122nd ASEE Annual Conference & Exposition
June 14 - 17, 2015
Seattle, WA
Making Value for Society
Paper ID #12971

Faculty Development Groups for Interactive Teaching

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Background

One ongoing challenge for engineering education is supporting and increasing the use of research-based practices for teaching and learning in the classroom. While there is evidence that increasing student activity and engagement during class does improve learning[1,2] the process of encouraging changes in teaching from lecture-driven courses to student-centered instruction remains a challenge. Drawing on results from K-12 teaching development that indicate the need for ongoing instructional development and the need to support faculty as they make pedagogical changes, we implemented a small group teaching development model. In a three-year project, we included two phases of teaching development groups. The teaching development model focused on increasing knowledge about research-based practices, particularly those focused on student engagement, combined with instructors' design and testing of interactive teaching strategies in their own classrooms. In the grant proposal, we asked the following questions: (1) What is the nature of the progress of a small group of invested faculty focused on interactive pedagogy? (2) How do faculty experienced in interactive pedagogy analyze student learning? The first question became the core of what we investigated over the life of the project. The second question evolved into understanding how faculty implemented teaching strategies that provided more formative assessment data and information about students' learning in an ongoing fashion.

Methodology

In year one, a pilot group was formed. This group consisted of four faculty members, all from different institutions. These faculty members would become group leaders in the second phase of the project, but in the first year they met monthly (via phone conference) as a teaching development group. We purposefully selected group leaders in electrical engineering and people we knew were familiar with and using interactive teaching strategies in their courses. They were also people with whom we had existing working relationships, so trust had been built before the project started. We began the project with a daylong in-person meeting in order to layout the objectives of the project and to provide an initial conversation about formative assessment, in particular the kinds of formative assessment they were currently using in their classes.

In year two, group leaders recruited instructors in engineering and other STEM disciplinary departments into local small groups at each of their institutions. Each group included the use of additional resources about research-based teaching and learning[3] to scaffold their discussions. Each instructor chose a new (to them) interactive teaching strategy to use in an upcoming course. Groups met regularly throughout the school year to discuss and plan their teaching. The group leaders continued meeting throughout the year (again via phone conference), as well. Conference call meeting notes, longer narrative descriptions written by group leaders, and survey data were collected to study the design of the groups.

Results

Research Question #1- Faculty Development Model

The survey results indicated that the faculty development groups were useful for supporting the instructors' teaching efforts. The groups provided sustained support and accountability. In addition, they supported connecting with other faculty interested in interactive teaching. At the same time that collaboration and community was important, instructors also had autonomy in selecting their own strategies and designing them for their own courses and contexts. A range of strategies were used by the instructors from small-scale formative assessments (e.g., muddy point cards) to in-class problem solving to flipped classroom models. A result of the project is the emphasis on providing entry points for faculty who become interested in making changes to their teaching. We found that supporting a range of strategies (even for small changes) could lead to a trajectory of larger changes over time as faculty realized the need for other ways to increase student engagement[4]. We also found that the groups needed to be both structured by having a facilitator but also sustainable by providing flexibility in meeting structure and group composition. For instance, groups set their own meeting schedules. Also, group composition decisions were made by the group leaders with some leaders choosing engineering-only groups and others including faculty from other STEM disciplines. The question of group composition is one that should likely be decided by the group or institution since future groups may want to organize by teaching strategy (e.g., if a collection of STEM faculty are interested in using flipped classroom models) or related courses.

Our primary criterion for group membership was that faculty needed to be interested in changing their teaching and that they be from STEM disciplines. Group members reported that it was helpful to be in a group with other people who were interested in considering new teaching strategies and were engaged in a similar process of thinking about their teaching. We would not recommend participation be mandated since that defeats the purpose of having a supportive environment for changing teaching. Bounding the groups at STEM disciplines was suggested since many of the STEM disciplines have similar teaching styles, similar concerns about content, and similar class formats with students needing both conceptual and procedural understanding. In addition, in some cases, faculty were able to learn about strategies that were being used in prerequisite courses in other departments.

Research Question #2 – Student Learning

Participants in the teaching development groups were asked to complete an online survey at the end of the study. Included among the questions asked of them were why they selected the particular strategy they chose to implement in their classes and what they learned from using that strategy. Survey responses indicated that faculty rationale generally fell in one (or both) of two categories. The most common rationale provided was that the strategies were selected to increase formative assessment; instructors wanted more opportunities to gauge students' understanding in real (or nearly real) time. They viewed the feedback on students' learning as having two purposes: (1) informing their teaching and (2) improving students' awareness of their own learning. In the words of one instructor who began using real-world experimental data-sets in classroom exercises, "This type of activity provided a useful and engaging formative assessment for me to utilize in the classroom." A second common rationale was focused on student engagement; instructors selected pedagogical strategies that made the classroom more interactive and helped students maintain focus. In explaining his/her motivation for incorporating short, interactive conceptual questions every 15-20 minutes in lecture, one instructor said, "The refocusing activities interrupt the monotony of pure lecturing and inject some energy and diversion into the class discussion." While participants adopted a range of pedagogical strategies with varying levels of complexity and disruptiveness, every survey respondent cited increasing feedback on student learning and/or increasing student engagement as a primary factor in motivating their choice of classroom innovation.

Overall Principles -- SIMPLE Design Framework

A main outcome of the project was the creation of the SIMPLE design framework for teaching development. In an end-of project wrap-up meeting for researchers and teaching group leaders, the group leaders shaped five principles (small groups, small changes, scaffolded, self-motivated, and structured) that they felt were critical to the success of their groups. We discussed two of the principles in more detail in an earlier paper (Authors, 2014). These evolved into the SIMPLE framework we created to guide the next project that broadened the teaching development groups to other STEM departments on our campus.

The SIMPLE design framework describes the characteristics that were identified as common across successful faculty development groups (and group participants) in the study. Groups should be **S**ustainable, focus on **I**ncremental change, include **M**entoring, be **P**eople-driven, emphasize interactive **L**earning **E**nvironments, and have a design focus. By sustainable, we mean the groups need to be constructed logistically such that they fit within the needs of the instructors and do not place too much burden in terms of time and cost on the instructors or the department. The incremental change principle means that the changes made by instructors do not have to be large, but successful change can have slowly, over a long period of time. For instance, over two years, one of our participants has shifted from a primarily lecture-driven format through using 1-2 in-class problems per class to now planning a class with minimal lecture comprised almost entirely of small group problem solving. This dramatic shift required small changes over multiple semesters for the instructor to feel comfortable planning for the new format. The mentoring principle means that instructors have mentoring in the form of a small learning community as they are trying new teaching strategies and providing feedback to each other. We are still exploring the role of the facilitator, but at minimum, the facilitator needs to also be interested in talking about teaching and willing to organize the group. People-driven groups are driven by the knowledge and experiences of the people involved, whether that is faculty in a teaching development group or students working together. The groups are organized around the needs, concerns, and interests of STEM faculty and are designed to meet their needs for creating more interactive learning environments as well as their abilities to implement new practices to improve the quality of student learning and engagement in STEM. The interactive learning environments principle means we are seeking learning environments that create interaction between students and instructors and among students. Multiple reports have commented on the need for such interaction to promote student engagement in their learning as well as the development of higher order skills such as critical thinking, problem solving and conceptual understanding[5].

Finally, the design principle means faculty agree to document their process of creating interactive teaching practices by creating a design memo that explains the innovation, the constraints and affordances of its use, and examples of its application in the classroom. This creates a sharable, external product and focuses their work on the design of teaching[6]. While group member share their work within their group, we are exploring mechanisms for having faculty share with wider groups of instructors in order to have their work disseminated even if only within their own institution. Other types of action research such as self-study focus on this need for an external audience to support critical examination and reflective practice[7].

Discussion and Future Research

In an extension of this project, we have expanded the teaching development groups to span the various STEM disciplines at our own institution. As in the original project, in addition to meeting with their teaching development groups, group leaders also meet on a monthly basis to provide support to each other and to share strategies for facilitating a teaching group. The SIMPLE design framework is being used to shape and guide these new groups. As a much broader range of disciplines is participating in the new study (example disciplines include biology, mathematics, and forensic science), we expect to see more variation in what the typical teaching approach looks like in these fields. As such, participating instructors will be starting from different points in terms of what constitutes innovation in their classrooms and what they view as the primary needs new innovations must address. We are examining new structures and characteristics in the data collected through this ongoing study.

Acknowledgements

This material is based on work supported by the National Science Foundation under grant numbers 1347675 (EHR/DUE), 1037683 (ENG/EEC) and while Margret Hjalmarson was serving as a Program Officer in the Division of Research on Learning in Formal and Informal Settings. Any opinions, conclusions, findings or recommendations are those of the authors and do not necessarily represent the views of the National Science Foundation.

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