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Stepping Up: How One Faculty Learning Community Influenced Faculty Members' Understanding and Use of Active-Learning Methods and Course Design

KerryAnn O'Meara
University of Massachusetts Amherst

The author assesses what effects the Science, Technology, Engineering, and Math Teacher Education Collaborative (STEMTEC) Faculty Fellows learning community program had over the course of an academic year on fellows' familiarity with and use of active-learning methods and course design. Based on surveys, interviews, focus groups, observations, and analysis of portfolios, the study concludes that the program had significant positive effects on participants' familiarity with and use of active-learning methods. Evidence suggests that fellows made substantial changes to their courses to improve student learning. The author discusses how changes occurred, how they might be linked to improved student learning, and what program elements were particularly successful.

Introduction

Active-learning and cooperative-learning pedagogies have been shown to enhance student retention and success in math, science, and engineering courses, and these strategies are believed to be important to improving the preparation of college graduates for careers in the sciences and as math and science teachers (Committee for Economic Development, 2003). Yet

research has shown that faculty tend to teach the way they were taught (Shymansky, Hedges, & Woodworth, 1990). Data suggest an overall instructional conservatism among many college teachers, particularly those in the sciences. As a result, a number of grant-funded projects have been developed over the last 10 years to encourage greater faculty knowledge of and use of active learning in undergraduate teaching (Committee for Economic Development, 2003; Millar, 2000).

Faculty who participate in professional-development activities tend to use more innovative instructional methods than those who do not (Cox, 2003; Light, Luna, Drane, & Calkins, 2005; Rust, 1999). Thus, advocates of active-learning methods have turned to faculty development as a primary strategy to increase their use. Whether the program is cohort-focused (addressing issues of a particular group, such as junior faculty or faculty of color) or issue-focused (such as emphasizing active-learning methods), evidence suggests that faculty learning communities produce substantial learning for their members (Austin, 1992; Cox, 2001; List, 1997). For example, Millis (1990) observes that these programs can help faculty understand the nature of cooperative learning and its documented impact on student achievement. According to Cox (2001), such programs both increase fellows' interest in undergraduate teaching and learning and nourish the scholarship of teaching and its application to student learning. Despite this evidence, as their budgets shrink, more and more colleges find themselves struggling to legitimize the learning benefits for students and faculty of professional development programs like the ones described above. Likewise, as colleges and universities struggle to determine whether they can afford to offer such programs, it is important to study which program elements are most successful in producing change and improvement in faculty pedagogy.

This article is intended to provide a model of how such faculty development programs might be evaluated. The program that was studied in this article was both issue-focused and cohort focused. The Science, Technology, Engineering and Math Teacher Education Collaborative (STEMTEC), a collaboration of institutions led by the University of Massachusetts Amherst, was funded by the National Science Foundation to prepare the next generation of science and math teachers in Western Massachusetts. One component of the larger collaborative, the Faculty Fellows program, was a faculty learning community created to assist science, math, and engineering faculty in learning about active-learning methods in an effort to increase their success in recruiting future math and science teachers to the profession. The program focused on early-career faculty who came from a diverse set of institutions in the collaborative, including two community

colleges, several liberal arts colleges, and a major research university. While the group was somewhat interdisciplinary (math, sciences, and engineering) and included faculty from different campuses there was, nonetheless, an emphasis on collegiality and learning from other participants that caused the program to be both issue-focused and cohort focused.

What follows is a brief history of the STEMTEC faculty learning community, the research questions and methodology that guided analysis of this program, the key findings, a discussion of how change occurred, and a reflection on how investment in such a program might be evaluated for its contributions to student learning.

STEMTEC Faculty Fellowships in Science and Mathematics Teaching Program: Context and History

The 2002 Faculty Fellows program engaged 16 fellows from 7 partner colleges in Western Massachusetts in a year-long faculty learning community aimed at enhancing fellows' familiarity with and likelihood of using active-learning methods in science, mathematics, and engineering courses and at facilitating the redesign of their courses to include active-learning methods. Modeled after the Lilly Teaching Fellows program, which provides course-release time for pre-tenure faculty to reflect on their teaching with colleagues (Austin, 1992; List, 1997), the fellows received a \$2,500 stipend each semester to support their involvement in the program. The program had two major components: bi-weekly dinner seminars and a course redesign project.

During the spring and fall 2002 semesters, the Faculty Fellows program held 16 dinner seminars of 2.5 hours each. The seminars included formal and informal discussions of teaching goals; active learning; informal and formal cooperative learning; alternatives to traditional tests; instructional technology; critical, higher order, and expert thinking; syllabus construction; interactive techniques for large classes; formative assessment; and individual reports from fellows on their course redesign efforts. Each session was a mix of mini-lectures by the program coordinators, videos modeling teaching techniques, exercises in which fellows tried out active-learning methods themselves, and unstructured discussions about fellows' own teaching and attempts at reform. All fellows received a copy of *Handbook on Teaching Undergraduate Science Courses: A Survival Training Manual* (Uno, 2002) and were assigned readings from the handbook related to each week's topic. Each fellow also designed a year-long plan to integrate active-learning methods into a course or courses that he or

she was teaching or would be teaching in the near future. At midyear fellows handed in a progress report to which they received feedback from the coordinators, and at conclusion of the program they submitted a final portfolio assessing the course redesign.

This article examines the degree to which the year-long Faculty Fellows program (January 2002 through December 2002) met its goals. The following research questions guided this study:

- Did participation in the Faculty Fellows program enhance fellows' familiarity with and/or use of active-learning methods? If so, how and why?
- Did fellows redesign their courses to include active-learning strategies? If so, how and to what extent?
- Which program elements were most successful in delivering the outcomes mentioned above? Which program elements were least successful?

Methods

Because the research questions were both quantitative (for instance, whether or not fellows were learning and using active-learning methods and to what extent) and qualitative (for instance, how and why fellows were learning and using active-learning methods), I employed several quantitative and qualitative data-collection strategies over the course of the year. Fellows completed a survey before the program began, at its midpoint, and at its conclusion. Fowler's (1993) work on survey methods guided the survey design. The three survey instruments I designed were reviewed by an expert in survey design to establish their validity and reliability. Based on this review, the survey was revised, confirmed, and given to fellows to complete. The first survey contained 15 items. One question asked fellows to rate their knowledge of various active-learning methods and the degree to which their courses achieved various learning outcomes on a 4-point scale from *not familiar with* to *use very often*. Another question asked fellows to assess their current courses for specific learning outcomes using a 4-point scale from *strongly disagree* to *strongly agree*. About half of the survey items had multiple questions. The second and third surveys repeated questions from the first survey in order to assess change in fellows' familiarity with active-learning strategies throughout the program.

There was a 100% response rate on the first survey (all 16 participants),

80% (12) of the midpoint surveys were received, and 87% (13) of the final surveys were received (by which time the total number of participants had dropped to 15).

I analyzed survey data using basic descriptive statistics and also used several qualitative methods to assist in understanding participants' experiences with active-learning methods and course redesign. Guided by experts in participant observation (Glesne, 1999), I attended, observed, and took notes at six of the fellows' dinner seminars (three in the spring and three in the fall). Two research assistants assisted me in interviewing 12 of the Faculty Fellows for 30-45 minutes each at the conclusion of the program using a semi-structured, open-ended question protocol I developed. The interview protocol included six questions on the fellows' experiences in the seminar meetings and with their own course redesign with special attention paid to how the experiences did or did not facilitate their knowledge and use of active-learning methods. We also discussed the fellows' perceptions of the success of their course redesign efforts. In addition, I facilitated two focus groups including all fellows, but without the program coordinators, at the program's midpoint and conclusion.

Document analysis provided additional context for the interview and survey data collected. Application materials, final course redesign portfolios, and communication from the fellows' listserv were analyzed using methods appropriate for document analysis (Whitt, 1992). In examining course redesign portfolios, I compared pre and post syllabi and participants' reflections on changes they had made and coded them for the presence or absence of active-learning methodologies.

The interviews, focus group sessions, and observation notes were transcribed and analyzed for themes relating to program goals as well as unexpected or divergent themes. I began data analysis by reading and rereading transcripts and then coding them according to categories that emerged from the data; coding reduced the amount of data and facilitated drawing conclusions from patterns that emerged (Miles & Huberman, 1994).

Findings

Impact of the Faculty Fellows Program on Participants' Familiarity With and Use of Active-Learning Methods

A list of teaching strategies known to inspire active learning was developed (see Table 1). While it may seem surprising to see lecture on this list, much has been written on strategies for enhancing active learning

within lectures (McKeachie & Svinicki, 2006), and, thus, it was included as a strategy. As Table 1 shows, the Faculty Fellows program was highly successful in increasing fellows' familiarity with new teaching strategies, most of which involved active-learning methods. At the beginning of the program in January 2002, one or more fellows noted that they were not familiar with at least 9 of the 12 teaching strategies listed in Table 1. When fellows were given the same list of teaching strategies at midpoint (May 2002) and at the conclusion (December 2002) of the program, however, the number of methods with which they were unfamiliar had decreased to two.

The survey data also were positive, but less definitive, concerning whether the Fellows program influenced fellows' likelihood of using these new teaching strategies and active-learning methods. Part of this lack of conclusiveness may be that many of the fellows had used at least some of the methods before beginning the program. Looking at survey data from January to May to December 2002, and combining the "use occasionally" and "use very often" categories, there were numerous areas where fellows clearly had begun using active-learning methods more often (see Table 1). First, there were areas where fellows seemed genuinely to increase their use of the strategies, even if only slightly: assessment (from 72% to 92.3%), hands-on activities (from 86% to 92.4%), cooperative learning (from 61.5% to 84.6%), teachers interacting with students in groups (from 57% to 69.3%), student presentations (from 53% to 69.2%), writing (from 64% to 77%), and teacher demonstrations (from 46% to 69.3%).

The ratings on the remainder of survey items represented no significant increases or decreases in use of active-learning methods across the course of the program. For example, the fellows went from 64.5% to 69.3% on class discussion, from 72% to 69.3% on utilizing digital educational media, from 100% to 92.3% on lecture, from 86% to 84.6% on lecture with discussion, and from 64% to 61.6% on utilizing other technology.¹

In the final survey at the end of the year, the fellows were asked to return to this same list of teaching strategies and indicate for each strategy whether or not the program was particularly effective in helping them to understand and use it. This time the fellows responded either yes or no; it was not a 5-point scale question. Responses on this question were less positive than previous responses. For example, only two strategies were identified by over 50% of the respondents as those that the program was particularly helpful in understanding and using: assessment, by 8 fellows (61.5%), and cooperative learning, also by 8 (61.5%). These two strategies were, in fact, those addressed most consistently throughout the Faculty Fellows program. In four other areas there were a small number

Table 1
Faculty Fellows' Use of Active-Learning Teaching Strategies

Directions: Listed below are various teaching strategies. For each strategy, please mark your degree of familiarity with and use (Use Occasionally = 1-3 times per semester; Use Very Often = 3-5 times per semester).

| | Not Familiar With | | | Familiar With But Have Not Used | | | Use Occasionally | | | Use Very Often | | |
|-------------------------------------|-------------------|-----|-----|---------------------------------|-----|------|------------------|------|------|----------------|------|------|
| | Jan | May | Dec | Jan | May | Dec | Jan | May | Dec | Jan | May | Dec |
| Lecture | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 25 | 23.1 | 92 | 75 | 69.2 |
| Lecture With Discussion | 0 | 0 | 0 | 14 | 0 | 7.7 | 21 | 42 | 15.4 | 65 | 58 | 69.2 |
| Class Discussion | 7 | 0 | 0 | 28.5 | 9 | 15.4 | 28.5 | 45.5 | 38.5 | 36 | 45.5 | 30.8 |
| Hands-On Activities | 0 | 0 | 0 | 14 | 8 | 0 | 43 | 25 | 46.2 | 43 | 67 | 46.2 |
| Utilizing Digital Educational Media | 7 | 0 | 7.7 | 21 | 9 | 15.4 | 43 | 64 | 23.1 | 29 | 27 | 46.2 |

Table 1
Faculty Fellows' Use of Active-Learning Teaching Strategies (continued)

Directions: Listed below are various teaching strategies. For each strategy, please mark your degree of familiarity with and use (Use *Occasionally* = 1-3 times per semester; Use *Very Often* = 3-5 times per semester).

| | Not Familiar With | | Familiar With But Have Not Used | | Use Occasionally | | Use Very Often | |
|----------------------------|-------------------|-----|---------------------------------|------|------------------|------|----------------|------|
| | Jan | Dec | Jan | Dec | Jan | Dec | Jan | Dec |
| Utilizing Other Technology | 14 | 0 | 22 | 23.1 | 50 | 46.2 | 14 | 15.4 |
| Assessment | 14 | 0 | 14 | 0 | 58 | 69.2 | 14 | 23.1 |
| Writing | 7 | 0 | 29 | 15.4 | 43 | 46.2 | 21 | 30.8 |
| Teacher Demonstrations | 39 | 7.7 | 15 | 15.4 | 23 | 30.8 | 23 | 38.5 |

| | | | | | | | | | | | |
|--|------|---|----|----|------|----|----|------|------|----|------|
| Cooperative Learning | 15.5 | 0 | 23 | 9 | 0 | 46 | 64 | 38.5 | 15.5 | 27 | 46.2 |
| Teachers Interacting With Students in Groups | 7 | 0 | 36 | 8 | 23.1 | 43 | 42 | 30.8 | 14 | 50 | 38.5 |
| Student Presentations | 7 | 0 | 40 | 34 | 23.1 | 40 | 50 | 53.8 | 13 | 16 | 15.4 |

Note. Percentages based on the total number of people who responded to the question. Response rates were as follows: January = 100% (N = 16 of 16 participants); May = 80% (N = 12 of 15 participants); December = 87% (N = 13 of 15 participants).

of affirmative responses: hands-on activities, by 4 fellows (30.8%), teachers interacting with groups, by 4 (30.8%), class discussion, by 3 (23.1%), and writing, by 3 (23.1%). The remaining areas—lecture with discussion, utilizing digital educational media, utilizing other technology, teacher demonstrations, student presentations, and lecture—had either no or just one or two positive responses.

Because the question asked whether the program was helpful in increasing fellows' understanding *and* use of the method, it is difficult to tease out whether the lower percentages of positive responses on this question were directed toward either understanding or use (or both). Qualitative data suggest that the program was quite helpful in increasing the fellows' familiarity with the methods covered in the dinner seminars, but that at times they wanted more detail from program coordinators concerning how to implement some of the strategies.

Data from individual interviews and from my observations suggest that at least for a certain set of cooperative-learning activities a great amount of detail was provided. For example, I observed one dinner session led by one of the coordinators on active-learning exercises, including the one-minute paper, the gallery walk exercise, interactive in-class exercises, and the use of rubrics (Angelo & Cross, 1993). Participants were divided into groups, and each group learned how to use a specific active-learning method. Then participants were reassigned to new groups, and each group member had to teach his or her new group members the technique that he or she had learned.

The small- and large-group discussions at the dinner seminars were lively and engaging. Fellows were highly involved in questioning each method, as if turning it over in their minds, considering how it might be useful to them and in what context. Each fellow left with detailed handouts on every teaching method discussed that evening and having personally experienced at least one or two of the methods.

In the focus group discussions, all fellows seemed to feel that the program had increased their familiarity with and likelihood of using active-learning methods. Individual interview data also were positive. The following statement by one of the participants illustrates most of the fellows' thoughts on this issue: "By far the most useful discussions for me were those where classroom activities were presented. I now incorporate several of these on a fairly regular basis in my courses. Think-Pair-Share exercises, for example, have led to classes where students discover important issues on their own." Another fellow concluded, "I've been teaching for 20 years. [And yet] every meeting provided me with something [new] I could take home and try to use."

When asked in the final focus group meeting what factors would most influence their future use of active learning in the classroom, fellows replied in unison that time, busyness, availability of resources, the student body, and the classrooms to which they were assigned would be the deciding factors. For example, one fellow who was frustrated in her efforts to implement active learning said, "teaching classes with large enrollments while also incorporating new teaching technologies is impossible when one is also faced with inadequate classroom facilities and inadequate support staff." Those fellows teaching at community colleges noted that often the student body was not adequately prepared to make the most of active-learning pedagogies. One fellow bemoaned having put considerable effort into a course website that her students never visited, or having some students in her classes refuse to do group work. In addition, the fellows all reflected concern in their final portfolios that integrating active-learning methods decreased the amount of time they could spend on content. One fellow said, "I have some reservations about the depth and breadth of factual content I can cover with the course revisions."

In conclusion, the preponderance of evidence suggests that the Faculty Fellows program was highly successful in expanding fellows' knowledge of active-learning methods and providing helpful information on how to use them. The program emphasized, and was most successful, in helping fellows use cooperative learning, hands-on activities, lecture with discussion, and activities involving teachers interacting with students in groups. Fellows took satisfaction in having a community of colleagues committed to teaching and to knowing they were doing their best to increase active learning despite barriers that might exist. One fellow said that having this community of supportive peers made him feel obligated to "step up [his] teaching," to push himself continually to do better.

Impact of the Faculty Fellows Program on Course Redesign

During their exit interviews participants were asked whether they were able to use any of the techniques they learned over the last year to improve their own teaching and/or student learning in their courses. All but one of the fellows said they had already begun integrating concepts learned throughout the program into their classes, and the remaining individual said he planned to do so later. All mentioned specific strategies and/or concepts that they had already integrated and described how. Some of the most common strategies already being used by participants were the pyramid exam, concept maps, cooperative-learning groups, integrating discussion into lectures through think-pair-share exercises, and the gallery

walk (Angelo & Cross, 1993). One fellow mentioned several strategies she had already used: "I used the mid-term quick evaluation involving handing out index cards for the students to write 3 things they liked and 3 things they didn't like so far in the course. I found it very helpful and informative for changing the class structure to better suit their needs and wants."

During their exit interviews the fellows also were asked whether they were satisfied with their course redesigns and what the change they had made would mean for their students. About 50% of the fellows were satisfied with their course redesign efforts, and about 25% said that they were not satisfied. The remaining 25% said redesigning a course was not really applicable to them and their situations, so it had not been part of their work during the program. Those who were not satisfied with course redesign blamed either themselves or their students, not the Faculty Fellows program, for their dissatisfaction. For example, someone who said she was not happy with her course redesign attributed it to the lack of interest her students had in the course: "It was tough because a lot of students don't make it to class, and their attitude towards school won't change." One fellow noted that while he was reasonably satisfied, he still needed to tinker with the course to find the right balance of content/breadth of knowledge and active-learning techniques, because in doing active learning "you just go slower." This individual felt that he was moving toward a balance on this issue, however.

Those fellows who were satisfied with their course redesign observed feeling confident that their students now spent more time "doing" rather than listening to lecture. They observed that students were enjoying class more, were more open to learning, were participating more, and were acquiring more learning skills (such as concept forming, questioning, decision making, applying, and analyzing).

Some of the fellows were more confident than others in the outcomes of their efforts. One fellow said, "Yes, I am extremely pleased with my course redesign. I'm not sure what it means for my students, other than that they definitely found the new approach both more enjoyable and more challenging. Did it help them learn more effectively? I don't feel qualified to assess that." Another fellow said, "They [my students] seem to be happier and more willing to approach new situations/problems which I hope comes from a deeper understanding of the material. They also spend less time asking me 'when will I ever need/use this?'"

The fellows were asked in the survey at the beginning of the program to assess the degree to which the course they would be redesigning had been achieving various teaching/learning outcomes up to that point, and

asked again at the end of the program the degree to which their revised course would be achieving these same outcomes (see Table 2).

All fellows reported that their revised course was producing greater learning outcomes than when they started. When the "strongly agree" and "agree" ratings were combined, fellows noted the greatest increases from the beginning to the end of the program in the following areas: "The course is designed to engage students as members of a learning community" (from 57% to 92.4%); "Interactions reflect collaborative working relationships among students . . . and between teacher and students" (from 60% to 92.3%); "Intellectual rigor, constructive criticism, and the challenging of ideas are valued" (from 71% to 92.3%); "Students are encouraged to generate conjectures, alternative solution strategies, and/or different ways of interpreting evidence" (from 57% to 77%); "The instructional strategies and activities respect students' prior knowledge and the preconceptions inherent therein" (from 62% to 84.6%); "Students have opportunities to reflect about their thinking" (from 58% to 76.9%); and "The course encourages students to seek and value alternative modes of investigation and problem solving" (from 38.5% to 53.8%).

In areas the fellows rated highly at the program's outset, only modest increases were noted over the course of the year. Combining "strongly agree" and "agree" categories again, fellows reported small increases in the following areas: "As a teacher, you display an understanding of mathematics/science concepts" (from 92% to 92.3%), "Elements of abstraction . . . are encouraged when it is important to do so" (from 58% to 61.6%); "The lesson promotes strongly coherent conceptual understanding" (from 78% to 84.7%); and "Appropriate connections are made to other areas of mathematics and science, to other disciplines, and/or to real-world contexts, social issues, and global concerns" (from 85% to 92.3%). It makes sense that fellows noted the fewest increases from course redesign efforts in these areas because, with the exception of the final learning outcome listed above, these outcomes are not specifically targeted by active-learning methods. When asked in another part of the survey to rate their own skills in the area of course redesign at the beginning, midpoint, and end of the program, fellows' ratings went from 50% to 82% to 76.9%, respectively.

During the final Faculty Fellows dinner seminar, fellows presented some of the outcomes of their course redesign efforts. One fellow described his efforts with a first-year class on programming language. He said that students demonstrated a math phobic response to the course: They were good at "plug and chug" equations, but when asked to create the questions and equations, they became scared. Thus, he tried to make it a more interesting class in which students designed their own

Table 2
Course Revision Strategies of Faculty Fellows

Directions: Please mark the degree to which each of the statements below represents your course.

| | Strongly Disagree | | Disagree | | Agree | | Strongly Agree | |
|---|-------------------|-----|----------|------|-------|------|----------------|------|
| | Jan | Dec | Jan | Dec | Jan | Dec | Jan | Dec |
| The course encourages students to seek and value alternative modes of investigation and problem solving. | 23 | 0 | 38.5 | 53.8 | 38.5 | 53.8 | 0 | 0 |
| Elements of abstraction (i.e., symbolic representations, theory building) are encouraged when it is important to do so. | 0 | 0 | 42 | 23.1 | 33 | 30.8 | 25 | 30.8 |
| Students have opportunities to reflect about their thinking. | 0 | 0 | 42 | 7.7 | 50 | 53.8 | 8 | 23.1 |
| The course is designed to engage students as members of a learning community. | 7 | 0 | 36 | 0 | 50 | 46.2 | 7 | 46.2 |
| The instructional strategies and activities respect students' prior knowledge and the preconceptions inherent therein. | 0 | 0 | 38 | 7.7 | 56 | 61.5 | 6 | 23.1 |

| | | | | | | | | |
|---|---|---|----|------|----|------|----|------|
| Interactions reflect collaborative working relationships among students (e.g., students work together, talk with each other about the lesson) and between teacher and students. | 0 | 0 | 40 | 0 | 47 | 38.5 | 13 | 53.8 |
| Intellectual rigor, constructive criticism, and the challenging of ideas are valued. | 0 | 0 | 29 | 0 | 50 | 61.5 | 21 | 30.8 |
| The lesson promotes strongly coherent conceptual understanding. | 0 | 0 | 22 | 7.7 | 64 | 46.2 | 14 | 38.5 |
| Students are encouraged to generate conjectures, alternative solution strategies, and/or different ways of interpreting evidence. | 7 | 0 | 36 | 15.4 | 50 | 38.5 | 7 | 38.5 |
| As a teacher, you display an understanding of mathematics/science concepts (e.g., in your dialogue with students). | 0 | 0 | 8 | 0 | 38 | 23.1 | 54 | 69.2 |
| Appropriate connections are made to other areas of mathematics and science, to other disciplines, and/or to real-world contexts, social issues, and global concerns. | 0 | 0 | 15 | 0 | 70 | 61.5 | 15 | 30.8 |

Note. Percentages based on the total number of people that responded to the question. Response rates were as follows: January, 100% (N = 16 of 16 participants); December, 87% (N = 13 of 15 participants).

programs. In one assignment he challenged students to create a program that would allow them to “eat their computer.” The professor said it appealed to students’ basic instincts related to food, power, and violence; as a result, students became less afraid of making mistakes. The real goal was to help students develop problem-solving skills through the vehicle of programming. In the future, he hoped to pair up students earlier to get them more involved in helping each other in the class. Another fellow presented his work integrating active-learning strategies into a class on organisms. To encourage students to participate more, he used think-pair-share exercises and incorporated into his presentations props, an exercise on students’ feelings about invertebrates, and the gallery walk exercise. The professor said that although most of these strategies worked well, the downside was he could not cover as much material as he had in the past. A third fellow’s presentation began with this statement: “I felt as if I would be depriving my students if I knew all of these techniques and didn’t use them.”

Each of the fellows was required to hand in a portfolio of his or her course redesign efforts at the conclusion of the program. Analysis of these final portfolios revealed that 60% of the fellows completed extremely thoughtful, comprehensive, and useful analyses of their work, 20% completed very good or good portfolios, and 20% did not hand in a portfolio. The following themes emerged from an examination of the 11 portfolios submitted. First, fellows’ pre/post syllabi confirmed, in a more qualitative way, the survey data suggesting that these individuals already were innovators before they joined the Faculty Fellows program. Most of their syllabi showed that they used active-learning strategies before they began the program, including student presentations and hands-on activities, and many had already built technology into their classes.

Documentation and evidence in the portfolios showed, however, that the program had helped the fellows to incorporate new active-learning strategies into their classes, to better articulate course goals, and to make the class more enjoyable for themselves and their students. The majority of fellows had added think-pair-share exercises, the use of props, the gallery walk, case studies, role-playing, and discussion groups, to name just a few innovations. Some used the experience to redesign a successful small class for a larger audience (200+ students); others created brand new courses. All of these efforts were concerned with increasing student engagement and retention, and all strove to increase students’ sense of the relevancy of the course to their everyday lives. Because most of the fellows did not convert an existing class into a reformed one, they had a difficult time determining whether the outcomes were truly different.

They found it especially difficult assessing abstract learning goals. Most of the fellows perceived their students as being more engaged than before, and, in general, they believed that because of their course revisions students were being given greater responsibility for their own learning. However, most fellows also provided a strong analysis of what did not work and why, and most mentioned that although they “lost time for content” when integrating active-learning exercises, they felt the benefits outweighed the costs.

The following statement by one of the fellows is illustrative of the many impacts the fellows perceived that the program had on participants, their students, and their courses:

[My institution] has always been dedicated to innovative educational approaches, of which student-centered classroom activities are an important part. Even then, being a STEMTEC fellow for the past year made it easier for me both to talk about different teaching techniques and put them into practice. I now run my classes as a facilitator, and this is in great part thanks to STEMTEC activities during the last year. While this allows me to conduct my teaching in a more satisfying way, I believe the biggest winners to be my students.

Program Elements: What Worked, What Was Less Successful

In the survey they completed at the conclusion of the program, faculty fellows were asked to rate (as “not at all helpful,” “somewhat helpful,” or “very helpful”) seven components of the program curriculum: the STEMTEC handbook and other assigned readings; videos that modeled teaching techniques; discussions among fellows about their own teaching and attempts to use different techniques; mini-lectures on active-learning strategies and other teaching techniques; exercises in which faculty fellows tried out the active-learning methods themselves; presentations by faculty fellows on their own projects; and the development of their individual portfolios. All seven components were rated highly by the fellows. The fellows felt the discussions among faculty fellows about their own teaching and attempts at reform were the most helpful part of the curriculum, with 13 (100%) finding that component “very helpful.” This was followed by mini-lectures on teaching strategies (10, or 76.9%, found “very helpful”; 3, or 23.1%, found “somewhat helpful”), exercises in which faculty fellows tried out the active-learning methods themselves (7, or 53.8%, found “very helpful”; 6, or 46.2%, found “somewhat helpful”), presentations by faculty fellows on their own projects (4, or 30.8%, found

"very helpful"; 9, or 69.2%, found "somewhat helpful"), and videos that modeled teaching techniques (6, or 50%, found "very helpful"; 6, or 50%, found "somewhat helpful"). The development of individual portfolios was seen as one of the weaker components of the program, with only about 15% finding this "very helpful." The handbook and other assigned readings were considered the least effective component, with less than 8% of the fellows finding this component "very helpful."

It is important to note that most of the fellows had not completed—or likely even begun—their final portfolio when they completed the final survey. Thus, their somewhat low rating on the usefulness of developing portfolios may not reflect the actual experience of it as much as the dread at having to complete yet another task. The handbook readings and the development of individual portfolios were the least structured of the seven components of the program. It is to the coordinators' credit that the more structured aspects of the program were found to be the most helpful by participants. The fellows seemed to believe that they gained the least from those areas in which they themselves invested the least time and energy—in this case doing the readings, preparing to present and listening to other fellows' presentations, and preparing final portfolios.

Interviews and focus groups confirmed and complemented the survey findings that the conversations between colleagues, the facilitation of the groups by the coordinators, and the individual course redesign project were key ingredients for success. The coordinators did an excellent job in facilitating the development of community and trust in the group so that conversations could generate substantial learning. For example, coordinators encouraged participants to consider stories of "teaching flops" confidential and to take risks and share their hopes and fears around their teaching by sharing stories from their own teaching lives. Interactions among fellows and between fellows and coordinators during dinner seminars helped fellows examine the learning goals they had for the courses they were revising. For example, one of the fellows described a course on computer programming and its goals, stating that the goal of the course was to teach students to think critically. Someone listening asked, "So you don't care if they learn specific programs?" He responded, "the goal is not to become computer scientists, but rather to take a problem and break it into bits to solve it." This individual then went on to describe a second course he wanted to revise, stating that the goal would be "developing students' skills and confidence in trying to figure out how to build something." Other fellows questioned him: "How will you evaluate it? How hard will the projects be?" This kind of back-and-forth exchange seemed to stimulate the individual to be more critical about his course plans and

to help him to confirm his student learning goals. The individual course redesign projects caused participants to assess the outcomes of their own pedagogy and their students' learning, something they said that they would not have done without these assigned projects.

Finally, when seeking successful ingredients for future learning communities it is important to consider the way the group was recruited. The group benefited from a structure that brought together from different institutions early-career faculty, who were already committed to teaching, to enjoy dinner and conversations that were purely informative and not evaluative in any way. The fact that the program lasted a full year, so that relationships were able to be built across disciplines and institutions, further added to its success (Harper, 1996).

Discussion and Implications

Previous studies of faculty development programs have observed the difficulty that arises in trying to assess what impact faculty development activities have had on student learning (Eble & McKeachie, 1985). Most sincere evaluators of faculty development programs have done what was done here. They look for changes in revised courses, in faculty members' perceptions of their learning and of their teaching skills, and from these they make inferences about impacts on student learning. Eble and McKeachie (1985) observe that "while no one measure may be convincing, the convergence of evidence from several sources—each having some probable relationship to the observed outcome—increases one's confidence that a program has indeed succeeded" (p. 179). I would add that, in addition to triangulating sources, pre and post data offer additional credibility to fellows' claims of change. And it is important, because they are time- and labor-intensive, that programs like this one be evaluated in terms of their success. Cox (2001) reports that faculty learning communities can range in cost anywhere from a low of \$1,000 per participant to the cost of release time for each participant, which will vary by institution. Each of the participants in this study was compensated \$5,000 for the entire program. Other project costs included the dinners and the coordinators' time, which were compensated by a similar stipend. However, when one considers that early-career faculty will be teaching hundreds, if not thousands, of students throughout their careers and compares these costs to the potential improvements in student learning in each of the participants' classes, it seems that a wise investment was made. Nonetheless, it is important that program evaluators and faculty developers continue to examine the link between faculty development and student learning.

Individual portraits or case studies of students who have had professors before and after faculty development experiences might help us to understand better, from students' perspective, how these new teaching practices actually influence student learning.

Conclusions

This faculty development model should be of interest to future programs aimed at strengthening teaching and learning in higher education. As Bowen (1977) observed in his catalogue of goals for higher education, the major goal of higher education is growth and learning that changes peoples' lives. Faculty learning communities such as this one have the potential to create substantial change in how their faculty teach and, by doing so, improve learning for all involved.

Footnote

There are two likely explanations for the lack of growth in these areas. First, fellows were relatively familiar with these strategies when they began the program, and second STEMTEC coordinators spent less time discussing these areas compared to the methods above. In interpreting these numbers, it is also perhaps best to disregard slight decreases in percentage of positive responses from the midpoint to the conclusion of the program in light of there being significant growth from the beginning of the program to the end. First, there was some variation in fellows' participation in the survey, and because of the small numbers, just one or two non-respondents could have impacted that slight dip. Second, while each of these active-learning methods was explored at different points in the year, many of the methods were explored in the first half of the year and, thus, may have been fresher in the minds of fellows when they completed the survey at the midpoint than at the end of the program. Regardless, it is important to note that in the areas with which the STEMTEC coordinators spent the most time, fellows noted some increase in their use of active-learning methods from the beginning of the program until the end.

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KerryAnn O'Meara is assistant professor higher education at the University of Massachusetts Amherst. Her research explores faculty community engagement, faculty and professional development, and organizational behaviors that support faculty and student learning. She recently founded a new master's degree track in service-learning and engagement in higher education at UMass Amherst, and her co-edited book with Gene Rice, *Faculty Priorities Reconsidered*, was published by Jossey-Bass in 2005.

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Faculty Learning Communities: Enhancing the Scholarship of Teaching, Learning, and Curriculum Practice

Harry Hubball &
Simon Albon

The University of British Columbia

Faculty learning communities provide an authentic forum through which to engage academics from diverse backgrounds in the scholarship of teaching, learning, and curriculum practice. The authors examine the development and impact of FLC strategies that were employed in an 8-month faculty certificate program on the scholarship of teaching and learning at the University of British Columbia. Research data collected over a 12-month period suggest that progressive FLC strategies organize a faculty certificate program around issues relevant to university faculty, ensure that the learning environment closely simulates the pedagogical context, and engage faculty as active participants in the scholarship of teaching, learning, and curriculum practice. Barriers to FLCs include university cultures, teaching award criteria, disciplinary barriers, and program scheduling logistics.

Introduction

In the face of the rapidly changing landscape of higher education, the scholarship of teaching and learning (SoTL) is essential for undergraduate program reform and developing responsive and integrated curricula, enhancing the quality of student learning experiences, serving the diverse professional development needs of faculty, and providing pedagogical