Reflective Faculty Peer Observation in Engineering

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Abstract

It is now widely held that student evaluations of teaching provide an insufficient measure of teaching effectiveness, particularly when they are the only metric used. One alternative measure is faculty peer observation. We have developed a novel faculty peer observation protocol focused on self-reflection and formative feedback for STEM faculty. Engineering faculty have found the protocol helpful and used the method to expand professional networks and improve student-centered classroom practices. This paper provides a summary of preliminary feedback from faculty and insights from early adopters in the field of engineering.

Introduction

Engineering education has steadily improved for many years as faculty slowly adopt evidence-based instructional practices (EBIPs). Training programs like the National Engineering Training Institute (NETI) have fostered a generation of faculty that understands the merits of improved instruction [1]. The documentation that these methods improve student engagement and retention in engineering and science is vast [2]–[4].

As awareness of evidence-based practices increased, pedagogical reformers hoped that engineering instructors would adopt and use new practices widely, but at many universities traditional lecture is still the dominant paradigm. The literature on pedagogical and institutional change helps us understand that awareness and adoption of new teaching ideas requires ongoing support and time. The salient messages for change agents are these: effective pedagogical change projects (1) align with or seek to change the beliefs of the individuals involved, (2) include long-term interventions (beyond one term), and (3) are compatible with the broader institutional culture and structure [5]. Each faculty member is on their own journey of exploration and teaching, and adjusting pedagogies may happen slowly over a career.

To address the need for ongoing support and to encourage self-reflection, we have developed a **formative** peer observation protocol designed specifically for science, technology, engineering, and mathematics (STEM) educators. Peer observation is a well-established method for providing feedback to faculty and may serve as an important alternative to student evaluations [6]. Legal concerns have emerged about using student evaluations as the only metric for evaluating teaching in promotion and tenure decisions due to the well-documented bias present in student evaluations.

Methods

Most of the authors had participated in traditional peer observation prior to this project but the various forms we used were summative: check-lists of basic practices. We noticed that the check-list approach implied stress for a faculty member when they did not receive “all the checks”, making them reluctant to continue participating in peer observation. Faculty also expressed concerns that it was not possible to observe all the features of the list during a typical one-hour lecture, nor were all items feasibly relevant in every class session. We considered these

challenges as an opportunity to improve peer observation on our campus, foster discussion of teaching, and increase the uptake of instructional change [7].

In 2017, we conducted a baseline study of the STEM faculty at our university and found many (40%) were aware of evidence-based practices, even if they have not yet tried them in the classroom. Eleven STEM faculty applied to participate in a pilot program called Redesigning Education For Learning through Evidence and Collaborative Teaching (REFLECT). Prior to our project, over half of the participants reported having never had a formal conversation with peers about teaching, and the remaining faculty reported doing so only occasionally. The program included several components to address our design goals as shown in Table 1.

Table 1. Summary of the REFLECT program structure and design goals. Each of these program elements map to different quadrants of the change framework proposed by Henderson et al. [5].

REFLECT Program Element	Program Design Goals
STEM Innovation Institute	• EBIPs training, increase awareness • Empower faculty as educational change agents • Support the wider spread of EBIPs
Peer observation protocol	• Build habit of reflective teaching • Formative assessment for new EBIPs • Sustained support from colleagues • Develop/test new tools for reflective teaching
Joy of Teaching lunch meetings	• Build community of practice and culture • Increase communication in STEM fields across campus

STEM Innovation Institute. The first program element was a STEM Innovation Institute, designed to calibrate the faculty on the best evidence-based practices at the beginning of summer. Participants were encouraged to think deeply about what methods they might use to improve their teaching and work on those projects over the summer, supported in part by a small stipend. The workshop was also designed to encourage cross-disciplinary interactions and/or collaborations, and catalyze the participants to take a leadership role in their units around transformation of teaching.

Peer Observation Protocol Training. Near the end of the summer, the faculty cohort came back together to be trained more formally on peer observation in general and on our formative protocol [8]. This workshop included an intentional deconstruction process that would address faculty fears of observation.

The REFLECT peer observation protocol was structured to enhance self-reflection and self-assessment of teaching, expose faculty to new EBIPs as they observe other practitioners, construct a support network among practitioners, and empower faculty to act as change agents on campus. The design process for the protocol is documented in detail by Dillon et al. [8]. One

important aspect of the protocol is the focus on specific "dimensions of teaching", allowing the faculty member observed to focus on just one aspect of instruction in a given observation, rather than a long list of best practices. The dimensions of teaching currently include topics such as equity of student engagement, group work, and use of technology. New dimensions have been developed that focus on best practices for diversity and inclusion, reconciliation, and creativity.

Table 2. Summary of the peer observation elements included in the REFLECT protocol. Adapted from Dillon et al. [8].

Peer Observation Framework Elements	Traditional Peer Observation Protocols	REFLECT Peer Observation Protocol
1. Pre-Observation Meeting	x	x
2. Dimensions of Instruction		x
3. Pre-Observation Self-Assessment		x
4. Classroom Observation	x	x
5. Student Minute Papers		x
6. Observer Student Comment Summary		x
7. Post-Observation Meeting	x	x

Another important feature of the REFLECT protocol is the opportunity for students to provide focused and specific input using an exit card at the end of the observation. The student exit cards are collected by the observer and summarized for the faculty instructor. The types of feedback designed to occur are shown in Figure 1.

Peer Observation Visits. Pairs of peer observers were formed, and faculty were encouraged to complete at least one (bi-directional) peer observation per term. Partners switched each term, giving the participants a chance to observe instructors outside of engineering, as well as someone closer to their own discipline.

Joy of Teaching Lunches. Monthly lunches were organized to encourage faculty discussion about teaching practices, encourage change agency, and boost morale throughout the term.

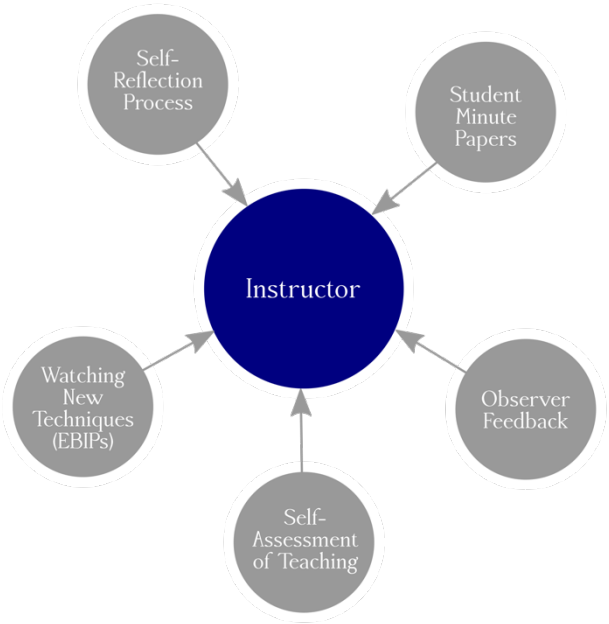

Figure 1. Summary of faculty feedback mechanisms adapted from Dillon et al. [8].

Results

The REFLECT project is still a work in progress on our campus, but one full cohort of 12 faculty members completed a survey after participating for a year. Four

members of the cohort were from our engineering and computer science unit on campus. We have now trained cohorts at two additional universities and hope to report results for a larger data set in the future.

We aggregated specific feedback and information about the experience of engineering faculty using several methods. A survey was sent to the faculty at the end of the STEM institute and again at the end of the academic year. An independent evaluator interviewed each participant near the beginning of the project and again near the end. These were open-ended interviews by an expert evaluator. We used a different, quantitative observation protocol COPUS [9] to observe the classroom of each faculty member before and after they participated in the REFLECT project. For each of these assessments we collected the data for the engineering faculty.

Cohort Survey

The survey was sent to all the faculty at the end of one academic year of peer observation. The engineering faculty reported that they participated in 2-5 observations during the course of the academic year. All the engineering faculty were partnered with at least one observer from outside of engineering. Several interesting trends emerged from the survey:

- All of the engineering faculty from our first cohort responded "strongly agree" or "agree" when prompted, "The peer observation process was helpful for me to reflect on my teaching."
- All of the engineering faculty from our first cohort responded "strongly agree" or "agree" when prompted, "The protocol (overall) provided useful feedback to me about my teaching."

The survey asked faculty to consider how participation in the REFLECT project influenced their practice of reflective teaching. The faculty comments included several helpful statements about the project.

- "Having a community that pushes for better teaching and learning practice provides the support I need to keep doing the work... Especially when others do not or question trying new things."
- "It has reminded me that every class minute is precious. Even if I cannot update or overhaul a lecture, I do think about how I could make it more student-centered. It has also made me ask questions about every lecture: what is the main point? what could I remove? what skill do I want to develop in students?"
- "I feel more comfortable taking small incremental risks in my teaching. I understand that these changes may be difficult for my students, but it's ultimately to their benefit."

External Evaluation

The external evaluator collected the following statements from the engineering faculty participants. The evaluator noted that the statements were well aligned with the perceptions of the other STEM faculty participants.

- "I loved peer observation. I would like to make that part of our evaluation process."
- "Peer observation 'Motivated me to shake things up.'"

- "Good to find other people on campus thinking about how they teach and improving their teaching and so that was great."

The evaluator noted that the engineering faculty also commented on a larger shift happening in the engineering unit, that EBIPs had caught on and the students had started pushing back on the faculty who were not yet using these methods. This is an exciting outcome for larger adoption and instructional shifts. At the end of the second faculty cohort, around half of the engineering unit at our university will have participated in the REFLECT peer observation process.

COPUS Observations

To provide a more quantitative estimate of change in teaching practice, the faculty were all observed using the COPUS protocol [9] before they started the REFLECT programming, and again after they finished the year of peer observations. The COPUS protocol tracks how time is spent in the classroom, for both students and instructors. Smith et al. found one of the best metrics for understanding the COPUS data is how much time students spend listening [9]. This is a good indicator of passive classroom activities like lecturing.

In our study, before the REFLECT program the engineering faculty in the program had a range of listening percentages from 60.7-92.9%. After the REFLECT program the engineering faculty had a range of listening percentages from 39.3-73.1%. All faculty reduced the percentage of listening in the classroom by at least 11%, with an average of 21.4%. One faculty member reduced the listening percentage by nearly 40%. The change in teaching practice this represents is staggering for the individuals in this program. If results like this are replicated in the second cohort, and at other universities, this is a powerful motivator for adopting formative peer observation.

Conclusions

A new type of formative faculty peer observation has been tested with a small cohort of STEM faculty at a teaching-focused university. The engineering faculty participants reported positive experiences and teaching practice shifts. Conversations with an external evaluator revealed that students have become their own advocates for EBIPs in the classroom in the engineering unit. COPUS results indicate that the student listening time in classrooms was reduced by an average of 21.4%.

The REFLECT team noticed that the engineering faculty found the project particularly helpful for formation of research projects and cross-campus networks. One observation pair found a project that connected environmental engineering and biology, and they recently published a joint paper [10]. Connecting faculty and creating community was a goal of the project, making this insight particularly positive.

Future work on the REFLECT project will focus on increasing the number of universities and faculty using the process. We plan to continue developing new formative dimensions of teaching to include in the REFLECT peer observation protocol. These dimensions should continue to support and enrich faculty development and reflection.

Acknowledgements

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