as a mentor to others and may sometimes receive benefits as a protégé. … The networking mentoring model, then, encourages changes in institutions through the contributions of newcomers. (p. 12)

These aspects of networking mentoring, as Wasburn (2004) has argued, make it an especially promising model to apply to faculty mentoring programs focused on teaching. It is equally promising when applied to faculty development programs focused on introducing faculty to SoTL, given that faculty who are new to SoTL are learning new research methodologies that are often not familiar to peers in their departments (McConnell, 2012). Wasburn (2004) notes that faculty may be more willing to adapt ideas and suggestions on teaching from colleagues in different departments. Therefore, when faculty come together to learn from one another outside of departmental relationships, "improved teaching might be produced through bottom up and horizontal mentoring, as well as top down mentoring" (p. 28).

The CIRCLE Faculty Fellowship program utilizes a model of networking mentoring in two ways, as described in detail in the next section. First, the structure of the program includes mentoring of the faculty member by the Teaching Center's executive director, who has expertise in STEM education and in SoTL, and mentoring of a graduate student or postdoctoral intern by the faculty member and by Teaching Center PhD staff, including the executive director. Second, the networking mentoring model is extended via the Fellows' participation in two learning communities. One is the STEM education research group, a group of faculty from STEM disciplines, education, and psychology who meet weekly to discuss ongoing research on teaching and learning. This group uses a "laboratory group" model for their meetings: each week one or more members of the group discuss their education research, then ask group members to offer feedback and suggestions for the next stage of development of the project—whether that stage is the refinement of a curricular innovation, the development of assessment tools, data analysis, or plans for future development (Fisher & Frey, 2011). The other learning community that the Fellows participate in is the broader community of STEM faculty at our university who are integrating evidence based teaching into their teaching. The structure of the CIRCLE Fellowship is designed to help build, sustain, and expand this community—initially in STEM and eventually in all disciplines.

Structure

The CIRCLE Fellowship provides faculty with a practical, mentored experience in designing, implementing, and evaluating evidenced based teaching. The structure of this program is akin to a "structured inquiry" research experience, in which participants develop and implement a SoTL project, with guidance and mentoring provided by experienced practitioners (Adams, 2009; Buck, Bretz, & Towns,

2008). The SoTL project develops over two years. Each year the projects go through three phases: development, implementation, and refinement (Figure 2).

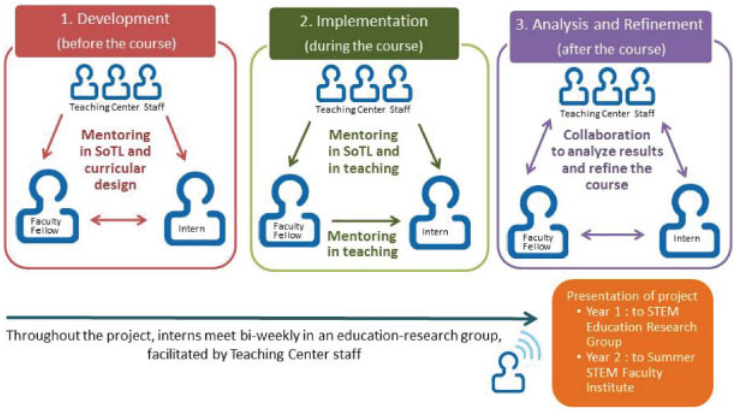

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Figure 2. Phases of an SoTL Project Developed Within the CIRCLE Fellowship Program; the Three Phases Are Repeated in Year 2

The first year of the CIRCLE Fellowship begins with the initial *development* phase, which occurs before the redesigned course is taught. During this phase, Teaching Center staff meet with the Fellow and the intern several times over the course of two to three months to (a) identify a problem, related to student learning, that the faculty member has observed in the course; (b) identify the specific learning objectives that the problem involves; (c) design a curricular innovation that draws on current literature relevant to the course and the discipline; (d) develop a plan for incorporating the innovation into the faculty member's course; and (e) design an assessment plan for evaluating the effectiveness of the incorporated innovation (in relation to the identified objectives). The development phase also includes the writing and submission of an institutional review board (IRB) application for the project. This phase includes guidance provided by Teaching Center staff on assessment methods, the IRB application process, and appropriate methods for data collection and analysis. During this phase, Fellows are mentored by the Teaching Center's executive director in the development of a curricular innovation that can be realistically implemented and evaluated. In addition, the graduate student or postdoctoral “future faculty” intern works with the Fellow to develop the materials and activities associated with the curricular innovation, with mentoring by the faculty member and by Teaching Center staff.

Next, during the second phase (*implementation*), the faculty Fellow mentors the intern on the implementation of the curricular innovation into the course (consulting with Teaching Center staff as needed), and Teaching Center staff mentor the intern in teaching and in the implementation of the assessment. Throughout this phase, the intern meets biweekly in a research group, consisting of all interns who are currently in the program and facilitated by Teaching Center staff. The structure of these meetings is modeled on a laboratory group meeting (Fisher & Frey, 2011), with participants reporting on the progress of the SoTL projects they are each working on and gathering feedback and suggestions from the group. At the conclusion of the first year, the interns present their SoTL projects at one of their biweekly research group meetings and at a meeting of the STEM faculty education research group (STEM ERG). The latter meeting is also attended by the CIRCLE Fellows and the Teaching Center's executive director. The presentation to STEM ERG allows the project team to gather responses to the results of the pilot project and to the project team's plans for further development of the project in year two. The timing of this talk coincides, roughly, with the third phase (*refinement)*, which begins when the CIRCLE Fellow and the intern meet with Teaching Center staff to discuss the implications of the research results for future development of the course and of the SoTL project—a process that leads to repetition of the three stages, as the curricular innovation and the evaluation are refined and implemented a second time. As in other models for the integration of evidence based teaching (e.g., Chasteen, Perkins, Beale, Pollock, & Wieman, 2011), our model requires at least two years—or a similar time frame in which the participating

faculty teach the course a second time, integrating modifications that are a result of the first implementation and assessment.

Starting in 2014, during the summer between their first and second years in the program, the Fellows will continue to refine both the curricular innovation and the SoTL project by participating in the Summer STEM Faculty Institute on Teaching (STEM FIT). This institute, which is being developed with support from the AAU grant, will be held for the first time in summer 2014. It will include a series of workshops in which faculty will work with their peers to develop a teaching plan integrating evidence based teaching methods. By participating in the institute, STEM faculty will join a learning community focused on evidence based teaching, and they will also be eligible to apply for the CIRCLE Fellowship program the following fall. Holding the Summer Institute on an annual basis will allow us not only to formalize a broad based learning community across STEM disciplines and to increase the number of faculty who are incorporating evidence based methods, but also to develop a pool of potential CIRCLE Fellowship candidates. Furthermore, because CIRCLE Fellows will participate in the institute in their first year and then return the following summer to present the results of their SoTL projects, the institute will serve as an opportunity for discussion and preliminary dissemination of insights produced through the practice of scholarly teaching.

Program Initiation

The CIRCLE Fellowship program had its genesis in an increasing interest of STEM faculty in developing curricular innovations that were supported by the university's multiyear grant from HHMI. These projects often resulted in collaborative research projects that brought together STEM faculty, Teaching Center staff, and faculty and staff in psychology and education. Such projects led to the founding of a multidisciplinary STEM education research group within which group members meet weekly to report on and develop the HHMI supported projects (Fisher & Frey, 2011). The success of this group laid the groundwork for the founding of a new research center focusing on the integration of cognitive science and classroom research and helped to create broader interest among STEM faculty in developing, implementing, and evaluating evidence based teaching. As this interest grew, however, it became clear that there were many members of the faculty who wanted to incorporate and evaluate evidence based methods into their teaching, but did not feel that they had the time, or the knowledge of SoTL, necessary to do so.

The result was a pilot program that was designed to facilitate incorporation and evaluation of evidence based methods by pairing a faculty member with a graduate student or postdoctoral intern who was interested in teaching. The pilot program thus began as an SoTL internship for graduate students. It was called the Washington University STEM Teaching as Research (WU STAR) Internship, and it began in spring 2011. Collaboration with the chair of the Biology Department, who is the principal investigator on the HHMI grant for improving life sciences education, led to the incorporation of a modest stipend for the participating interns into the existing HHMI supported programs focused on professional development of future faculty. The program began with three projects implemented in Population Ecology and Introduction to Ecology; it expanded to include an additional project in Environmental Geochemistry, as well as one in Biochemistry and one in Microbiology (“WU STAR Projects”; see Table 1).

Table 1. Pilot Program (WU STAR Internship): Projects

Semester	Course	Students (#)	Level	Project
Spring 2012	Population Ecology	17	Juniors/Seniors	A Comparison of Discussion Based Methods (CREATE) for Improving Scientific Literacy
Spring 2012	Introduction to Ecology	63	Sophomores/Juniors/Seniors	Using Primary Literature to Utilize the Scientific Inquiry Process
Spring 2012	Introduction to Ecology	63	Sophomores/Juniors/Seniors	Teaching Basic Statistics in an Introductory Ecology Course
Fall 2012	Environmental Geochemistry	20	Juniors/Seniors	Investigating the Use of Guided Inquiry and Computer Modeling to Teach Students How to Apply Conceptual Information to Solve Problems
Fall 2012	Biochemistry	177	Juniors/Seniors	The Effects of Incorporating Primary Literature and Guided Discussion via Optional

				Journal Club Sessions on Improving Student Learning and Engagement
Spring 2013	Microbiology	53	Juniors/Seniors	Using Group Work to Enhance Primary Literature Discussions

Our pilot program was formalized as the CIRCLE Fellowship with faculty stipend support from the university's three year AAU grant for improving STEM education. The CIRCLE Fellowship officially began in fall 2013, with two Fellows who teach Principles of Biology, a course enrolling approximately 740 students each spring semester. In fall 2014, it will be expanded to include two Fellows who teach General Chemistry, an introductory course enrolling approximately 800 students (Table 2).

Table 2. CIRCLE Faculty Fellowship: Projects

Semester	Course	Students (#)	Level	Project
Spring 2014, 2015	Principles of Biology	740	First Years	Incorporating Interactive Engagement with “Clickers” and Group Work in Introductory Biology
Fall 2014, 2015	General Chemistry	780	First Years	Incorporating Interactive Engagement with “Clickers” and Group Work in Introductory Chemistry

Feedback and Refinement

Starting in fall 2012, we began to gather feedback from participants in the WU STAR program, including the Faculty Fellows as well as the future faculty interns. To this end, participants were invited to complete pre and postprogram perception surveys. Due to the small sample sizes for each survey (between 3 and 12 respondents), we have gathered this feedback mainly for the purposes of improving and refining the CIRCLE Fellowship program. One of the insights we gathered during the first two years was the amount of knowledge that the interns needed to design and implement a SoTL project, with mentoring by the Faculty Fellow and Teaching Center staff. The interns’ responses to the postprogram survey suggest, however, that they had developed a much better sense of how to narrow the scope of a research question so that the SoTL project could be realistically implemented. One intern noted, for example, that she had learned that her project's research question was “too ambitious” and that in future projects she would “start small and then expand.” The interns’ survey responses also suggested that they had a new awareness of SoTL as rigorous research that—like their own disciplinary research—would take time to develop into a publishable study. For example, one recommended to future interns that they should be prepared to develop a project “over multiple years.”

On the one hand, concerns expressed about the amount of time required for SoTL have led us to improve our preprogram communication with interested faculty, graduate students, and postdocs. However, these concerns have also led us to address the need for formalized training in SoTL by creating a one credit Introduction to SoTL course for graduate students and postdocs. This course, which is currently co taught by the executive director and two postdoctoral instructors (one of whom took the course during its first year), was first taught in spring 2013. Now in its second iteration, it has become a *prerequisite* for the internship. This course is designed as an opportunity to learn about SoTL through “structured inquiry,” a process in which participants learn how to find and read SoTL literature, become familiar with quantitative and qualitative methods that are commonly used in SoTL research, and design a SoTL project that can be implemented in an undergraduate STEM course—from the identification of a narrow research question to the development of assessment methods. Because they learn about SoTL by “doing it,” the interns develop a deep understanding of SoTL principles and practices. Participants in this course use a workbook, *Engaging in the Scholarship of Teaching and Learning: A Guide to the Process, and How to Develop a Project from Start to Finish* (Bishop Clark & Dietz Uhler, 2012), which provides a framework for “hands on” development of a SoTL project.

The participants in the course have represented diverse STEM disciplines. These disciplines include the natural and physical sciences, as well as psychology—a combination that leads to fruitful opportunities for networking mentoring, in which participants can learn from one another as well as from the Teaching Center staff who are the course instructors. For example, participants from psychology bring expertise in social science research methods, but have less knowledge about classroom based research, while

participants from the natural and physical sciences lack knowledge about social science research, but bring knowledge gained from exposure (whether as students or teaching assistants) to evidence based teaching methods that are commonly used in these disciplines, such as Peer Led Team Learning (PLTL), Process Oriented Guided Inquiry Learning (POGIL), and Problem Based Learning (PBL) (Eberlein et al., 2008).

During summer 2014, we will integrate key features of the Introduction to SoTL course into the Summer STEM Faculty Institute on Teaching, which will include a framework for participants to develop a SoTL project. After completing the SoTL workshops during the Summer Institute, the participating faculty will have developed an evidenced based curricular innovation, as well as a plan for implementing and assessing that innovation in one of their courses. After two years, participation in this institute will be opened to faculty from other universities in our region. Therefore, the structured inquiry approach we have developed in the course will be integrated into our own faculty development programs and will eventually have an impact well beyond those programs.

Benefits: Developing a Community of Scholarly Teachers Incorporating Evidenced Based Teaching

The preliminary feedback we gathered during the pilot version of the program suggests that participants perceived it to be a valuable means for developing a scholarly approach to teaching. The faculty Fellows who participated in the first two years of the program reported on the postprogram survey that they perceived it to be either “helpful” or “very helpful” in (a) stimulating their own thinking about teaching and course design and (b) increasing their use of evidence based teaching and their interest in SoTL. For example, one Fellow reported that the program was “a great opportunity to test drive some really interesting ideas in my class. Some worked and some didn't, and we had lots of ideas about how to tweak stuff to make it better.” This faculty member noted that she is now “thinking more about how to incorporate informal assessment (without publication being a goal) into my classes”; at the same time, she reported being “more likely to try” additional SoTL projects, in collaboration with the Teaching Center. Fellows also agreed that it was “very likely” that they would continue to incorporate the evidence based curricular innovations developed and evaluated via the SoTL projects, and they found meetings with Teaching Center staff throughout the project to be very helpful, particularly in the first and second stages of development and implementation. One of the 2013–2014 CIRCLE Fellows, moreover, noted in an interview that the Fellowship program has been essential in helping her and her coinstructors to implement active learning in the university's large enrollment introductory Principles of Biology course. In particular, she noted the significance of having the guidance and support provided by Teaching Center staff on the implementation of “clicker” questions for in class active learning activities. She added that without Teaching Center mentoring, she would have been “at a loss” on how to evaluate this curricular change.

The Faculty Fellows who completed the postprogram survey also describe the benefits of the program in helping the interns develop a scholarly approach to teaching—an impression shared by the interns. One Fellow, for example, remarked on the postprogram survey that the “program helps the interns and faculty members to really think about what they feel are important learning objectives that are not being achieved in a current course curriculum … [and] through the program, the interns learn how to implement and evaluate course changes.” Five of the seven interns also described the program as helping them to develop specific learning objectives and to design assessments shaped by those objectives. When asked to identify “the most valuable aspect” of the program, furthermore, one intern replied, “learning to teach rigorously—from lesson plans, to assessing student learning (even on a small scale), to teaching.” Another replied, “being mentored throughout the semester in asking questions about teaching.” Through the presentation of their projects to the STEM ERG, the interns also had the opportunity to learn how to present education research to faculty from diverse disciplines.

Survey responses by participants in the Introduction to SoTL course also suggest that they perceive the knowledge gained in the course to be instrumental in their ongoing efforts to improve and develop their teaching. The most frequently cited benefit of the course on the postcourse survey was the potential to

improve student learning. One course participant remarked, for example, that “it will make … me think more deeply about the teaching practices I use and how they can be improved.” Another remarked that the major benefit of the course was the opportunity to gain “firsthand experience in studying how students learn.” Responses to a midsemester course evaluation also showed that the course participants perceived an increase in their confidence to practice SoTL in the future, as well as an increase in knowledge about SoTL research methods. Participants appreciated the course's “structured inquiry” approach, in which they could apply knowledge of SoTL to design a project. In addition, they appreciated the opportunity to continually refine their projects with feedback from peers and instructors. One course participant, who had recently accepted a faculty position at a liberal arts college, expressed a sense of excitement that she would soon have “the opportunity to meet and share ideas [and] research with [colleagues] who are also interested in SoTL.” Another reported that the course had helped her or him to “become more integrated in a community of teachers that value how students learn.”

When we adapt the Introduction to SoTL course into workshops offered during the Summer STEM Faculty Institute on Teaching, and as more faculty participate in the Fellowship program, we will continue to build a learning community that supports the development of scholarly teachers who are well equipped to develop, implement, and evaluate evidence based teaching. The formalization of this program during the three year AAU grant period will continue after the conclusion of the three year grant. At that time, we will create a formal proposal and application process, and we will invite applications from faculty in STEM, as well as humanities and social sciences, disciplines. In fact, the Schools of Arts & Sciences and Engineering have each committed to stipend support for a total of six CIRCLE Fellows (and the accompanying six graduate student or postdoctoral interns) a year after the conclusion of the AAU grant. As a result, we expect that our faculty will not only contribute to current knowledge about teaching and learning, but also continually expand their knowledge in a multidisciplinary space that Huber and Hutchings (2005) call the “teaching commons”—a space where faculty put an end to “pedagogical solitude” and open up their teaching to peer review, collaboration, and improvement (Shulman, 1993).

Recommendations for Introducing Faculty to SoTL by Combining Structured Inquiry With Networking Mentoring

Based on our experience, we would like to suggest the following recommendations for institutions where there is interest in creating a structured, long term approach to introducing faculty to the practice of Scholarship of Teaching and Learning.

1. *Create a structure that combines formal learning opportunities (such as a series of workshops or an institute) with a mentored opportunity to design and implement a SoTL project*. Faculty members need to learn how to read primary literature in a new discipline, and they need to learn new research methodologies and terminology. This learning requires time, and it is facilitated via discussions with other faculty, practitioners of SoTL, and centers of teaching and learning. Faculty also need an opportunity to apply and extend their knowledge of SoTL by designing their own SoTL projects, with mentoring and guidance provided by staff from centers of teaching and learning (CTL), or other practitioners who have expertise in SoTL (Adams, 2009; McKinney, 2007).
2. *Develop multiple, informal opportunities for faculty to participate in “networking mentoring” as they develop, implement, and refine these projects*. At our university, networking mentoring takes place within an instructional team including a faculty fellow, a graduate student or postdoctoral intern, and Teaching Center staff. At institutions that do not include graduate or postdoctoral training programs, the instructional team might instead bring together coinstructors of a course, or a series of courses, with staff from centers of teaching and learning. In this instance, advanced undergraduates can also be trained to participate as research assistants in the implementation of the SoTL project.

3. *Create a structure that extends faculty involvement in a SoTL program over two years at a minimum, allowing time for the project team to use insights gained in the first year of the project to continue to refine the curricular innovation and the assessment of that innovation*. This extended time frame will enable the faculty member to develop and refine, in collaboration with the project team, curricular innovations that are based on the assessment performed in the first year (Chasteen et al., 2011). This extended time frame will also allow for the development of a more robust, publishable study of the results of the assessment. In addition, the extended mentoring opportunity enables the faculty member to continue to develop and refine his or her skills and knowledge of SoTL practice, leading to a greater probability of continuing in SoTL practice after his or her completion of the Fellowship.
4. *Create additional opportunities for "networking mentoring" by developing learning communities, made up of faculty from different but related disciplines*. Participation in such communities is crucial to the faculty, who can otherwise feel isolated within their own departments, where they may be the sole individuals participating in SoTL research (Huber & Hutchings, 2005; Marquis et al., 2014; McConnell, 2012; McKinney, 2007; Michael, 2012). These learning communities can be, for example, education research groups that meet to discuss and develop multidisciplinary modes of research on teaching and learning; ideally, these groups include faculty from departments such as psychology and education, who can contribute knowledge about social science research and current knowledge from cognitive science and the learning sciences (Fisher et al., 2013; Fisher & Frey, 2011).
5. *Whatever their composition, such learning communities should include staff from centers of teaching and learning, whenever possible*. CTL staff members bring two essential areas of expertise to the process: (a) "on the ground" experience with developing, implementing, and evaluating curricular innovations in courses, and (b) expertise in SoTL.
6. *As you build your program, seek opportunities for stipend support, whether from schools and departments or from external sources* (Huber & Hutchings, 2005; McKinney, 2007). Beginning with modest stipends for faculty and graduate students, we have found, has been instrumental in encouraging faculty involvement and building institutional support for our program.

Conclusion

The approach we have developed to introducing faculty to SoTL has led to an increase in the development and implementation of evidenced based teaching in undergraduate STEM courses during a period when the reward structure for faculty positions at our university has not yet changed to broadly recognize SoTL in measurements of research productivity. Moreover, this approach is continuing to build interest in evidence based teaching. Through the formalization and refinement of this program, which will be supported by two of the university's schools at the conclusion of the three year, external grant, we have laid the groundwork for institutional change.

We believe that in order for evidence based teaching to be implemented in a sustained, broad based way, faculty should become collaborators on SoTL projects. By learning to read and understand SoTL literature, to design and evaluate curricular innovations based on the research, and to make modifications in their teaching based on the results of the evaluation, faculty develop a conceptual understanding of SoTL research that can transform their teaching. Becoming a practitioner of SoTL can be a daunting prospect for faculty, who may envision embarking on SoTL as an entrée into a new discipline—a decision that could divert them away from their disciplinary research. Therefore, faculty members need mentoring from staff at centers of teaching and learning, and they need instructional support—in the form of stipends, team teaching opportunities, teaching interns, or research assistants—if they are to develop and implement feasible projects. We believe that our CIRCLE Faculty Fellowship makes SoTL a viable option for faculty, making it clear that participating in a SoTL project does not mean making an abrupt shift to a new pathway of research, but rather entails participating in collaborative inquiry that can lead to improved student learning and to a long term commitment to scholarly teaching.

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