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STEMTEC Evaluation Report For Year 5 (Fall 2001/Spring 2002)

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Executive Summary

The Year 5 evaluation of STEMTEC was extremely comprehensive, involving surveys of students, faculty members and administrators, interviews with faculty and senior administrators, and classroom observations in K-12 and postsecondary settings. The findings from this year's evaluation are quite consistent with last year's assessment as the initiative appears to have continued achieving many of its goals. Many accomplishments of the program remained evident, some new strengths were identified, and some limitations continue. On balance, the strengths outweigh the weaknesses. Suggestions for improvement have also been documented in case they can be used to inform future activities of on-going STEMTEC efforts and perhaps assist other collaborative efforts in future endeavors. Key findings include:

1. With respect to its strengths, the results conclusively indicate that STEMTEC has had a positive effect on getting math and science teachers to reform their teaching to facilitate student-active learning. The faculty survey, the student surveys, the campus coordinator interviews, and the classroom observations all provide data that the STEMTEC teaching philosophy is being successfully applied in STEMTEC classrooms. Specific examples of evidence supporting this finding include:

- Teaching Scholars were 50% more likely to report participating in hands-on learning in STEMTEC courses than they were to report experiencing lecture-based learning.

- STEMTEC faculty on average reported spending 60-70% of their professional time on improving teaching or reforming curriculum.

- Lecture-based learning was recorded only 25% of the time in observation of STEMTEC classes, while small group discussion and teacher interaction with students were each observed to occur about 33% of the time in class.

- Students were observed to be highly engaged for 70% of the time during the classroom observations of STEMTEC courses.

- Senior administrators consistently reported that the major accomplishment of STEMTEC was its success in reforming science and math instruction at participating institutions.

2. The results also suggest that STEMTEC is providing rewarding teaching experiences for many math and science students.

- The teaching scholars once again rated their teaching experiences highly.

- 90% of students surveyed indicated that they were encouraged to ask questions in STEMTEC classes and 72% of these students reported being encouraged to provide instructors with feedback.

3. Preliminary indications from classroom observations of STEMTEC *graduates* suggest that reform teaching practices are being used once they become teachers in public schools. A variety of active learning techniques were used a high percentage of the time in lessons taught by STEMTEC graduates. Additionally, the students of these STEMTEC graduates were observed to be highly engaged for 90% of the time during the classroom observations.

4. The evaluation of the new Faculty Fellows program indicates promising results from this new initiative. During their participation in the program, faculty fellow participants reported growth in each of the following areas: skills as a teacher, understanding of how students learn, collegial contacts, philosophy of teaching, design of courses, overall professional development as a university faculty member, comfort level with sharing teaching strategies with colleagues, and self confidence as a teacher.

5. Despite the many strengths of STEMTEC, there are a few areas of concern. Success in recruiting underrepresented minorities into the math and science teaching profession remains a weakness. Minority participation (11%) in Year 5 remained at about the same level as prior years; this is less than the overall demographics of the Collaborative institutions, but on par with teacher preparation programs, in general. Earlier in the project, there was a greater emphasis on recruitment activities, but in Year 5 there were few activities specifically targeted to this goal. The difficulty of the task is acknowledged, however the goal of increased diversity within the STEMTEC student ranks has yet to be achieved.

6. The failure to accomplish the goal of recruiting under-represented minorities may also be attributed to a lack of awareness about STEMTEC among students. This lack of knowledge about the program is clearly evident from the student surveys in which many students indicated no knowledge of the STEMTEC program. This finding was reinforced by information received from teaching scholars, a third of whom indicated no knowledge of having ever been enrolled in a STEMTEC course and only 15% of them responding that it was important for them to enroll in a STEMTEC course.

In sum, despite the few lingering areas of concern, the evaluation of STEMTEC is overwhelmingly positive. A tremendous amount of progress has been accomplished across almost all seven of the original goals.

Introduction

As STEMTEC began Year 5, some of the project goals had already been accomplished, while less progress had been made toward other goals. In the final year of the STEMTEC project, the evaluation shifted its primary focus to assessing the effect STEMTEC has had on the college students (i.e., the future teachers). Another focus was an evaluation of the support STEMTEC provides to new K-12 science and math teachers. Further, the redesign of STEMTEC courses remained an important aspect of the evaluation. The seven STEMTEC goals were reprioritized in terms of the evaluation for Year 5 of the project as described below.

Priority One: Conduct strong programs of evaluation and assessment (Goal 7).

Priority Two: Improve the preparation of future K-12 teachers of mathematics and science (Goal 3).

Priority Three: Recruit and retain promising students into the math and science teaching profession, with special attention to underrepresented groups (Goal 4).

Priority Four: Develop program to support new science and math teachers in their first year in the classroom (Goal 5).

Priority Five: Redesign the science and math curricula on the campuses of the Collaborative to incorporate new pedagogies and establish mechanisms for supporting faculty in their course redesign (Goal 2).

Priority Six: Establish dissemination mechanisms (Goal 6).

Priority Seven: Establish a functional educational collaborative (Goal 1).

Although we present these goals and priorities as distinct components of the Collaborative, they are all closely related and so our primary evaluation questions each address multiple STEMTEC goals. The specific evaluation questions we addressed are:

(a) Has STEMTEC conducted a strong program of evaluation and assessment?
(b) Has STEMTEC improved the preparation of K-12 math and science teachers?
(c) Has STEMTEC recruited new math or science teachers?
(d) Has STEMTEC improved the retention of math or science teachers?
(e) Has STEMTEC recruited under-represented minorities into the math/science teaching profession?
(f) Has STEMTEC improved the retention rates among under-represented minority math/science teachers?
(g) Has STEMTEC effectively supported math and science teachers in the first year of teaching?
(h) Has STEMTEC facilitated redesign of the science and math curricula on the campuses?
(i) Has STEMTEC facilitated the incorporation of new pedagogies on the campuses?
(j) Has STEMTEC established mechanisms for supporting faculty in their course redesign?
(k) Have the philosophies and successes of STEMTEC been effectively disseminated?
(l) Is the collaborative fully implemented?
(m) Is the collaborative running efficiently?
(n) What are the strengths and weaknesses of the STEMTEC program?
(o) What improvements can be made?

At the conclusion of this report, we relate how the data presented in each chapter provide answers to these questions (see Evaluation Summary and Recommendations). The evaluation matrix from which we operated is presented in Appendix A.

Results of the Teaching Scholar Survey

Sharon Cadman Slater

Results of the Teaching Scholar Survey

In each year of the STEMTEC project, the Student Program awards NSF scholarships to students interested in exploring the prospect of becoming a science and/or math teacher. These students, called Teaching Scholars, must be enrolled at one of the eight institutions associated with the STEMTEC Collaborative: Amherst College, Greenfield Community College, Hampshire College, Holyoke Community College, Mount Holyoke College, Smith College, Springfield Technical Community College, or the University of Massachusetts Amherst. Further, scholarship recipients agree to attend at least three events organized by STEMTEC, arrange to participate in a teaching experience, and submit a final report at the end of the academic year. The results presented in this paper summarize the information reported by students in the 2001-2002 Teaching Scholar Mandatory Final Report and Survey.

Method

In May 2002, a survey was mailed to sixty-three 2001-2002 NSF Teaching Scholars. The goal of the survey was to gather information from the Teaching Scholars about their learning and teaching experiences over the academic year. The participants and the survey are described in more detail in the following sections.

Participants

Sixty-two of the sixty-three (98%) Teaching Scholars completed and returned surveys. The survey was conducted through the mail, and various follow-ups with the Teaching Scholars were made by email. Although the final report and survey are mandatory requirements of the scholarship, there are no repercussions for failing to complete the form, except perhaps to be denied renewal of the scholarship. Nonetheless, all but one of the students did respond. The Teaching Scholars who responded to the survey represented seven of the eight institutions involved in the Collaborative; there were no Teaching Scholars from Amherst College this year. Approximately half of the participants were students from the University of Massachusetts. The participants were predominantly female and white, with only ten describing themselves as African American or Black, Asian, Hispanic or Latino/a, Multiracial, or Other. (More detailed demographics of the participants are presented in the Results section below.)

Description of Survey

The 2001-2002 Teaching Scholar Mandatory Final Report and Survey is presented in Appendix B. On the survey, Teaching Scholars supplied their names, permanent addresses and telephone numbers, and email addresses. Respondents were asked to indicate their ethnicity, their campus, expected graduation date, and teaching level interests. Questions on the survey were designed to gain information about the Teaching Scholars' interests in teaching and how they perceive their teaching skills. Of particular interest was how STEMTEC may have influenced their attitudes about teaching and their teaching skills.

Results

The results section first describes the demographics of the participants. Second, Teaching Scholar attitudes about teaching are discussed, including student interest in teaching and how they perceive their skills. Next the teaching experiences of the Scholars are described. Finally, the Scholars' impressions of the STEMTEC program are presented.

Demographics

As mentioned earlier, a total of 62 of the 63 Teaching Scholars responded to the survey, yielding a response rate of 98%. The one non-participating Scholar was a student at the University of Massachusetts. The sample of students was predominantly female (76%) and Caucasian (77%). Ethnicity/Race information is presented in Table 1.1.

Table 1.1. Ethnicity/Race Categorization of the Teaching Scholars

Ethnicity or Race	Number of Respondents	Percent
Caucasian or White	48	77.4%
Multiracial or Other	5	8.1
No Response	4	6.5
African American or Black	2	3.2
Asian	2	3.2
Hispanic or Latino/a	1	1.6

Over half of the students were enrolled at the University of Massachusetts Amherst (55%), and six of the remaining eight institutions involved with the Collaborative were represented by at least one Teaching Scholar. As mentioned above, Amherst College was not represented. There was also a mix of expected graduation dates, with the majority of students expecting to graduate in 2002 or 2003 (74%). Keep in mind that graduation dates could be for associate's, bachelor's, or master's degrees. Breakdowns of campus and graduation information are presented in Tables 1.2 and 1.3, respectively.

Table 1.2. Campus Affiliation of the Teaching Scholars

Campus	Total Number of Scholars	Number of Respondents	Percent of Respondents
University of Massachusetts Amherst	35	34	54.8%
Mount Holyoke College	11	11	17.7
Hampshire College	6	6	9.7
Smith College	6	6	9.7
Greenfield Community College	2	2	3.2
Springfield Technical Community College	2	2	3.2
Holyoke Community College	1	1	1.6

Table 1.3. Expected Graduation Dates of Teaching Scholars

Expected Graduation Date*	Number of Respondents	Percent
2002	25	40.3%
2003	21	33.8
2004	10	16.1
2005	1	1.6

*Dates include May, August, and December graduations

Students graduating in May 2002 were asked to briefly describe their future plans, and in particular their plans related to teaching. Four of the students planned to continue their education: one in environmental chemistry, one in a masters program for elementary education, one in another masters program (unspecified), and the fourth will pursue a bachelor's in biology. Three of the students are applying for work outside of the classroom: one as a health educator, one at a museum, and one at a historical society. All three of these positions would involve informal teaching. Two have secured non-teaching jobs: one in research, the other as an alumni intern at their current institution. The remaining students plan to teach at some point. Five specifically stated that they have secured teaching jobs (2 high school math, 1 high school biology, 1 high school physics, and 1 middle school math), while nine are actively looking for teaching positions. Subject levels these graduating seniors would like to teach include elementary (4), high school biology (2), high school physics (1), high school math (1), unspecified math or science (1).

Future Teaching Plans

All Teaching Scholars were asked to indicate the levels and subjects they were interested in teaching. High School teaching was the most popular choice, with 45 of the 62 (73%) students indicating an interest in teaching at that level. Math and Biology were the most popular choices for teaching subject. Tables 1.4 and 2.5 contain the information on interests in teaching level and subject, respectively.

Table 1.4. Teaching Levels of Interest to Teaching Scholars

Teaching Level	Number of Respondents	Percent*
High School	45	72.6%
College	27	43.5
Middle School	25	40.3
Elementary	18	29.0
Other	6	9.7

*Respondents could select more than one level, therefore the percent column does not sum to 100.

Table 1.5. Subjects of Interest to Teaching Scholars

Subject	Number of Respondents	Percent*
Math	25	40.3%
Biology	14	22.6
All Science	9	14.5
Environmental Science	7	11.3
Physics	6	9.7
Chemistry	6	9.7
Earth Science / Geology	5	8.1
Elementary	3	4.8
Computer Science	2	3.2
Health / Life Science	1	1.6
Other	1	1.6

*Respondents could select more than one subject, therefore the percent column does not sum to 100.

Of the sixty-two respondents, seventeen (27%) were currently enrolled in teacher certification programs when they completed the survey. Eight of those students were enrolled for high school (grades 9-12) certification, four were for elementary (grades K-6), and one was for grade levels 5-12. Certification subject areas were: biology (4), general science (4), math (3), earth science (2), and physics (1).

Fourteen of the sixty-two Teaching Scholars (23%) completed teacher certification programs in the 2001-2002 academic year. Six of those students completed certification for the elementary level and four completed certification for the high school level. Certification subject areas for this group were: general science (5), math (2), biology (1), chemistry (1), physics (1), and elementary (1). Of the remaining Teaching Scholars not enrolled in certification programs, twenty-five (40%) were planning to enroll in a certification program someday, thirteen (21%) were not planning to enroll, and five (8%) were unsure.

Attitudes Toward Teaching

The Teaching Scholars were asked to rate the attractiveness of a career in teaching and the likelihood that they would someday teach a course in math or science. Ratings for these two questions were on a 6-point scale, with one meaning "not at all attractive or likely" and six meaning "very attractive or likely." The mean response to the question, "How attractive does a career in teaching science or math sound to you?" was 5.1 (standard deviation = 0.84) and the median was 5.0, indicating a positive response. Only one of the respondents (2%) chose a response less than 3. The mean response to the question, "How likely is it that you will someday teach a math or science course?" was 5.4 (standard deviation = 0.97). Again, only one respondent selected a response less than 3 on this six-point scale.

The Teaching Scholars were also asked to rate their level of agreement with eight statements about teaching interest and skills on a five-point scale (strongly disagree, disagree, neutral, agree, strongly agree). Responses to six of the eight statements were positive (i.e., median response was "agree"), while responses to the other two statements were neutral. These results are summarized in Table 1.6 where the medians, means, and standard deviations of responses are listed by statement. As the summary presented in Table 2.6 indicates, the Scholars tended to agree that the STEMTEC experiences and activities were rewarding. The responses to the last question suggest that many of the teachers would have become math or science teachers irrespective of STEMTEC. However, the responses to the other questions suggest that STEMTEC has helped them become better teachers.

Table 1.6. Means, Medians, and Standard Deviations of Responses to Statements About Teaching

Statement	Median Response	Mean[1] (Standard Deviation)
My STEMTEC teaching experience provided me with knowledge or skills that will make me a more effective math or science teacher.	Agree	4.3 (0.65)
The STEMTEC Teaching Scholar activities (e.g., workshops, talks) provided me with skills or knowledge that will make me a more effective math or science teacher.	Agree	4.2 (0.66)
The STEMTEC Teaching Scholar workshops were a good use of my time.	Agree	4.1 (0.74)
I was very committed to becoming a teacher *before* I participated in the Teaching Scholars Program.	Agree	4.1 (1.04)
My STEMTEC teaching experience (the teaching activity I participated in during the award period) increased my interest in teaching math or science.	Agree	4.0 (0.77)
The STEMTEC Teaching Scholar activities increased my interest in teaching math or science.	Agree	3.8 (0.90)
One or more STEMTEC faculty members helped me to reach my teaching goals.	Neutral	3.3 (1.04)
I am more likely to become a teacher now, than I was at the beginning of this school year.	Neutral	3.4 (1.00)

[1]Means and standard deviations were calculated by using 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly Agree.

Teaching Experience

As described in the beginning of the paper, one of the requirements of the NSF Teaching Scholarship was to complete a teaching experience, defined as "a formal or informal teaching activity on your own campus, another campus, or a K-12 classroom." On the survey, students were asked to indicate, among other things, the number of hours spent on the teaching experience, the grade level, the subject area or topic, and the kinds of activities that were involved in their experience.

Teaching Scholars varied a great deal in the amount of time spent on the teaching experience, with some students reporting to have spent 30 or 40 hours total, and others reporting having spent "hundreds." The majority of students appear to have had some sort of weekly commitment associated with their teaching experience. Teaching experiences were primarily in K-12 settings, but several served as teaching assistants at the college level. Regardless of where the teaching experience occurred, or how much time was invested, the results were predominantly positive.

Each Teaching Scholar was asked to write a brief description of their teaching experience. To give some direction to these descriptions, students were asked two specific questions: "What were your responsibilities?" and "How did this experience affect your attitude / commitment towards teaching?" The types of experiences varied, with students describing situations where they were responsible for "everything a real teacher does," students who prepared a single topic to present to a group, students working as teaching assistants at the college level, tutoring one-on-one, or assisting or observing K-12 classrooms. Table 1.7 contains information on how many students participated in specific activities as part of their teaching experience.

Table 1.7. Teaching Activities Experienced by Teaching Scholars

Teaching Activity	Number of Respondents	Percent*
Hands-On Activities	41	66%
Tutoring	34	55
Observation	33	53
Small Group Work	33	53
Preplanning	30	48
Lecturing	27	44
Teaching Assistantship	22	35
Other Teaching Experience	11	18

*Respondents could select more than one subject, therefore the percent column does not sum to 100.

A few students mentioned that their teaching experience gave them an "eye-opener to the realities of teaching." Examples of realities that were named were dealing with co-workers and parents, classroom management issues, the tremendous amount of work, and political aspects of education. Despite learning about these challenges involved with teaching, the single most common comment made by the Teaching Scholars was that the teaching experience solidified their interest to teach. Several students specifically stated that being in the classroom either increased their interest and motivation to teach or confirmed their decision to become a teacher.

Evaluation of the STEMTEC Program

Included on the survey were questions designed to collect information about the STEMTEC program, including questions about STEMTEC courses, activities, and the strengths and weaknesses of the program. One surprising result has to do with what the Teaching Scholars had to say about STEMTEC courses. Nearly one-third, or 20 (32%), of the respondents claim to have never taken a STEMTEC course. However, when asked how important it was for them to take STEMTEC courses, 35% of the Teaching Scholars answered, “somewhat important.” (See Tables 1.8 and 1.9 for more information about STEMTEC courses.) These percentages show improvement over last year’s survey of the Teaching Scholars, where nearly half of the Scholars (48%) reported taking no STEMTEC courses and 41% of Scholars said that taking STEMTEC courses was “not at all important” to them.

Improvement aside, however, it seems that more members of this select group of Teaching Scholars would be interested and motivated to take STEMTEC courses. Were the STEMTEC courses not advertised completely enough among the group of Teaching Scholars? If not, how likely is it that the students at large are selecting courses because the courses are affiliated with STEMTEC? These results suggest that dissemination of information about STEMTEC courses on the eight campuses, or even just among the Teaching Scholars, could be improved further.

Table 1.8. Number of STEMTEC Courses Taken by Teaching Scholars

Number of STEMTEC Courses	Number of Respondents	Percent
0	20	32.3
1	7	11.3
2	6	9.7
3	9	14.5
4	4	6.5
5	1	1.6
6	3	4.8
7	1	1.6
No Response	11	17.7

Table 1.9. “How important was it for you to take STEMTEC courses?”

Response	Number of Respondents	Percent
Not at all important	15	24.2
Somewhat important	22	35.5
Very important	9	14.5
No response	14	22.6

Teaching Scholars were also asked to rate the various activities and events offered by STEMTEC throughout the year. Table 1.10 includes a summary of what was reported by the students. Very few students completed the information for any given activity, therefore it is difficult to evaluate the individual events. Overall, for those that did attend the activities, reactions were positive. For each activity, the majority of respondents found that it both helped them become better teachers and increased their interest in teaching.

The Teaching Scholars were also asked a series of questions about the STEMTEC program itself. When asked how they found out about STEMTEC and the Teaching Scholars program, 37 (60%) listed Professors or staff, 9 (15%) said friends, 6 (10%) found out about STEMTEC from flyers, 3 (5%) found out from an information session, and 3 (5%) reported that they learned about STEMTEC through the School of Education. When asked if the STEMTEC Teaching Scholarship allowed them to do anything that they would not have been able to do otherwise, 42 (68%) answered "yes." Of those 49, twenty-seven students (44%) reported that the money enabled them to spend less time working to pay for school. Sixteen (26%) said that the scholarship allowed them to be involved with STEMTEC events. Other things mentioned that the scholarship facilitated were: networking (15%), visiting schools (8%), the chance to consider teaching (3%), and building a teaching library (2%**).** Twenty-nine (47%) said that they would reapply for the Teaching Scholarship next year; thirty-three (53%) said they would not. Of those not reapplying, most are completing their degree requirements this year and therefore are not eligible to reapply. Other reasons stated for not reapplying include: missed the application deadline (3), no time for Teaching Scholar activities (2), not interesting in teaching (2), and taking time off from school (1).

Teaching Scholars were asked to describe the strengths and weaknesses of the STEMTEC program. Among the most frequently stated strengths were, the STEMTEC events and activities (47 / 76%) and networking with other students interested in teaching (23 / 37%). Other strengths mentioned were the teaching activities (11 / 18%), faculty and staff (6 / 10%), the scholarship money (4 / 7%), and the flexibility of the Teaching Scholars program (3 / 5%). Weaknesses perceived by the students include inconvenient times of events (5 / 8%), lack of connection to other schools (5 / 8%), lack of math resources (4 / 6%), too little STEMTEC requirements (4 / 6%), and receiving scholarship money too late (3 / 5%). Finally, students were asked, "If there were only one activity that the STEMTEC Student Services Program could continue providing in the future, what should it be?" The most common response to this question was some sort of event. Twelve students (19%) mentioned the events in general, the rest specifically noted which event they would like to see continue: classroom management workshop (12), certification session (6), Sunwheel workshop (5), Science as Inquiry (3), panel discussions with teachers (3), and Project Learning Tree workshop (3).

Table 1.10. Summary of Responses to Various Teaching Scholar Activities

Activity	Location	Number Who Responded	(a) Helped Me Become a Better Teacher*			(b) Increased My Interest in Teaching*		
			Yes	No	Not Sure	Yes	No	Not Sure
K-12 Classroom Experience	Various	40	90%	--	8%	90%	5%	5%
Teaching Modeled in STEMTEC Courses	Various	18	78%	--	22%	78%	6%	17%
STEM Institute Talks	Various	18	67%	--	33%	78%	17%	6%
Project Learning Tree	NVC, Amherst	13	54%	15%	31%	85%	8%	8%
Dealing With Discipline	UMass Amherst	13	85%	8%	8%	54%	15%	23%
Geology Tour	CT River Valley	11	73%	18%	9%	82%	--	9%
Classroom Management Workshop	UMass Amherst	11	73%	--	27%	73%	18%	9%
Certification Information Session	UMass Amherst	10	40%	30%	30%	60%	30%	10%
The Peer Math Summit	Mount Holyoke College	10	70%	10%	20%	80%	10%	10%
Gee Whiz Chemistry	UMass Amherst	9	44%	--	55%	67%	11%	22%
Science as Inquiry	Hitchcock Center, Amherst	8	75%	--	25%	75%	13%	13%
Sunwheel Program	UMass Amherst	8	38%	13%	50%	63%	13%	25%
Help! I have to take a teacher test.	Hampshire College	7	29%	29%	43%	29%	29%	43%
Hampshire College Event	Hampshire College	7	86%	--	14%	43%	14%	29%
Math Without Tears	Smith College	6	100%	--	--	67%	17%	17%
Science and Math Education Reform	UMass Amherst	5	80%	--	20%	40%	--	60%
Project Wet	Notch Visitors Center, Amherst	5	40%	20%	40%	80%	20%	--
Workshop on Astronomy Resources	Amherst College	5	40%	20%	40%	40%	40%	--
Environmental Education Conference	Holy Cross College, Worcester	5	80%	--	20%	100%	--	--
Vernal Pool Workshop	Northfield Mountain	5	80%	--	20%	100%	--	--
Project Wild	NVC, Amherst	1	--	--	100%	--	--	100%

*Percentages were calculated based on the number of students who responded.

Discussion

Much can be learned from the Teaching Scholars' responses to the final survey and report. In general, the results show the same trends discovered in the analysis of these data from last year. The aspects of the Teaching Scholar Program that students found the most beneficial were the teaching experience, the events and activities, and the opportunity to network with other students interested in teaching. Also, students reported that the Teaching Scholar Activities increased both their interest in becoming a teacher and their teaching skills. This particular group of Teaching Scholars had many students interested in teaching at the high school level. For this group, more activities geared toward high school level teaching or with mathematics topics would have been beneficial. It would be useful to collect this kind of information at the beginning of the academic year so activities could be planned to match the interests of the particular group of Teaching Scholars as much as possible.

Further, the importance of the teaching experience cannot be emphasized enough. Even though nearly all students reported positive teaching experiences, regardless of the setting or time commitment, students should be encouraged to seek out teaching opportunities at the K-12 level, preferably those that involve weekly commitments.

The lack of knowledge about and lack of interest in STEMTEC courses from this population of students that is so closely in contact with STEMTEC staff was troubling. More needs to be done to advertise what these courses have to offer. Considerable time and effort has been expended on improving the STEMTEC courses, it seems worth the extra effort to heavily publicize them. Faculty and staff were named most often as the way that Teaching Scholars found out about the program. This would be one avenue for informing students about STEMTEC courses. Perhaps complete lists and descriptions of recommended STEMTEC courses could be provided for the STEMTEC Teaching Scholars as soon as their awards are offered to them. If one of the premises of the STEMTEC program is that college students will learn reformed teaching practices by modeling the teaching that they observe in STEMTEC classes, getting Teaching Scholars to take more STEMTEC courses should have been a priority of the program. This year's Teaching Scholars reported being more aware of STEMTEC courses than last year's Scholars, but there was still a large proportion who reported not taking any STEMTEC courses and who claimed that taking such courses was not important to them.

Overall, the responses to the 2000-2001 Teaching Scholar Mandatory Final Report and Survey were very positive. The Student Services Program is doing an outstanding job of organizing activities and events for students interested in teaching and in providing them with the opportunity to experience teaching in the K-12 setting. Due in large part to their participation in the scholarship program, the Teaching Scholars are motivated, excited, and committed to try teaching as a career.

STEMTEC K-12 Classroom Observations

Joseph B. Berger and Rebecca Klock

STEMTEC K-12 Classroom Observations

Classroom observations were conducted in five K-12 math and science classrooms during Spring 2002. The purpose of the classroom observations was to assess and document the extent to which reformed teaching practices are occurring in science and math K-12 classrooms. The participating STEMTEC teachers graduated from the University of Massachusetts and are currently teaching math or science. This type of assessment informed the following research questions that are key components of the annual evaluation.

1. What reformed teaching practices and strategies have actually been incorporated into classroom instruction?
2. To what extent are students being engaged in the classroom?
3. How effective is classroom instruction in promoting higher levels of classroom-based cognitive activity?

More specifically, the classroom observations focused on the collection of the following types of information.

- Classroom context and demographics
- Purpose of classroom lessons and associated pedagogical techniques;
- Documentation of teaching strategies and activities used by the instructor to fulfill the purpose of the lesson.

A slightly modified version of the Classroom Observation Protocol (COP) was used to measure and assess the presence of reformed teaching in STEMTEC courses. The original version of the COP was developed by a team of researchers at the University of Minnesota working for the Core Evaluation of the Collaborative for Excellence in Teacher Preparation (CETP) programs. The research plan for the classroom observation component of the 2001-2002 evaluation of STEMTEC is more thoroughly described in the next session.

Method

Classroom Observation Protocol

Previous evaluation efforts of STEMTEC incorporated classroom observations. However, the degree to which those observations were systematic is unknown. For example, there is no indication that the observation protocols used in those evaluation efforts were explicitly derived from standardized instruments, nor is there evidence that they were appropriately field-tested prior to use. Given the need to use an established observation protocol for this phase of the 2001-2002 STEMTEC evaluation, a number of options were considered.

Three potential observation protocols were considered for use in this evaluation. The research team conducted a review of literature and solicited feedback from numerous sources – including STEMTEC campus coordinators, the CETP Core Evaluation team at the University of Minnesota, and National Visiting Committee members. A variety of classroom observation instruments were identified as a result of these investigations. After considering several options, the Classroom

Observation Protocol (COP) was chosen for use in this project over other approaches. Some of the other options considered were (a) the development of our own protocol, (b) the use of protocols used in previous STEMTEC evaluations, (c) the Reformed Teaching Observation Protocol (RTOP) developed by the Arizona Collaborative for Excellence in the Preparation of Teachers (ACEPT), (d) the Local Systemic Change Revised Classroom Observation Protocol developed by Horizon Research, and (e) the inquiry-oriented classroom observation developed by Neil Stillings and his colleagues at Hampshire College.

The COP was selected for use in this evaluation for a number of reasons. First, it is the classroom observation instrument that has been developed and supported by the CETP Core Evaluation team. By using the CETP Core instruments, STEMTEC may eventually be able to compare results from this evaluation with the results from other CETP programs. Using the core instrument will also enable STEMTEC to provide data to the Core Evaluation team as they work to document the effects of the larger CETP program as a whole. Second, the COP draws heavily from other established classroom observation protocols, which increases the reliability and validity of the instrument in comparison with locally developed protocols. Third, the COP focuses on a wide range of recognized reformed instructional practices and allows for the identification of what is happening in the classroom during specific time intervals – both of these features are preferred by NSF in assessments of classroom observations according to the Core Evaluation team at the University of Minnesota. Finally, excellent training materials for the COP were available from the Core Evaluation team and one of the evaluation team members (Joe Berger) received training at the University of Minnesota in the use of the COP.

The potentially subjective nature of classroom observation makes it imperative that observers are comprehensively trained to consistently and appropriately use the observation protocol in a manner that produces reliable and valid results. Therefore, it is extremely important in any rigorous and methodologically sound classroom observation plan that classroom observations be conducted by qualified and well-trained observers. The training materials available from the CETP Core Evaluators facilitated effective and efficient training of observers for this phase of the STEMTEC evaluation.

During the training period, the evaluation team also worked with and assessed the COP with regards to its appropriateness for its specific use in evaluating STEMTEC courses. During the training and assessment stages it was determined by the research team that a few changes needed to be made to the COP. The changes include:

- First, the classroom checklist form was modified and re-formatted to make it easier to mark classroom activities as they occurred during the observation.

- Second, item 11 in the rating of key indicators section was split into two separate items (one asking if appropriate connections were made to other areas of mathematics/science and/or to other disciplines and a second item asking if appropriate connections were made to real-world contexts, social issues, and global concerns) to avoid the double-barrel nature of the original item.

- Third, greater specificity was added to the definition of ratings given to items 13-15 in the rating of key indicators section. These three items focus on effectiveness and are rated on a scale of 1 to 5, but no definitions were provided in the COP about what meaning should be attached to each score. Therefore, it was decided that a score of one indicated "no effect", while a score of five indicated "very effective."

- Fourth, the evaluation team decided not to use the final section of the COP that focuses on assessing the overall quality of instruction. The decision not to use this section was made because the research team felt that the evaluation of teaching quality based on a observation of a single class meeting was inappropriate and beyond the scope of the intended evaluation.

A copy of the revised version of the COP that was used in this evaluation is included in Appendix C. Briefly, the revised COP consists of five components. The five components include a description of background information about the class and the instructor, a description of the classroom demographics, a description of the physical environment of the class, a description of the purpose of that particular class, and a rating of key indicators of reformed teaching strategies.

Sampling and Collection Procedures

Initially, six classes were selected for observation during the spring semester of the 2001-2002 academic year. Ultimately, five of these observations were completed. Observations occurred between the dates of May 1, and June 7, 2002. The observations were completed by one member of the evaluation team, who was trained in advance on use of the (revised) COP. The classrooms were identified from a list of teachers that were involved with STEMTEC as undergraduates. All observations were conducted after an initial contact had been made with the course instructor by the observer and permission had been given by the instructors for their classes to be observed.

Results

Description of the Sample

Data were collected from a total of five classrooms. All of the instructors were identified as STEMTEC instructors.[a] The observations took place at five different schools; Weston Middle School in Weston Massachusetts, West Springfield Middle School in West Springfield Massachusetts, Great Falls Middle School in Montague Massachusetts, Pinkerton Academy in Derry New Hampshire, and the YMCA in Becket Massachusetts. The classes were eighth grade Earth Science, ninth grade Algebra I, seventh grade General Science, and two physics classes (one fifth grade and one ninth grade). The courses ranged in enrollment from 10 students to 19 students with an average enrollment of 16. The classes ranged in time from 35 minutes to 85 minutes. Table 2.1 summarizes the description of the observed classes.

All five instructors are certified teachers, their certification is either in grades five through nine or in grades nine through twelve. The number of years of experience of the observed teachers ranged from one to two years. Three of the instructors had been involved with STEMTEC since their junior year in college, and the other two were not sure how many years they had been involved with

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[a] STEMTEC instructors are defined as anyone who has taken part in one of the conferences and any faculty who have revised a course due to contact with existing STEMTEC faculty (Marie Silver, personal communication).

STEMTEC. There was excellent sex balance in the sample, as three of the observed instructors were female and two were male.

Table 2.1

Description of Classroom Sample

Discipline	Type of Student	Enrollment	Time Period
Math	9th grade	19	35 min
Physics	5th grade	10	1 hr. 25 min.
General Science	8th grade	18	40 min.
Physics	9th grade	15	45 min.
Geology	8th grade	18	50 min.

Summary of Observed Classroom Activities

A wide range of teaching practices and instructional activities were observed in the five classrooms. These activities were recorded in five-minute intervals during the observed classes. The observer focused on the instructional activities that were directed toward the students in the classes or the activities in which the students themselves were engaged during the class period. The version of the COP used in these evaluations included 17 categories of instructional activities and strategies.

The list of instructional activities[a] is summarized in Table 2.2, which summarizes the frequency with which each of the instructional activities was observed in each of the classes. Eleven of the 17 activities were observed in at least one of the classes. The most prevalent observed activities were hands-on activity, which was observed in 3 of the 5 classroom observations and occurred in approximately 46% of the five-minute segments, and teacher interacting with students, which occurred in all the classroom observations and 48% of the five minute segments. Lecture occurred in four of the classes 36% of the time, and small group discussion occurred in two of the classes 26% of the time. Administrative tasks were also conducted in most classes (4 of 5), but very little total class time was spent on such activities (16%). None of the other activities were observed frequently.

[a] Complete definitions of these activities can be found in the COP Training Manual.

Table 2.2

Summary of Observed Instructional Activities

Activity Code	Activity	Number of Classes in Which Activity was Observed	% of Time in Which Activity was Observed[a]
TIS	teacher/instructor interacting w/ student	5	48.0%
HOA	Hands-on activity/materials	3	46.0%
L	lecture/presentation	4	36.0%
SGD	Small group discussion	2	26.0%
AD	administrative tasks	4	16.0%
WW	writing work (if in groups, add SGD)	2	10.0%
LWD	lecture with discussion	2	4.0%
I	Interruption	2	4.0%
UT	utilizing digital educational media and/or technology	1	2.0%
PM	problem modeling	1	2.0%
SP	student presentation	1	2.0%
CL	cooperative learning (roles)	0	0%
D	demonstration	0	0%
A	assessment	0	0%
RSW	reading seat work (if in groups, add SGD)	0	0%
LC	learning center/station	0	0%
CD	class discussion	0	0%
Other		0	0%

Summary of Levels of Student Engagement

In addition to documenting the types of activities that were occurring in the classroom, the observer also recorded the levels of student engagement, which are summarized below in Table 2.3. Levels of engagement are defined by the percentage of students in the classroom who the observer believed were engaged in the task. If more than 80% of the students in the class were engaged in the task at hand during a five-minute period, then they were defined as being highly engaged. If less than 20% of the students were engaged in the class during any five minute period, then a mark of low engagement was recorded by the observer. If the percentage of engaged students was between 20% and 80%, then students were coded as having medium levels of engagement.

The observer found that students were highly engaged ninety percent of the time. Medium levels of engagement were recorded only 6% of the time and low levels of engagement were reported

[a] Percentages add up to more than 100% because activities could occur concurrently within a five-minute time segment.

4% of the time. It is important to note that 60% of the segments including low or mixed engagement occurred in the same classroom.

Table 2.3

Summary of Student Engagement

Level of Engagement	**% Time**
High	90.0%
Medium	6.0%
Low	4.0%

Summary of Cognitive Activity Levels

Evaluations were also made during the observations about the level of cognitive activity occurring in the classroom. Receipt of knowledge, defined by involvement in the rote reception of information (e.g. lectures, going over worksheets, questions, watching something, or homework), was most prevalent as it was observed to be occurring 48.0% of the time. Application of knowledge (e.g. doing worksheets, homework or practice problems similar to ones modeled in class, skill building, performance) was found to be occurring almost as much as receipt of knowledge (38.0%). Knowledge representation, defined as occurring when students manipulate information (e.g. organizing, trying to make sense out of something, describing, categorizing), was observed 14.0% of the time. Knowledge construction, which occurs when students are creating new meaning (e.g. higher order thinking, generating, inventing, solving problems, revising, etc.), was non-existent during the times these classes were observed. Table 2.4 summarizes the observations regarding levels of cognitive activity.

Table 2.4

Summary of Cognitive Activity Levels

Cognitive Activity	**% Time**
Receipt of Knowledge	48.0%
Application of Procedural Knowledge	38.0%
Knowledge Representation	14.0%
Knowledge Construction	0.0%

Summary of Ratings of Key Indicators

After observing what actually happened in the classroom, the observer also reflected upon and assessed how well the classes rated on a number of key indicators related to the broader goals of the CETP initiative. The rating of these indicators is summarized below in Table 2.5.

The scale for the key indicators ranged from one to five (where 1 = not at all and 5 = to a great extent for the first 12 items below; and 1 = no effect and 5 = very effective). The most highly rated item focused the extent to which the instructors displayed an understanding of the mathematics/science concepts with their students, with four of the five teachers scoring a five. It is important to note that all the data is displayed in Table 2.5 because of the range and variety of different indicator scores. For example, there were two lessons that were at the extreme, one lesson scored very high on all of the indicators and the other lesson scored very low on the indicators. Of the other three lessons, only one consistently scored 3 or 4 on each indicator.

Table 2.5

Ratings of Key Indicators

Item	1	2	3	4	5
1. This lesson encouraged students to seek and value alternative modes of investigation or of problem solving	2	2	4	5	5
2. Elements of abstraction (i.e., symbolic representations, theory building) were encouraged when it was important to do so	1	4	3	3	5
3. Students were reflective about their learning	1	2	3	5	5
4. The lesson was designed to engage students as members of a learning community	2	2	3	4	5
5. The instructional strategies and activities respected students' prior knowledge and the preconceptions inherent therein	3	3	4	3	5
6. Interactions reflected collaborative working relationships among students (e.g., students worked together, talked with each other about the lesson), and between teacher/instructor and students	1	3	4	5	5
7. Intellectual rigor, constructive criticism, and the challenging of ideas were valued	3	3	3	4	4
8. The lesson promoted strongly coherent conceptual understanding	2	4	4	3	4
9. Students were encouraged to generate conjectures, alternative solution strategies, and ways of interpreting evidence	1	2	3	4	4
10. The teacher/instructor displayed an understanding of mathematics/ science concepts (e.g., in his/her dialogue with students)	4	5	5	5	5
11. Appropriate connections were made to other areas of mathematics/ science and/or to other disciplines	3	2	3	2	3
12. Appropriate connections were made to real-world contexts, social issues, and global concerns	4	1	4	3	5
13. Students' understanding of mathematics/science as a dynamic body of knowledge generated and enriched by investigation	2	2	3	4	4
14. Students' understanding of important mathematics/science concepts	3	4	4	3	5
15. Students' capacity to carry out their own inquiries	2	4	4	4	5

Student Perspective

Student surveys were given out to each of the observed classrooms. Four of the teachers returned the surveys. The remaining teacher did not leave enough time and the surveys that were close to completion were not accurate, and therefore were discarded. There were two different surveys given out randomly in each classroom to a total of 62 students. About 50% of the students filled out form A and 50% of the students filled out form B. The two forms asked most of the same questions but the responses categories were different. Form A asked the students to report if an activity occurred and if it did occur, to what extent was it helpful. The exact response categories were, “did not happen, did happen and not helpful, did happen and somewhat helpful, and did happen and very helpful.” Form B asked how frequently the activity occurred, and the response categories were “never, seldom, occasionally, and regularly.” Table 2.6 summarizes the students’ demographic information and Table 2.7 summarizes the results of the surveys.

In addition to including the means, Figures 2.1-2.5 show a breakdown of responses for 5 of the survey questions.

Table 2.6

Summary of Student Demographics (n=62)

Sex		Speak a Language other than English at home		Grade level	
Male	48.3%	Yes	15.0%	5th	16.7%
Female	51.7%	No	85.0%	7th	25.0%
				8th	30.0%
				9th	23.3%
				10th	5.0%

Table 2.7

Summary of Student Responses (means)

Form A: How helpful do you think the following activities were? If an activity did not happen, mark "did not happen?" Form B: How often were you asked to do the following in this class?	Form B[a]: Frequency of Activity	Form A[b]: Helpfulness of Activity
Having enough time for you to learn what is required?	3.22	3.45
Doing activities that allow you to collect information (data) and figuring out what the information means (analysis)?	3.13	3.07
Working with other students where the whole group gets the same grade?	2.87	2.96
Completing assessment/ assignments that include: a. complicated problems?	2.72	2.77
b. portfolios?	1.68	1.79
c. multiple choice/ short answer items?	2.90	2.86
d. full-length papers/ reports?	2.06	2.04
Determining how much you know about something?	2.72	2.62
Basing new information on what you already knew about the topic?	2.71	3.03
Designing and making presentations to your class that help you learn?	2.65	2.40
Having a voice in decisions about class activities?	2.63	2.55
Using or making models, e.g., physical, conceptual, or mathematical models?	2.50	2.62
Writing about why you think something?	2.47	2.31
Participating in whole-class discussions where your teacher talked less than the students?	2.41	2.41
Working on problems related to real world or practical issues?	2.25	2.77
Making connections to other science, technology, engineering, and mathematics (STEM) and non-STEM fields?	2.21	2.14
Using technology, e.g., computers, calculators: a. to better understand ideas in class?	2.13	2.83
b. as a tool to gather and organize information?	3.03	2.80
c. as a tool for checking understanding (testing)?	1.94	2.83
d. as a tool to communicate with your teachers?	1.39	1.75

[a] Response categories were coded 1=never, 2=seldom, 3=occasionally, and 4=regularly
[b] Response categories were coded 1=did not happen, 2=did happen and not helpful, 3=did happen and somewhat helpful, and 4=did happen and very helpful

Figure 2.1: Participating in whole-class discussions where your teacher talked less than the students?

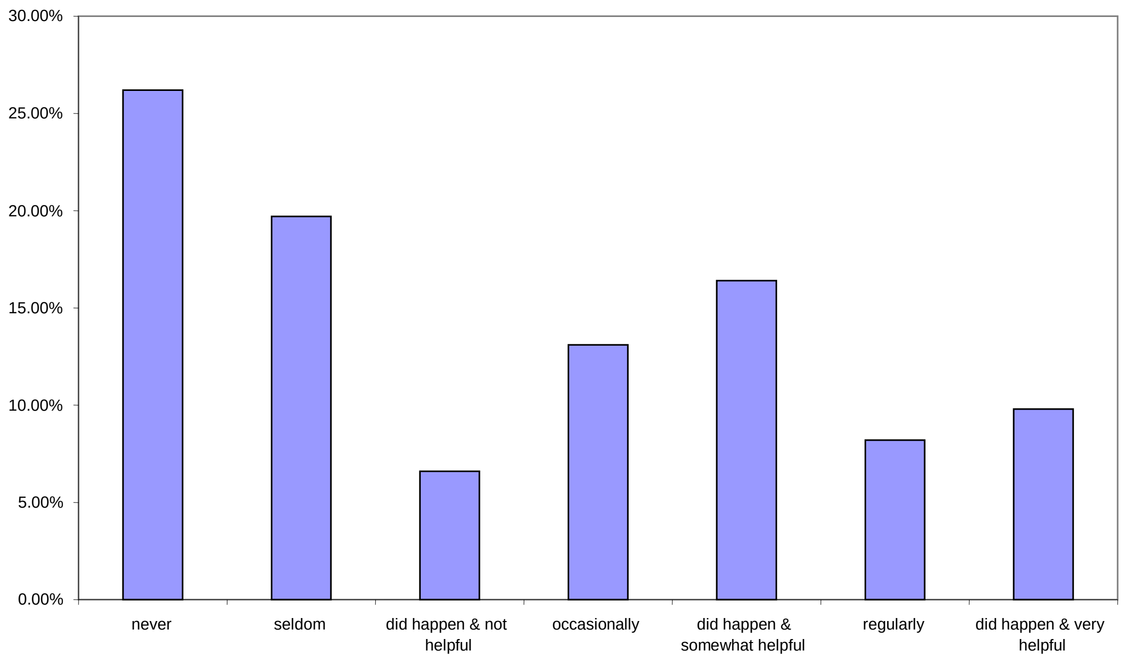


Figure 2.2: Using or making models?

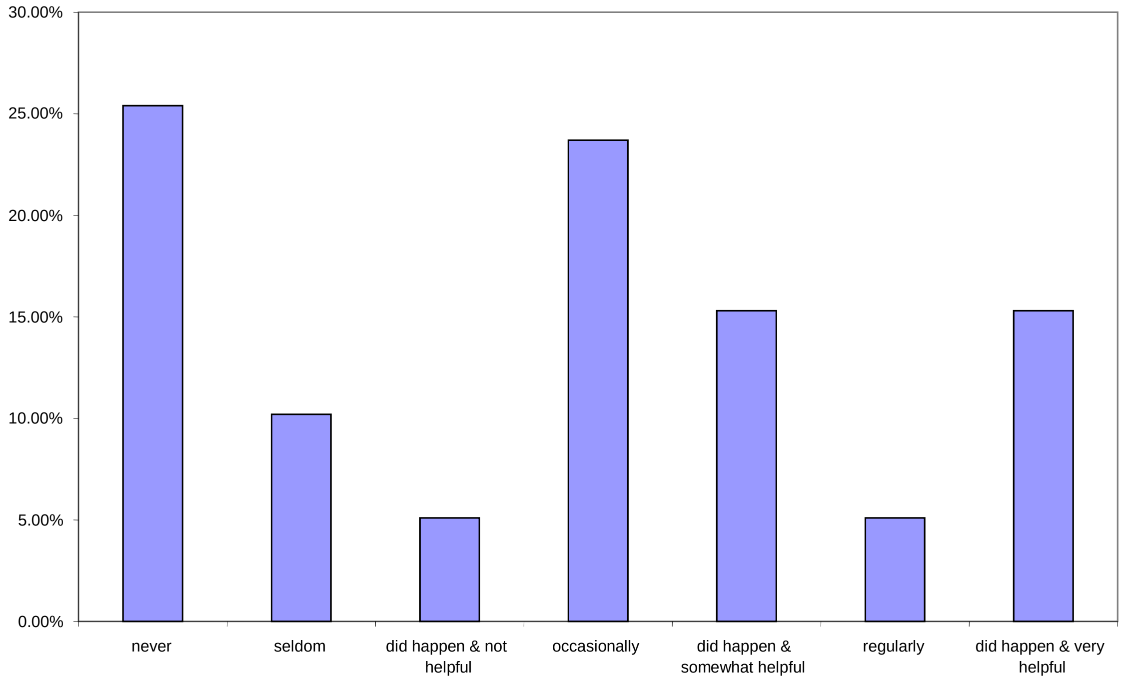


Figure 2.3: Doing activities that allow you to collect information (data) and figuring out what the information means (analysis)?

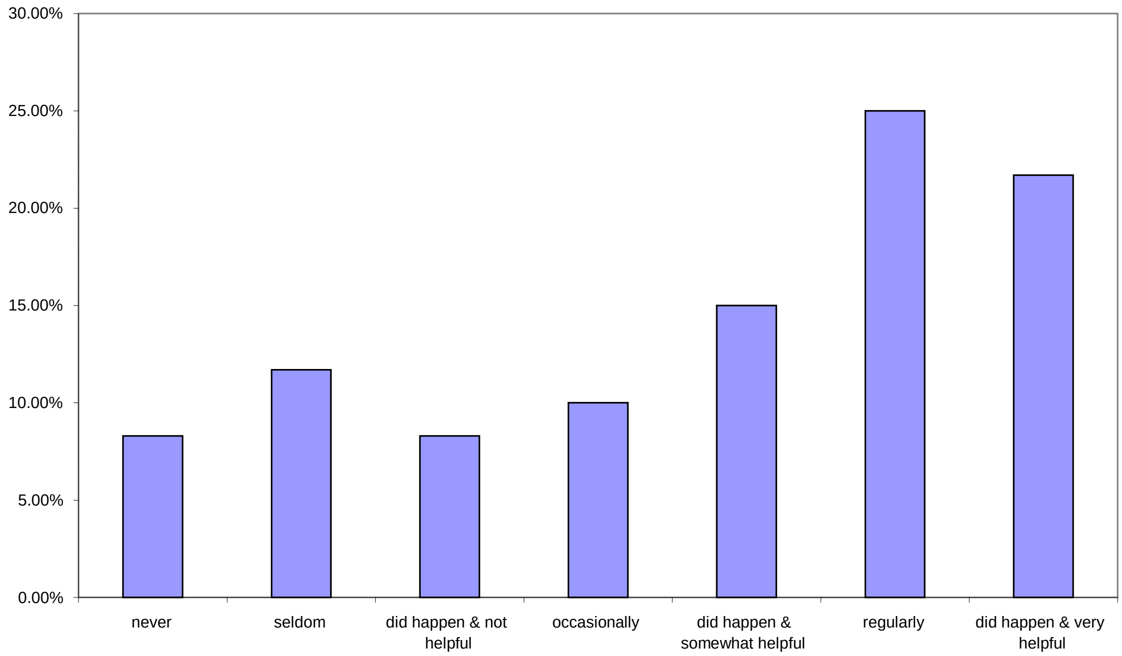


Figure 2.4: Using technology as a tool to gather and organize information?

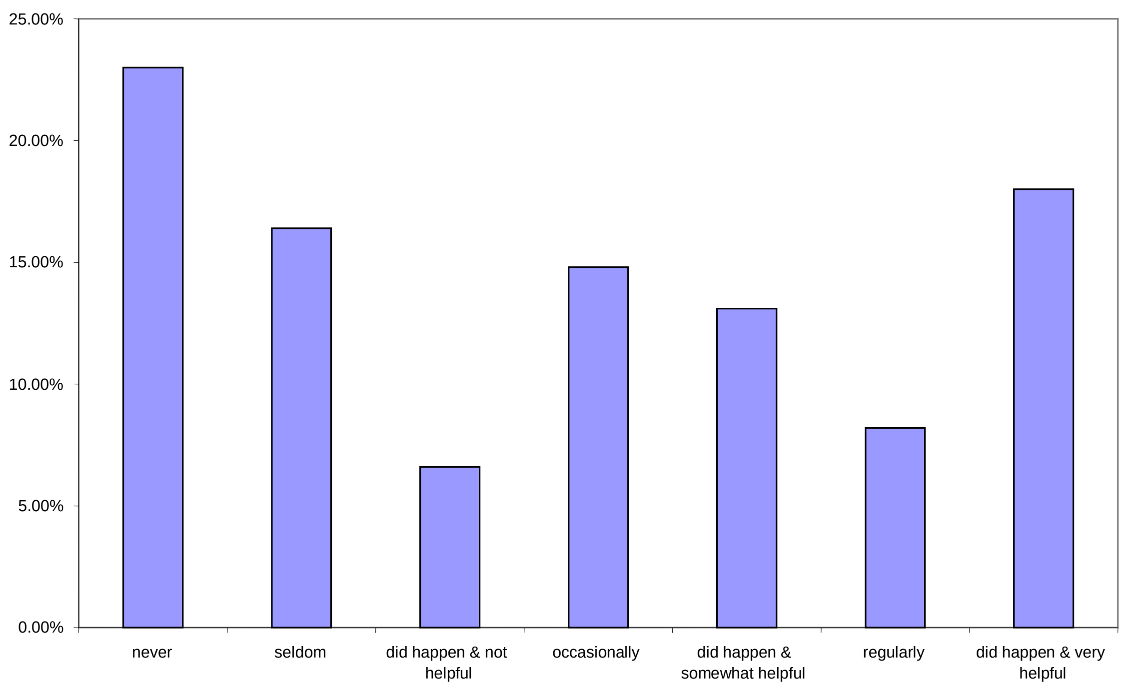
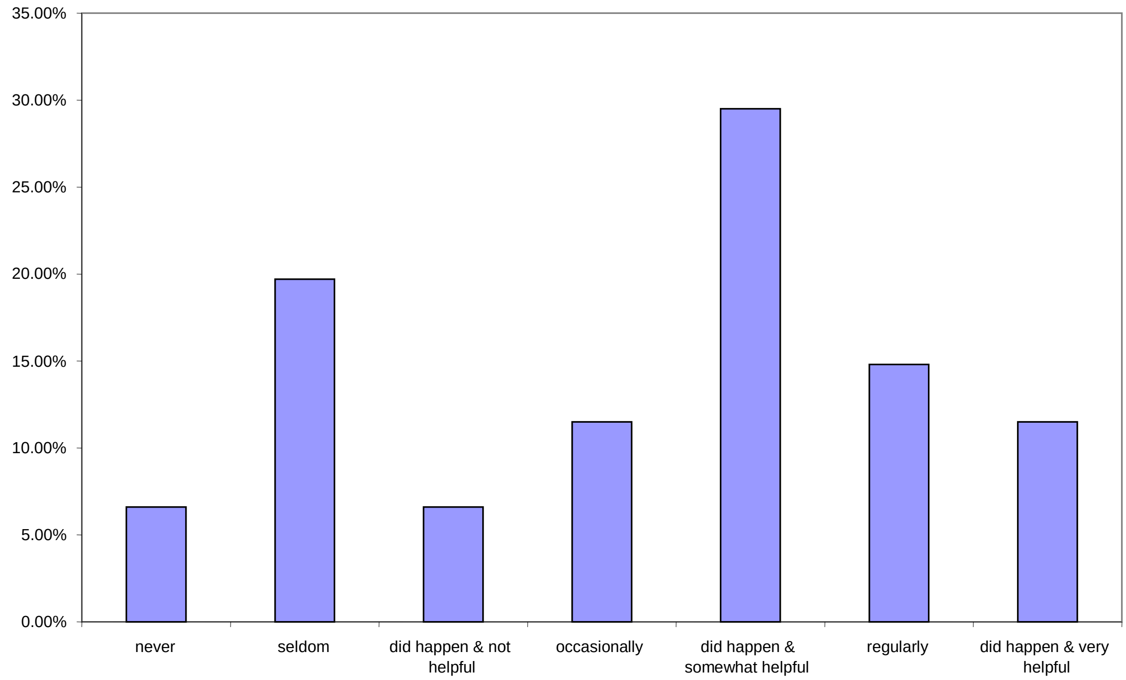


Figure 2.5: Basing new information on what you already knew about the topic?



Almost 50% of the students said that they never or seldom have had whole class discussions where the teacher talked less than the students. In the observations, if the students were interacting with each other it was usually in a small group, not as a whole class. Also, one quarter of the students said that they never used or made models, which is surprising considering these are math and science classrooms. On the other hand, almost 70% of the students indicated that they collected and analyzed data regularly and it was helpful. In addition, 60% of the students indicated that the teacher based new information on what the students already knew regularly and it was helpful. It was interesting to see that the "use of technology to gather information" question showed many responses at either end of the spectrum. This could have been because of the difference in classroom equipment. The classrooms ranged from having five computer stations with internet connections, to a room at a YMCA camp with nothing more than benches.

By breaking down the students' answers by classroom, a comparison can be drawn between the student perspective and the perspective of the observer. However, it must be noted that the observer only saw one class and the students have been with the teacher for a longer length of time. Only one of the five observations was done in a Math class, and the other four were science classrooms. In the math class, the teacher spent 43% of the time lecturing, and the students did not get to work in small groups or do any hands on activities (besides some written work). According to the students in the math class they hardly ever used or made models or did activities that allowed them to collect information (data) and figure out what the information means (analysis). Whereas students the science classes indicated that they regularly collected and analyzed data and it was helpful (n=32, 76.2%). Also, in the math classroom, 66% (n=12) of the students said that they never had a voice in decisions about classroom activities or if they did, it was not helpful.

In one of the science classrooms, the teacher spent 50% of the time on administrative tasks, such as checking off homework, putting the students in groups and handing out assignments and the students did not spend any time on hands-on activities. In this class, 50% (n=7) of the students indicated that they used or made physical or conceptual models only occasionally.

Discussion

This assessment is a descriptive snapshot of what kinds of instructional activities are being employed in the classrooms of STEMTEC instructors. The sample is small so caution should be used regarding the generalization of these findings across the STEMTEC program. However, the diversity of grade levels, students and instructors in the sample provides a good foundation for concluding with some general observations of the extent to which reformed instructional practices are being incorporated into classrooms by STEMTEC faculty. A descriptive summary of the observed classes shows that courses were covered across a variety of grade levels and topics.

Beyond the basic description of what STEMTEC classes look like, the remainder of the discussion will be organized around addressing the three research questions listed at the beginning of this section.

What reformed teaching practices and strategies have actually been incorporated into classroom instruction?

Hands on activity and teacher interacting with student appear to be the dominant forms of classroom instruction in the STEMTEC classrooms observed as part of this evaluation. However, a variety of other techniques are being incorporated into many classes. Lecture and small group discussion were the second most dominant forms of classroom discussion. The small group discussion was usually accompanied by hands on activities and teacher interacting with students. Some effective means for utilizing educational technology were also observed in one class, where a teacher hooked a TI-85 calculator up to a projector.

Future evaluations should incorporate observations throughout the semester to see if different instructional strategies and techniques are used at varying points in the semester. Also, more classrooms should be observed, which may give a clearer picture of whether reformed teaching practices and strategies have been incorporated into the classroom. Of the five observations, one instructor incorporated hardly any reformed teaching practices and strategies, whereas in two of the observations, the instructors successfully incorporated these practices and strategies.

Reformed teaching is about more than merely incorporating certain techniques into the classroom, it is also about the attitude instructors bring into the classroom and their abilities to use the tools to engage students in learning. Taken together, the solid ratings among the key indicators suggest that STEMTEC teachers are engaged to some extent in reform teaching.

To what extent are students being engaged in the classroom?

Further evidence that STEMTEC courses are engaging in some level of reform teaching can be found in the high levels of student engagement that were observed in these classes. Overall, students were observed to be highly engaged 90% of the time. Additionally, medium levels of engagement were reported 6% of the time, and more importantly, there was low engagement only 4% of the time. Clearly, these STEMTEC instructors are having success in engaging students with teaching and learning as it occurs in the classroom.

The high levels of engagement are encouraging and suggest that the actual counting of time spent on particular kinds of instructional activities (e.g., lecturing) may be less important than the ways in which instructors conduct such activities. For example, one of the teachers, who relied heavily on lecturing, was highly motivated and prepared, resulting in high engagement. Another teacher that lectured was not prepared or effective, and as a result, this class is where 60% of the low and mixed segments occurred. Again, additional observations at various points in a semester would be helpful in providing more insight on this important issue.

How effective is classroom instruction in promoting higher levels of classroom-based cognitive activity?

These observations suggest that students are largely receiving knowledge and applying procedural knowledge in these STEMTEC classes, rather than having opportunities engage in higher-level cognitive activities. It is encouraging that students spent more than one third of their time applying knowledge. It is less encouraging that they spent only about one seventh of their class time engaged with knowledge representation and it is somewhat alarming that there was virtually no evidence of knowledge creation as a cognitive activity in these classes.

Conclusion

In sum, these classroom observations provide a good initial picture of what is happening inside some K-12 classrooms taught by STEMTEC influenced teachers. These observations are even more valuable when considered in light of other evidence collected in other parts of the STEMTEC evaluation. Additionally, a larger number of observations over different points in time as part of future evaluation activities should provide additional insights about the extent to which reform teaching is being effectively practiced in STEMTEC courses. It is unfortunate that classroom observations were not conducted at the beginning of the STEMTEC initiative as a baseline for determining how much instructional practices have changed over time. However, additional observations in the future may be helpful in detecting emerging trends toward greater use of reform teaching techniques in science and math courses.

It is difficult to conclude whether teachers are incorporating reformed teaching practices and strategies, or how effective the classroom instruction is in promoting higher levels of classroom-based cognitive activity. Two of the teachers were successfully doing these things, while one was not, and the other two were successful to some extent. On the other hand, students are highly engaged and instructors appear to be working hard to develop teaching styles that are more interactive and engaging for students.

STEMTEC and Faculty Fellow Classroom Observations For 2001-2002

Rebecca Klock

STEMTEC and Faculty Fellow Classroom Observation For 2001-2002

Introduction

Classroom observations were conducted in 14 postsecondary science and math classes during the 2002 spring semester. Nine STEMTEC courses were observed along with five courses taught by Faculty Fellows. The purpose of the classroom observations was to assess and document the extent to which reformed teaching[a] practices are occurring in science and math classes at postsecondary institutions participating in the STEMTEC project. This type of assessment informed the following research questions that are key components of the annual evaluation:

1. What reformed teaching practices and strategies have actually been incorporated into classroom instruction?
2. To what extent are students being engaged in the classroom?
3. How effective is classroom instruction in promoting higher levels of classroom-based cognitive activity?

More specifically, the classroom observations focused on the collection of the following types of information:

- Classroom context and demographics:
- Purpose of classroom lessons and associated pedagogical techniques:
- Documentation of teaching strategies and activities used by the instructor to fulfill the purpose of the lesson.

Method

A slightly modified version of the Classroom Observation Protocol (COP) was used to measure and assess the presence of reformed teaching in STEMTEC and Faculty Fellow courses. The original version of the COP was developed by a team of researchers at the University of Minnesota working for the Core Evaluation of the Collaboratives for Excellence in Teacher Preparation (CETP) program. The revision of that instrument and reasons why it was used for this evaluation are described in Berger and Klock (2002, a separate chapter in this report).

Sampling and Collection Procedures

Nine observations of STEMTEC courses and five observations of Faculty Fellow courses were completed during the 2001-2002 academic year. Observations of STEMTEC instructors occurred between the dates of December 3, 2001 and April 3, 2002. The observations were completed by three members of the evaluation team, all of whom were trained in advance on use of the (revised) COP. The STEMTEC courses were identified from a list of courses that were certified as STEMTEC

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[a] Reformed teaching has been defined in accordance to the guidelines established by the Core Evaluation of CETP at the University of Minnesota. As such, reformed teaching includes classroom practices that use active learning techniques and instructional strategies that facilitate high levels of cognitive activity among students as engaged learners.

courses by the STEMTEC coordinating office. The Faculty Fellow courses were identified from a list of instructors who had been involved in STEMTEC training for five months. Observations of the Faculty Fellow instructors occurred between the dates of May 1 through May 8, 2002. All observations were conducted after an initial contact had been made with the course instructor by the observers and permission had been given by the instructors for their classes to be observed.

Results

Description of the Sample

Data were collected from a total of nine STEMTEC classrooms. All of the instructors were identified as STEMTEC instructors.[2] Four of the observations took place at the University of Massachusetts Amherst (UMass), two occurred at Greenfield Community College, and one each occurred at Hampshire College, Mount Holyoke College, and Amherst College. Three of the courses were physics classes, two were chemistry classes, one was a geology course, one was a biology course, one was an oceanography course, and the final observation occurred in a natural sciences course. The courses ranged in enrollment from 6 to 50 students with an average enrollment of 26 students. Six of the courses were primarily intended for science/math students, and three of the courses were designed for students fulfilling general education/liberal arts requirements. The classes ranged in time from 50 minutes to 1 hour and 45 minutes. Table 3.1 summarizes the description of the observed STEMTEC classes.

[2] STEMTEC instructors are defined as anyone who has taken part in one of the conferences and any faculty who have revised a course due to contact with existing STEMTEC faculty (Marie Silver, personal communication).

Table 3.1

Description of STEMTEC Classroom Sample

Campus	Discipline	Student Type	Enrollment	Time Period
UMass	Geology	Math/Science Majors	47	50 minutes
UMass	Physics	Liberal Arts/General Education	36	50 minutes
UMass	Physics	Math/Science Majors	28	50 minutes
UMass	Chemistry	Math/Science Majors	32	55 minutes
GCC	Oceanography	Liberal Arts/General Education	13	50 minutes
GCC	Physics	Math/Science Majors	6	1 hour 45 minutes
Hampshire	Natural Sciences	Liberal Arts/General Education	9	1 hour 15 minutes
Amherst	Chemistry	Liberal Arts/General Education	50	50 minutes
Mt. Holyoke College	Biology	Math/Science Majors	9	60 minutes

Data were also collected from five Faculty Fellow classrooms. Two of the observations took place at UMass, and one observation took place at GCC, Holyoke Community College (HCC) and Springfield Technical Community College (STCC). Three of these courses were biology classes, one was an engineering class and one was a chemistry course. The classes ranged in size from 11 to 49 students with an average enrollment across the five classes of 21 students. Two of the courses were designed for students fulfilling general education/liberal education requirements, and three of the courses were primarily intended for science/math students. The classes ranged in time from 50 to 60 minutes. Table 3.2 summarizes the description of the observed Faculty Fellow courses.

Table 3.2

Description of Faculty Fellow Classroom Sample

Campus	Discipline	Student Type	Enrollment	Time Period
UMass	Engineering	Math/Science Majors	49	1 hour
UMass	Chemistry	Math/Science Majors	23	1 hour
GCC	Math	Math/Science Majors	11	50 minutes
STCC	Math	Liberal Arts/General Education	12	50 minutes
HCC	Math	Liberal Arts/General Education	13	50 minutes

The STEMTEC instructors who were observed included eight full professors and one associate professor. The length of the academic careers of the observed instructors ranged from fifteen to thirty-five years. Two of the instructors had been involved with STEMTEC for three years, three of them had been involved for four years, and the other four had been involved with STEMTEC for five years. Of the observed instructors, seven were male and two were female. Table 3.3 summarizes the relevant demographic characteristics of the observed STEMTEC instructors.

Table 3.3

Demographic Characteristics of STEMTEC Instructors

Sex	Academic Rank	Instructional Experience	STEMTEC Involvement
Male	Associate Professor	15 years	3 years
Male	Professor	15 years	5 years
Male	Professor	25 years	5 years
Female	Professor	30 years	5 years
Male	Professor	20 years	5 years
Male	Professor	35 years	4 years
Male	Professor	32 years	3 years
Female	Professor	17 years	4 years
Male	Professor	23 years	4 years

The Faculty Fellow instructors who were observed included three instructors, one assistant professor, and one full professor. The academic careers of the instructors ranged in length from three years to twelve years. Four of the observed instructors were female and one was male. All of the observed Faculty Fellow instructors had been involved with STEMTEC for approximately five months. Table 3.4 summarizes the relevant demographic characteristics of the observed Faculty Fellow instructors.

Table 3.4

Demographic Characteristics of Faculty Fellow Instructors

Sex	**Academic Rank**	**Instructional Experience**
Female	Instructor	5 years
Female	Instructor	6 years
Male	Professor	12 years
Female	Assistant Professor	4 years
Male	Instructor	3 years

Summary of Observed Classroom Activities

A wide range of teaching practices and instructional activities were observed in the nine STEMTEC and five Faculty Fellow classrooms. These activities were recorded in five-minute intervals during the observed classes. Observers focused on the instructional activities that were directed toward the students in the classes or the activities in which the students themselves were engaged during the class period. The version of the COP used in the evaluations included 17 categories of instructional activities and strategies. The list of instructional activities[1] is presented in Table 3.5, which also summarizes the frequency with which each of the instructional activities was observed in each of the STEMTEC classes. Sixteen of the 17 activities were observed in at least one of the classes. The most prevalent observed activity was small group discussions, which was observed in 8 of the 9 classroom observations and occurred in approximately 33% of the five-minute segments. Teacher interacting with student occurred in 7 of the classes more than 32 % of the time. Lecturing with discussion occurred in all 9 of the classes and lecturing occurred in 7 of the classes. Both forms of lecturing occurred in 25% of the five-minute segments. Utilizing digital educational media, student presentations, and hands-on activities occurred in almost half of the classes (4 out of 9). Administrative tasks were observed in all nine of the classes, with almost 18% of every five-minute interval devoted to these tasks. Interruptions and class discussions occurred in 5 out of the nine classes, but more time was allotted to interruptions (18.5%) than was devoted to class discussions

[1] Complete definitions of these activities can be found in the COP Training Manual.

(11.1%). None of the other observed activities occurred in more than one of the classes or over ten percent of the five-minute intervals.

Table 3.5

Summary of Observed Instructional Activities of STEMTEC Instructors

Activity Code	**Activity**	**Number of Classes in Which Activity was Observed**	**% of Time in Which Activity was Observed**
SGD	small group discussion	8	33.3%
TIS	teacher/instructor interacting w/ student	7	32.4%
LWD	lecture with discussion	9	25.0%
L	lecture/presentation	6	25.0%
SP	student presentation	4	24.0%
UT	utilizing digital educational media and/or technology	4	21.3%
HOA	hands-on activity/materials	4	20.4%
I	interruption	5	18.5%
AD	administrative tasks	9	17.6%
LC	learning center/station	1	12.0%
CD	class discussion	5	11.1%
PM	problem modeling	3	7.4%
D	demonstration	3	4.6%
WW	writing work	2	3.7%
A	assessment	1	3.7%
CL	coop learning (roles)	1	2.7%
RSW	reading seat work	0	0%
Other		0	0%

Table 3.6 summarizes the observed classroom activities in the Faculty Fellow classrooms. These data were remarkable differently from the observed STEMTEC classrooms. Teacher interacting with student was the most prevalent activity and occurred in all five of the classes with almost 54% of the five-minute intervals including this activity. Writing work and small group discussion both were devoted approximately 44% of the time, with writing work occurring in four of the classes and small group discussions occurring in three. Surprisingly, lecturing occurred in only one of the classes (16.7%) and lecture with discussion occurred in only three of the classes with 22.2% of the intervals included this activity. Administrative tasks occurred in all five of the classes and encompasses 27.8% of the time. Hands-on activities and cooperative learning occurred in two of the classes with hands-on activities encompassing slightly more of the time (27.8%) than cooperative learning (24.0%). Interruptions and problem modeling were observed in three of the five classes while

20.3% of the intervals utilized digital educational media. Overall, fifteen of the seventeen categories occurred in at least one of the Faculty Fellow classes.

Table 3.6

Summary of Observed Instructional Activities of Faculty Fellow Instructors

Activity Code	Activity	Number of Classes in Which Activity was Observed	% of Time in Which Activity was Observed
TIS	teacher/instructor interacting w/ student	5	53.7%
WW	writing work	4	44.4%
SGD	small group discussion	3	43.7%
HOA	hands-on activity/materials	2	27.8%
AD	administrative tasks	5	27.8%
CL	coop learning (roles)	2	24.0%
LWD	lecture with discussion	3	22.2%
UT	utilizing digital educational media and/or technology	1	20.3%
L	lecture/presentation	1	16.7%
PM	problem modeling	3	16.7%
LC	learning center/station	1	14.8%
I	interruption	3	14.8%
A	assessment	1	13.0%
D	demonstration	1	7.4%
CD	class discussion	1	2.0%
SP	student presentation	0	0%
RSW	reading seat work	0	0%
Other		0	0%

Summary of Levels of Student Engagement

In addition to documenting the types of activities that were occurring in the classroom, the observers also recorded the levels of student engagement which was summarized in Tables 3.7 and 3.8. Levels of engagement are defined by the percentage of students in the classroom who the observer believed were engaged in the task. If more than 80% of the students in the class were engaged in the task at hand during a five-minute period, then they were defined as being highly engaged. If less than 20% of the students were engaged in the class during any five-minute period, then a mark of low engagement was recorded by the observer. If the percentage of engaged students was between 20% and 80%, then students were coded as having mixed levels of engagement.

The observers found that STEMTEC students were highly engaged 71% percent of the time. This is slightly less than the previous year where the students were highly engaged over eighty percent of the time. Faculty Fellow students were highly engaged almost 69% of the time which is about the same as the STEMTEC students. Mixed levels of engagement of both STEMTEC and Faculty Fellow students were recorded 28% of the time, while low levels of engagement were recorded less than .02% of the time for both groups.

Table 3.7
Summary of STEMTEC Student Engagement

Level of Engagement	% Time
High	71.3
Mixed	27.7
Low	.01

Table 3.8

Summary of Faculty Fellow Student Engagement

Level of Engagement	**% Time**
High	68.5%
Mixed	27.8%
Low	.02%

Summary of Cognitive Activity Levels

Evaluations were also made during the observations about the level of cognitive activity occurring in the classroom. Receipt of knowledge, defined as involvement in the rote reception of information (lectures, going over worksheets, questions, watching something, homework), was most prevalent in both the STEMTEC and Faculty Fellow classes as it was observed to be occurring 62.0% and 57.4% respectively. This is remarkably less than last year's evaluation when receipt of knowledge was observed 82% of the time. Application of knowledge (e.g. doing worksheets, homework or practice problems similar to ones modeled in class, skill building, performance) was found to be occurring approximately one third of the time in both the

STEMTEC and Faculty Fellow classes. Knowledge representation, defined as occurring when students manipulate information (e.g. organizing, trying to make sense out of something, describing, categorizing), was observed 30.6% of the time in the STEMTEC classrooms and 27.8% of the time in the Faculty Fellow classrooms. The last category, knowledge construction, occurs when students are creating new meaning (e.g. higher order thinking, generating, inventing, solving problems, revising, etc.), was observed much more frequently in the Faculty Fellow classrooms than in the STEMTEC classrooms. Knowledge construction was observed to occur 22.2% of the time in the Faculty Fellow classrooms and only 8.3% of the time in the STEMTEC classrooms. Tables 3.9 and 3.10 summarize the observations regarding levels of cognitive activity.

Table 3.9

Summary of Cognitive Activity Levels of STEMTEC Courses

Cognitive Activity	**% Time**
Receipt of Knowledge	62.0%
Application of Procedural Knowledge	33.3%
Knowledge Representation	30.6%
Knowledge Construction	8.3%

Table 3.10

Summary of Cognitive Activity Levels of Faculty Fellow Courses

Cognitive Activity	**% Time**
Receipt of Knowledge	57.4%
Application of Procedural Knowledge	32.0%
Knowledge Representation	27.8%
Knowledge Construction	22.2%

Summary of Ratings of Key Indicators

After observing what actually happened in the classroom, the observers also reflected upon and assessed how well the classes rated on a number of key indicators related to the broader goals of the CETP initiative. The rating of these indicators are summarized below in Table 3.11.

In general, key indicators were evaluated quite favorably by the observers. On a scale of one to five (where 1= not at all and 5 = to a great extent for the first 12 items below; and 1 = no effect and 5 = very effective for the final three items), all fifteen items had a mean score higher than three and twelve of the items had an average score above 4. The most highly rated item focused the extent on which the instructors displayed an understanding of the mathematics/science concepts with their students (m = 4.88). This was the same item that was the highest rated last year. It was also encouraging to see that other highly rated indicators included the extent to which the interactions reflected collaborative working relationships among students and students' capacity to carry out their own inquiries (both items had a mean of 4.63). The lowest ratings, which still averaged in the above average range, focused on the extent that appropriate connections were made to other areas of mathematics/science concepts (m = 3.38) and students' understanding of mathematics/science as a dynamic body of knowledge generated and enriched by investigation (m = 3.86).

Table 3.11
Summary of Ratings of Key Indicators of STEMTEC Courses

Item	Mean[a]	S.D.	Range
1. This lesson encouraged students to seek and value alternative modes of investigation or of problem solving.	4.25	1.93	3-5
2. Elements of abstraction (i.e. symbolic representations, theory building) were encouraged when it is important to do so	4.00	2.00	2-5
3. Students were reflective about their learning	4.13	2.03	2-5
4. The lesson was designed to engage students as members of a learning community	4.25	1.92	3-5
5. The instructional strategies and activities respected students' prior knowledge and the preconceptions inherent therein	4.86	2.20	3-5
6. Interactions reflected collaborative working relationships among students (e.g. students worked together, talked with each other about the lesson), and between teacher/instructor and students	4.63	2.15	3-5
7. Intellectual rigor, constructive criticism, and the challenging of ideas were valued	4.43	2.10	2-5
8. The lesson promoted strongly coherent conceptual understanding	4.63	1.98	4-5
9. Students were encouraged to generate conjectures, alternative solution strategies, and ways of interpreting evidence	4.50	2.05	3-5
10. The teacher/instructor displayed an understanding of mathematics/science concepts (e.g. in his/her dialogue with students)	4.88	2.14	4-5
11. Appropriate connections were made to other areas of mathematics/science and/or to other disciplines	3.38	1.88	2-5
12. Appropriate connections were made to real-world contexts, social issues, and global concerns	4.50	2.12	2-5
13. Students' understanding of mathematics/science as a dynamic body of knowledge generated and enriched by investigation	3.86	2.13	3-5
14. Students understanding of important mathematics/science concepts	4.43	2.10	3-5
15. Students' capacity to carry out their own inquiries	4.63	2.15	3-5

[a] Response categories were coded 1= not at all and 5 = to a great extent for the first 12 items; and 1 = no effect and 5 = very effective for the final three items

Discussion

This assessment is a descriptive snapshot of what kinds of instructional activities are being employed in the classrooms of STEMTEC instructors. The sample is small enough that caution should be used regarding the generalization of these findings across the STEMTEC program. However, the diversity of courses, students and instructors in the sample provides a good foundation for concluding with some general observations of the extent to which reformed instructional practices are being incorporated into classrooms by STEMTEC faculty. The courses ranged in size from the very small to the quite large and included a variety of students – including science majors, education majors, and other students.

Small group discussions and high levels of teacher-student interaction appear to be the instructional strategies most often observed in these classes. Lecture, and lecture with discussion to a lesser extent, appears to remain a prominent (about 25% of the time in the “regular” STEMTEC courses) form of classroom instruction in the STEMTEC courses observed as part of this evaluation. Additionally, a variety of other techniques are being incorporated into many classes. Hands on activities, student presentations and writing work were all observed being incorporated into classes in various ways. Some novel and effective means for utilizing educational technology were also observed in some classes.

The solid ratings of key indicators suggest that STEMTEC instructors are well prepared, engaging, and able to contextualize knowledge for students.

Further evidence that STEMTEC courses are engaging in some level of reform teaching can be found in the high levels of student engagement that were observed in these classes. Overall, students were observed to be highly engaged about 70% of the time across the two groups of instructors. There was also almost no evidence of low engagement. Clearly, these STEMTEC courses and instructors are having success in engaging students with teaching and learning as it occurs in the classroom. The high levels of engagement are commendable.

These observations suggest that students are largely receiving knowledge (almost two-thirds of the time) in these STEMTEC classes, rather than having opportunities engage in higher-level cognitive activities. However, it is encouraging that students spent almost one third of their time applying knowledge. It is less encouraging that students in regular STEMTEC courses spent less than one tenth of their class time engaged with knowledge creation as a cognitive activity in these classes. However, the Faculty Fellows engaged their students in knowledge creation almost three times (22%) as frequently in these observations. The other indicators from the observations also suggest that the Faculty Fellows are providing more interactive and dynamic classroom that engage their students at higher levels. It is not clear if this is due to the fact that instructors with this type of commitment to reformed teaching are more likely to self-select into the Faculty fellows program or if the program itself is creating this effect, or some combination of the two. This is worth further study and may provide a strong basis for expanding the Faculty Fellows program.

Conclusions

In sum, these classroom observations provide a good initial picture of what is happening inside STEMTEC classrooms. These observations are even more valuable when considered in light of other evidence collected in other parts of the STEMTEC evaluation. As was noted last year, it is unfortunate that classroom observations were not conducted at the beginning of the STEMTEC initiative as a baseline for determining how much instructional practices have changed over time. In general, the observations provide some evidence that reform teaching is being practiced in STEMTEC classrooms. The evidence is even stronger in the Faculty Fellows' courses and this program may provide a model for not only sustaining but improving upon the accomplishments of STEMTEC even after the formal grant period comes to a conclusion.

STEMTEC Faculty Fellowships In

Science And Mathematics Teaching Program: Mid-Project Report

Kerry Ann O'Meara

STEMTEC Faculty Fellowships In Science And Mathematics Teaching Program: Mid-Project Report

Introduction

The 2002-2003 Faculty Fellows program engages 16 faculty members from 7 partner colleges (UMass, Greenfield Community College, Hampshire College, Springfield Technical Community College, Holyoke Community College, Framingham State, Smith College) in a learning community aimed at increasing teaching effectiveness in college math, science, and engineering courses. Fellows receive a $2,500 stipend to support their involvement in the program. Biweekly dinner seminars during spring, 2002 and fall, 2002, (6:00-8:30), create a forum where fellows can explore innovative and effective strategies for improving the learning of students in college science and mathematics courses. Each Fellow designs a plan to integrate active learning methods into courses that they teach and implements that plan in fall, 2002. Throughout the fellowship fellows have access to STEMTEC resources on teaching and learning, and receive feedback on their course redesign. The Faculty Fellows design is informed by the Lilly Teaching Fellows program which takes pre-tenure faculty and offers them course-release time to reflect on their own teaching with colleagues. The Faculty Fellows program is coordinated by Charlene D'Avanzo, Allan Feldman, and Richard Yuretich. Marie Silver and Celeste Asikainen provide technical support. KerryAnn O'Meara is evaluating the program.

The PRIMARY GOALS of this project are:

- To enhance faculty members' familiarity with active learning methods.
- To increase the likelihood that faculty will use active-learning methods in science, mathematics, and engineering courses.
- To facilitate the redesign of courses to include active-learning methods.
- To increase faculty satisfaction and excitement about the scholarship and practice of teaching.
- To provide support for early career faculty to strengthen their investment and commitment to teaching.
- To have a positive influence on faculty teaching careers, and professional development early in faculty careers (pre-tenure).

<u>Curriculum and Resources</u>

During the spring, 2002 semester, the Faculty Fellows held 8 dinner meetings. Topics for the sessions included formal and informal discussions of: teaching goals, active learning, informal cooperative learning, formal cooperative learning, alternatives to traditional tests, instructional technology, critical, higher order, & expert thinking, and plans for course redesign. During each session there were mini-lectures by the program coordinators, STEMTEC videos modeling teaching techniques, exercises where faculty fellows tried out active learning methods themselves, and unstructured discussions among faculty fellows about their own teaching and attempts at reform. Fellows were all given a copy of the following book: Uno, Gordon, E. (1999). Handbook on Teaching Undergraduate Science Courses: A Survival Training Manual (Saunders College Publishing) and were assigned readings from the handbook related to each weeks topic. Course redesign plans were handed in at the end of the first semester.

Evaluation Questions

Based on Faculty Fellows' goals, the following questions were created to guide the evaluation over one year:

1. Does participation in the Faculty Fellows program enhance faculty members' familiarity with active learning methods?
2. Does participation in the Faculty Fellows program increase the likelihood that participants will use active learning methods in the redesign of their courses?
3. Did program participants feel supported in their efforts to redesign courses?
4. Does participation in the Faculty Fellows program increase faculty satisfaction with, and excitement about, the scholarship and practice of teaching?
5. Did the Faculty Fellows program impact any of the following aspects of faculty members' teaching careers?
   (a) philosophy of teaching,
   (b) course design,
   (c) skills as a teacher,
   (d) understanding of student learning,
   (e) commitment to teaching
   (f) self-confidence
   (g) degree of being "pedagogically self-conscious"
6. Did the Faculty Fellows program impact any of the following aspects of faculty members' professional lives?
   (a) view of himself/herself as a professional
   (b) overall professional development,
   (c) collegial contacts, sense of collegiality and community
   (d) mentoring other faculty,
   (e) credentials for tenure review/contract renewal

Method

To explore the degree to which the Faculty Fellows is meeting its goals (after the first semester) the following methods/data collection were employed. A pre-post survey was given to fellows at the beginning and end of the spring, 2002 semester (see Appendix D). The evaluator attended, observed and took notes at three dinner meetings. A focus group of all fellows, absent program coordinators, was held during the last meeting of the spring, semester. Application materials, some course redesign materials, and communication from the fellows' listserv were all reviewed.

** In the fall, 2002 semester, the evaluation will continue, and the evaluator will attend three more dinner meetings, ask participants to complete a final survey, hold a final focus group and may interview a sample of fellows individually. Additionally, pre/post syllabi and pre-post teaching evaluations will be included in the final evaluation of the faculty fellows project.

Preliminary Findings

It is important to note that this evaluation concerns only the first half of the Faculty Fellows program. The final evaluation of the program will be conducted when the program ends in December, 2002. Substantive discussion of course redesign, implementation and evaluation, will be left to the final evaluation. First, findings on the effectiveness of the curriculum and resources is presented, followed by findings related to specific Faculty Fellows' goals.

Curriculum And Resources

In the survey completed at the end of the spring, 2002 semester, fellows were asked to rate (very helpful, somewhat helpful, or not at all helpful) five components of the curriculum (dinner meetings; STEMTEC videos; mini-lectures; exercises; and the handbook). Twelve fellows completed the survey. All five components were rated highly by fellows. Fellows felt the discussions among faculty fellows about their own teaching and attempts at reform was the most helpful (11 (92%) very helpful; 1 (8%) somewhat); followed by videos and mini-lectures (9 (75%) very helpful; 3 (25%) somewhat); exercises where faculty fellows tried out the active learning methods themselves (7 (58%) very helpful, 4 (34%) somewhat, and 1 (8%) not helpful) and the handbook (3 (25%) very helpful, 8 (67%) somewhat, 1 (8%) not at all).

Dinner Meetings

Data collected from observations of dinner meetings and in the focus group suggest that the most compelling component of the FF program is the opportunity at dinner meetings for fellows to report back to each other after having experimented with an active-learning method, tell their story, and receive support and feedback from the group. These discussions appeared to be the real highlight of each dinner meeting and participants all seemed to leave the time allotted for these discussions wanting more. Overall, the mood of the three sessions I attended was very positive and comfortable. There always seemed to be smiling faces, laughter, attentiveness, and engagement during these periods. The meal seemed to act as a bridge for fellows between work and the meeting, easing fellows into the sharing of teaching stories.

For example, one faculty member in such a session on February 5th described having integrated the muddiest point exercise into her class. She then said, "it got people talking, broke the silence. In retrospect, maybe I should have gone with them [into groups]."

Another faculty member followed with, "something I am trying is that everyone, once a week has to bring an article and write 4-5 sentences on it and present it to the class. It makes science more relevant to them."

> "I've started using a two minute essay at the end of class, with the questions, what was the main point of the lecture, what sticks in your head from this lecture, what is confusing, needs clarification. Its simple and I am enjoying doing it. It isn't very profound but I like it, it is working pretty well."

Another faculty member chimed in that he was putting on his website the main objective of his lecture beforehand. "I feel like it is a better way to teach. I don't know how to assess if its' working." One of the coordinators offered that there was a term for what he was doing called, "advance organizer," with the idea that just like in public speaking we tell students where we are going with our teaching.

During breaks there were often interesting science discussions (e.g. about the life of bees) that benefit from a cross fertilization of disciplines. There is a great deal of informal cooperative learning, people are genuinely interested in helping each other work through teaching "problems" they have in their heads.

During one open session after a discussion of problem-based learning the group offered examples from their own teaching. One faculty member shared that they had led discussions of issues that were somewhat of a mystery in science; another mentioned having group discussions about something the teacher admits not knowing the answer to; a third said she had the class discuss why an experiment might have failed. Examples were also given by the coordinators from their own teaching. As this was happening you could see the wheels turning in everyones' heads, considering how they might try one of the things mentioned. In summary, the dinner meetings are a very effective tool that seem to be working very well in helping the program achieve its goals.

The STEMTEC Videos

The STEMTEC Videos are well-made and the faculty fellows really appreciated having the opportunity to observe skilled teachers implementing a teaching strategy being discussed. For example, on February 5, they watched a short piece from the STEMTEC video "How Change Happens" which shows Jose Mestre teaching in a large physics program that displayed a version of Think-Pare-Share (TPS). After watching the program the group discussed why TPS seemed to work so well. They discussed the importance of picking the questions carefully, having students use their own vocabulary to discuss the issue, and how peer pressure helps. They concluded, "teaching something helps people learn it." A faculty fellow then posed, "but do other students learn through listening to peers thinking through an issue?" Afterwards a useful discussion followed. Clearly, the videos are accomplishing their task of modeling and stimulating good discussions.

Mini-lectures

The Mini-lectures provided helpful overviews of the topics. For example, on March 5, a coordinator delivered a mini-lecture on cooperative learning, quoting from well-known educational theorists like Richard Light and Karl Smith. Many of the fellows had not read much on how students learn, pedagogy or curriculum development, so they seemed to appreciate the mini-lectures as windows into this literature. However, the amount of time devoted to mini-lectures, usually no more than ½ hour is about right and should not be lengthened to ensure that there is enough time for the other elements of the program.

The exercises

The exercises where fellows tried out active-learning methods themselves seemed helpful. However, at times the exercises were challenged by the group being too tired for role-playing at the end of the day, and by fellows finding it difficult to pretend that they were students. However the coordinators did a nice job of using these challenges as teaching moments. For example, during one exercise on problem-based learning where fellows divided into groups and roles as leader, scribe, and skeptic, there seemed to be high energy, and positive body language. When each group reported back their answer to the "problem" and reflected on their methods and process, there was a useful discussion about the differences between faculty and students in doing the exercise.

The handbook

Few fellows seemed to mention the readings in the dinner meetings, or in the focus group, and the program coordinators did not refer to them that often either. The handbook seems to serve fellows well as background reading, but it is likely that many of the fellows did not read many of the assigned articles in the handbook. A few fellows indicated that they did not get a chance to read it at all. For example, one faculty fellow noted on his/her survey that the handbook was not helpful but then wrote in, "but only because I did not find the time to read it."

Impact Of Faculty Fellows On Familiarity With And Use Of Active Learning Methods

The first semester of the Faculty Fellows program was very successful in increasing fellows familiarity with and likelihood of use of, active-learning methods. Table 4.1 and 4.2 present the data from the January, 2002 survey and the May, 2002 survey questions on active-learning methods. Looking at these data from January to May, 2002, and combining the "Use Occasionally" and "Use Very Often" categories, the following increases in uses of active learning methods was notable: Fellows went from 64.5% to 91% on class discussion; hands-on activity (from 86% to 92%); utilizing digital educational media (from 72% to 91%); assessment (from 72% to 100%), cooperative learning (from 61.5% to 91%); teachers interacting with students in groups (from 57% to 92%) and student presentations from 53% to 66%. These survey data also indicate that familiarity with different methods have increased as well, as in the January, 2002 survey at least 1 or more fellows noted that they were not familiar with 12 of the 15 methods listed, while the May, 2002 survey notes that 1 or more fellows were not familiar with only 5 methods listed. The survey data also indicate that the fellows are familiar with, but not using learning centers/stations, out-of class experiences, reading seatwork, and writing work as often as the other methods.

In the focus groups, all fellows seemed to feel that the program had increased their familiarity and likelihood of using active learning methods. During the focus group session, one faculty member said, "I always had a fear of letting go control. When I tried it [active-learning methods] I was stunned at how well they responded." Another faculty member said, "I liked hearing what others had tried, sharing common experiences, and hear from others that not everything was working." Another faculty member said, "It was sometimes difficult to move from discussion of a method to implementation." Others agreed with this statement and thought more time in the meetings discussing the details of implementing an active-learning method within specific contexts might be helpful.

Table 4.1

Active-Learning Teaching Strategies (January, 2002)

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

	Not Familiar	**Familiar, but have not Used**	**Use occasionally**	**Use very often**
lecture	0	0	1 (8%)	12 (92%)
lecture w/ discussion	0	2 (14%)	3 (21%)	9 (65%)
class discussion	1 (7%)	4 (28.5%)	4 (28.5%)	5 (36%)
hands-on activity	0	2 (14%)	6 (43%)	6 (43%)
utilizing digital educational media	1 (7%)	3 (21%)	6 (43%)	4 (29%)
utilizing other technology	2 (14%)	3 (22%)	7 (50%)	2 (14%)
assessment	2 (14%)	2 (14%)	8 (58%)	2 (14%)
reading seatwork	12 (92%)	0	1 (8%)	0
writing work	1 (7%)	4 (29%)	6 (43%)	3 (21%)
teacher demonstration	5 (39%)	2 (15%)	3 (23%)	3 (23%)
cooperative learning	2 (15.5%)	3 (23%)	6 (46%)	2 (15.5%)
teacher's interacting with students in groups	1 (7%)	5 (36%)	6 (43%)	2 (14%)
learning centers/stations	10 (72%)	1 (7%)	1 (7%)	2 (14%)
out-of class experiences	6 (46%)	4 (31%)	3 (23%)	0
student presentations	1 (7%)	6 (40%)	6 (40%)	2 (13%)

Table 4.2

Active-Learning Teaching Strategies (May, 2002)

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

	Not Familiar	**Familiar, but have not used**	**Use occasionally**	**Use very often**
lecture			3(25%)	9 (75%)
lecture w/ discussion			5 (42%)	7 (58%)
*class discussion		1 (9%)	5 (45.5%)	5(45.5%)
hands-on activity		1 (8%)	3 (25%)	8 (67%)
utilizing digital educational media		1 (9%)	7 (64%)	3 (27%)
utilizing other technology	2 (17%)	4 (33%)	4 (33%)	2 (17%)
**assessment			6 (60%)	4 (40%)
*reading seatwork	6 (55%)	4 (36%)		1 (9%)
writing work		3 (27%)	5 (46%)	3 (27%)
teacher demonstration	1 (8%)	3 (25%)	4 (33.5%)	4(33.5%)
*cooperative learning		1 (9%)	7 (64%)	3 (27%)
teacher's interacting with students in groups		1 (8%)	5 (42%)	6 (50%)
learning centers/stations	5 (42%)	5 (42%)	1 (8%)	1 (8%)
out-of class experiences	2 (17%)	6 (50%)	3 (25%)	1 (8%)
student presentations		4 (34%)	6 (50%)	2 (16%)

(o) Out of 11 responses
**Out of 10 responses

Impact Of Faculty Fellows On Understanding Of Student Learning/Assessment

Just about every Faculty Fellows session, but in particular the ones that focused on teaching goals and on critical and high order thinking, involved fellows in reflecting on how students learn, and how assessment might be used to modify lessons to increase student learning in fellows classes.

In January, 2002 when asked to what extent fellows had used student assessment results to modify what was taught and how, out of 13 responses, 0 said, To a great Extent; 9 (69%) Somewhat; 3 (23%) Very Little, and 1 (8%) Not at All. In May, 2002, when asked the same question, out of 12 responses, 1 (8%) said to a great extent, 6 (50%) said somewhat, and 5 (42%) said very little. Combining the first two categories the ratings went from 69% to 58%.

It is interesting to note the decrease in fellows noting their use of assessment presented in this data. One possible and likely explanation is that the program has helped fellows to better understand what assessment is and is not, and thus fellows were more careful in noting whether they were using it in the second survey. Fellows noted in the last session that they wished that they had learned more about student assessment, and coordinators noted it is a priority for fall, 2002 seminars.

Turning from the specific topic of student assessment to the broader topic of how students learn, it was easier to document growth. On February 5, the fellows were asked to reflect on something they learned as a result of being involved in some active-learning activity. Fellows seemed genuinely engaged and reflected on what they learned, how they learned it, and even what it felt like to learn it. Afterwards, one faculty member questioned, “If I get involved in active learning, how do I know this is the most effective/ efficient way to learn something.” Another faculty member commented after this exercise that what we are learning must be meaningful in some way in order to stick.

Another commented that they were highly motivated in their own example, and “it is easy to teach motivated students,” how do you get students to be motivated when they don’t start out that way. Can you motivate students by being enthusiastic?” This questioning illustrates one of the best aspects of the program–teacher/scholars trying to discover together how to best engage their students.

The coordinators discussed the paradigm shift that has been noted by Barr and Tagg several times: of changing from a process of delivering information, to helping people learn, which they explained takes more expertise. This framework seemed to be helpful to fellows as they considered their own methods for helping students learn.

During my second observation of a seminar, there was an interesting discussion of student group work and its benefits and challenges. One faculty member explained that students had told her that they understand the math problems when she explains them in class but have trouble doing them when they get home. She explained that group-work helped her students, because the groups engaged in problem-solving together, and those who had less confidence, but have the skills, benefited from the group experience. Another faculty member responded, that group work certainly allows a lot of peer-to- peer teaching to go on, but a challenge is how to mix the groups so that the “star” students are not all in the same group. Two other concerns about group work were brought up by faculty- when the dynamics of a group are bad and a lot of class time needs to be spent facilitating those relationships, and the concern that group work can decrease the amount of material faculty feel that they can cover. This particular concern was mentioned often. A third faculty member described a challenge of getting the passive group members more engaged. Another faculty member responded by saying that maybe its okay not to address it.

Overall, coordinators and fellows contributed to an atmosphere that was very supportive of questioning and considering how they and their students and learn. In the focus group one faculty member commented that the program had given her enough, “knowledge to feel comfortable giving up control of the class,” and allowed her to, “trust students more.” Clearly this confidence was the product of a supportive environment where she felt she was encouraged to reflect and learn with her peers.

Impact Of Faculty Fellows On Teaching Careers; Professional Development; Satisfaction With Teaching

Faculty fellows were asked at the beginning of the semester to list their goals for their participation in the program and then at the end of the semester to assess the degree to which (to a great extent, somewhat, very little, not at all) the program helped them to meet these goals. Four goals emerged as central:

- To meet with and talk with other people interested in teaching
  (To a Great Extent 11 (92%); Somewhat 1 (8%)) (12)
- To explore new pedagogical techniques and ways of thinking about teaching
  (To a Great Extent 6 (60%); Somewhat 4 (40%) (10/12 had this as a goal)
- To learn new methods for engaging students and encouraging active learning
  To a Great Extent 9 (75%); Somewhat 3 (25%) (12)
- To enhance my effectiveness as an instructor
  To a Great Extent 3 (25%); Somewhat 8 (67%); Very Little 1 (8%) (12)

It should be considered a major success of the program that the number one FF goal of meeting other people and forming a learning community around teaching issues was also the goal in which participants were most satisfied.

Tables 4.3 and 4.4 provide a snapshot of survey responses to questions about professional development that can be compared from the beginning of the program in January, 2002 and again at the end of the first semester in May, 2002.

Table 4.3

Professional Development

How would you rate your own professional development in each of the following areas:

	High	Good	Okay	Poor
*Skills as a teacher	0	12 (80%)	3 (20%)	0
*Understanding of how students learn	0	7 (47%)	7 (47%)	1 (6%)
Commitment to teaching	11(69%)	3 (19%)	2 (12%)	0
*Collegial contacts	1 (7%)	7 (47%)	5 (33%)	2(13%)
Philosophy of teaching	0	3 (19%)	12 (75%)	1 (6%)
Design of courses	0	8 (50%)	7 (44%)	1 (6%)
*Overall professional development as a university faculty member	1 (7%)	6 (40%)	7 (46%)	1 (7%)
Knowledge of resources for teacher education in math/science	1 (6%)	5 (31%)	6 (38%)	4(25%)
Comfort level with sharing teaching strategies with colleagues	1 (6.5%)	9 (56%)	5 (31%)	1 (6.5%)
Self-confidence as a teacher	1 (6%)	8 (50%)	6 (38%)	1 (6%)
**The credentials you have collected to demonstrate teaching excellence for promotion/tenure	1 (7%)	5 (36%)	7 (50%)	1 (7%)
***Publication record	1 (8%)	5 (38.5%)	5 (38.5%)	2(15%)
**Involvement with networks committed to teacher preparation in math/science	0	1 (7%)	5 (36%)	8(57%)

Based on 16 responses, unless noted
*15 responses
**14 responses
***13 responses

Table 4.4

How would you rate your own professional development in each of the following areas: (12 responses, unless noted otherwise)

	High	Good	Okay	Poor
Skills as a teacher	4 (33%)	8 (67%)	0	0
Understanding of how students learn	2 (16.5%)	8 (67%)	2 (16.5%)	0
Commitment to teaching	9 (75%)	2 (17%)	1 (8%)	0
Collegial contacts	2 (17%)	7 (58%)	2 (17%)	1 (8%)
Philosophy of teaching	2 (17%)	7 (58%)	3 (25%)	0
*Design of courses	2 (18%)	7 (64%)	2 (18%)	0
*Overall professional development as a university faculty member	2 (18%)	7 (64%)	2 (18%)	
Knowledge of resources for teacher education in math/science	2 (17%)	3 (25%)	6 (50%)	1 (8%)
Comfort level with sharing teaching strategies with colleagues	4 (33%)	7 (58%)	1 (9%)	0
*Self-confidence as a teacher	3 (27%)	6 (55%)	2 (18%)	0
*The credentials you have collected to demonstrate teaching excellence for promotion/tenure	3 (27%)	3 (27%)	4 (37%)	1 (9%)
**Publication record	1 (10%)	3 (30%)	4 (40%)	2(20%)
Involvement with networks committed to teacher preparation in math/science	0	5 (42%)	4 (33%)	3(25%)

*Out of 11 responses
**Out of 10 responses

By combining the high and good ratings for both the January and May surveys, it is possible to see significant movement in the following areas from January to May: skills as a teacher (from 80% to 100%); understanding of how students learn (from 47% to 83.5%); collegial contacts (from 54% to 75%); philosophy of teaching (from 19% to 75%); design of courses (from 50% to 82%); overall professional development as a university faculty member (from 47% to 82%); comfort level with sharing teaching strategies with colleagues (from 62.5% to 91%); and self confidence as a teacher (from 56% to 82%).

Comparatively there was very little, no, or a decreased rating in the following areas: Knowledge of resources for teacher education in math/science (from 37% to 42%); the credentials you have collected to demonstrate teaching excellence for promotion/tenure (from 43% to 54%); and publication record (from 46.5% to 40%). While there was movement in the category of involvement with networks committed to teacher preparation in math/science (from 7% to 42%) it also appears that more could be done in the program in this area. These ratings are consistent with the first semester's curriculum as there was not a significant amount of time spent on these issues. However, given that the program focuses on pre-tenure faculty, and that it hopes to situate these faculty within the

STEMTEC network of teacher educators in math and science courses, the coordinators may want to consider how to emphasize these areas in Fall, 2002.

There was only a small increase in the category of commitment to teaching (from 88% to 92%), but this is due to the high initial rating and the fact that the program recruits faculty who have an established commitment to teaching. This is consistent with how faculty rate their satisfaction with their work as teachers, showing that the FF program seems to provide a slight increase to a group of people that were already highly satisfied with their teaching. For example, when asked to check the statement that best characterized their satisfaction with their work as teachers at the beginning of the program, out of 13, 2 (15%) said they were very satisfied, 10 (77%) somewhat satisfied, 1 (8%) somewhat unsatisfied, and 0 very unsatisfied. When asked the same question again after the first semester of the program in May, 2002, out of 12 responses, 4 (33%) said very satisfied, 8 (67%) said somewhat satisfied and 0 said somewhat unsatisfied or very unsatisfied.

During the focus group and throughout the dinner meetings, fellows mentioned different aspects of the program that were helpful to their professional development. A major benefit of the program mentioned often was the sense of community that they felt they were forming around teaching. During the focus groups one faculty member said, "it was great to be part of a community where everyone cares about teaching."

A second area mentioned in the focus groups was how the program was helping them to become more pedagogically self-conscious. Fellows said that sometimes this was good, other times difficult. One faculty member in the focus group said, and others agreed, "I was more miserable with my teaching this semester because I was taking it apart, like okay I am going to do this boring thing again, that isn't very creative."

Another faculty member responded that "its [active learning] a lot of work, while slapping a lecture together is much easier."

The third area that fellows mentioned concerning their own professional development was courage and inspiration. One faculty member said, "Having this group to come talk to gave me a lot of courage to go do things." Another agreed that the group provided, "inspiration to take more risks."

Course Redesign

During the last session of the spring semester, fellows submitted course design plans. During the session they met in groups and then reflected as a group about commonalities among their plans. Most had chosen classes of 30 or under, and had plans to incorporate more case studies, student projects and peer evaluation into their classes to increase higher order thinking among their students. After that last session, the project coordinators provided individual feedback to fellows, and additional support will be provided as the course was implemented in the fall semester. Observations from this last session suggest that the plans submitted to coordinators were more rough drafts than complete plans and will likely need to be modified with more detail once coordinators have provided feedback. Also, several fellows seemed to have plans to implement changes in more than one course. Special attention should be paid to these course design plans in the first few sessions of the fall semester so that fellows are clear on what exactly they are redesigning as part of the STEMTEC project, how and when they will implement the reforms, and how they will assess and evaluate their success.

I observed some great group thinking in the last session when fellows presented their initial ideas about course redesign. For example, one faculty member from Hampshire described his course on Computer Programming and its goals, stating that the goal of the course was to teach students to think critically. A faculty member listening said, “ 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.” He then went on to describe a second course he wanted to revise stating that the goal would be similar in, “developing skills and confidence in trying to figure out how to build something.” Other faculty questioned: How will you evaluate it? How hard will the projects be? This kind of back and forth seemed to stimulate the faculty members’ to be more critical about his projects and help him to confirm his student learning goals.

Recommended Improvements For Fall, 2002 Semester

When asked about topics or teaching approaches fellows would like to see incorporated into the fall, 2002 sessions the following list was given: more on techniques for active learning assessment and evaluation strategies, group work dynamics, learning centers/stations, using case studies and the web, tips for improving writing, formative and summative assessment of teaching techniques. Additional comments from focus groups included:
“The ideas are great, maybe more about practical ways to implement these ideas for “problem” situations like large classes, lack of TA help, no computer access, etc.”
“Assign more reading from the STEMTEC manual. It’s a great book, though I rarely took the time to read it.”
“More specific examples of what people are trying”
“More depth.”
“More detailed examples of things that work and things that don’t.”

Fellows all agreed they wanted more time in the next semester for them to talk about how their teaching reforms are going and to continue watching teaching strategies modeled in videos. Because of the fact that there are a limited number of dinner meetings in the spring and many areas that fellows have mentioned that they would like addressed, it might be useful for coordinators to make a list and have participants rate their interest in various areas over the summer as well as to confer together on the major priority areas that coordinators feel should be considered core areas for the spring semester.

Conclusion

In summary, the Faculty Fellows program is well on its way to achieving its stated goals. The program benefited from the fact that they started with a group of faculty who were already very committed to teaching, and who were aware of and using some active-learning methods before they joined the program. Modeled after the Lilly Teaching Fellows program, the faculty fellows program also benefits from research that demonstrates that bringing pre-tenure faculty together in this way sustains and enhances their commitment to teaching. Building from these benefits the coordinators have done an excellent job in designing a curriculum and resources that increase faculty member’s familiarity with a variety of active-learning methods, and instill confidence in fellows in their ability to use them. The synergy at the dinner meetings was exciting and was clearly increasing fellows' commitment to and excitement about their teaching. Several faculty complimented the coordinators, saying that their stories about their own teaching were "inspiring." One faculty member described the process as helping her "climb up a little bit," in terms of her own performance. This perhaps, is the best compliment of all, as it represents a faculty member who like the program, is aiming for excellence in teaching and who feels that they have the support to achieve it.

Summary of Senior Administrator Interviews

Stephen G. Sireci and Joseph B. Berger

Summary of Senior Administrator Interviews

Introduction

The Science, Technology, Engineering, and Mathematics Teacher Education Collaborative (STEMTEC) comprised eight college and university campuses: Amherst College, Greenfield Community College, Hampshire College, Holyoke Community College, Mount Holyoke College, Smith College, Springfield Technical Community College, and the University of Massachusetts Amherst. To increase our perspective on the successes and limitations of STEMTEC, we decided to interview *senior* administrators on the STEMTEC campuses, to gather their impressions of this five-year project. This study provides unique information beyond the other interviews, surveys, focus groups, and classroom observations conducted thus far because these senior administrators were not part of the STEMTEC team on their campus, but they were in key positions to gauge its effects. The results of the interviews are summarized in this report.

Method

Interview Protocol

Only one or two administrators were targeted for each campus and so an open-ended interview format was used to gather the administrators' perceptions of the strengths and limitations of STEMTEC. Each administrator was asked if he or she was familiar with STEMTEC and was then asked seven additional questions. The specific questions asked were:

1. Are you familiar with STEMTEC?
2. What is your understanding of the major purposes of STEMTEC?
3. Do you think STEMTEC has been successful in accomplishing its goals on your campus?
4. What do you think are the most important things that STEMTEC has accomplished?
5. What are the limitations or failures of STEMTEC? Has it been disappointing in any way?
6. Do you think that the positive changes begun by STEMTEC will continue?
7. Do you think STEMTEC has helped increase the ethnic and gender diversity of students planning to become math or science teachers?
8. Do you have any other comments about STEMTEC?

The interview protocol was kept relatively short because we assumed these senior administrators were very busy and would have limited time to respond.

Procedure

All interviews were conducted during July and August 2002. All targeted administrators were telephoned to request their participation in the study. E-mails were sent to those administrators who were unavailable by phone due to travel or hectic schedules. The initial contact explained the purpose of the study and informed the administrator that he or she was under no obligation to participate and was free to refuse to answer any or all interview questions. The administrators were also informed that their results would be anonymous and that no identifying information would be reported.

The administrators were given the option of responding to the interview by phone or by e-mail. Appointments were scheduled for the administrators who chose to respond by phone. The interview questions were e-mailed to the administrators who chose to respond by e-mail. For those interviews that were conducted over the phone, the interviewer followed up each response by encouraging the administrator to provide as much commentary as possible regarding the specific question. After the last question was answered, the interviewer encouraged the administrator to provide any other comments about STEMTEC that they thought were germane to the evaluation.

At the conclusion of the interview, the administrators were thanked for their participation. Some administrators requested a copy of the final report and were told they should receive a copy sometime in the fall of 2002.

Participants

Fourteen administrators were targeted for the interview. Our goal was to interview at least one administrator at each of the STEMTEC campuses. Our success in this area was limited. All administrators who agreed to participate responded to all interview questions. However, only eight administrators participated, representing six of the eight schools. The targeted administrators from Hampshire College and Mount Holyoke College were not interviewed, most likely due to the short time frame for conducting the interviews and the fact that the interviews were conducted over the summer.

Of the eight participants, one was a Vice President, five were Deans, one was a center director, and one was a department chair. Four of the participants were men and four were women. Only one administrator was interviewed at each of the community colleges and at UMASS. Two of the participants responded by e-mail; the other six were interviewed over the phone.

Results

To simplify reporting of the results, responses will be summarized separately for each question.

Question 1: Are you familiar with STEMTEC?

All administrators reported that they were familiar with STEMTEC.

Question 2: What is your understanding of the major purposes of STEMTEC?

All of the administrators correctly identified at least two of the major purposes of STEMTEC and many identified at least three. Seven of the eight administrators acknowledged that a major purpose of STEMTEC was to improve the teaching of math and science at the postsecondary level and six administrators mentioned the goal of recruiting students into the math and science teaching professions. Four of the administrators mentioned that STEMTEC was designed to improve math and science teaching at the elementary or secondary school levels. Three respondents acknowledged that STEMTEC's recruitment initiatives particularly targeted women or minorities, and one respondent stated that STEMTEC was designed to build collaboratives among math and science teachers from different colleges and universities. A summary of the administrators' responses to this question is presented in Table 5.1.

Table 5.1

Administrators Perceptions of STEMTEC Purposes

Perceived Purpose	Number of Administrators
Improve math and science teaching at the postsecondary level	7
Recruit new math and science teachers	6
Improve math and science teaching at the elementary or secondary school levels	4
Recruit minority math and science teachers	3
Recruit women math and science teachers	3
Build inter-campus collaboratives of math and science teachers	1

Note: Total number of Administrators=8.

Table 5.2 presents the four major goals of STEMTEC and lists the number of administrators who mentioned each goal. Similar to the purposes listed in Table 5.1, seven of the eight administrators acknowledged the major purpose of improving postsecondary science education and six administrators acknowledged the recruitment goals of STEMTEC. However, only half of the administrators explicitly acknowledged the STEMTEC goal of improving K-12 math and science education and none of the administrators mentioned the goal of developing support programs for new math and science teachers.

Table 5.2

Administrators Perceptions of STEMTEC Purposes

STEMTEC Goal	Number of Administrators Acknowledging Goal
Redesign science and math curricula on the campuses to incorporate new pedagogies and establish mechanisms for supporting faculty in their course redesign	7
Recruit and retain promising students into the teaching profession, with special attention to underrepresented groups	6
Improve preparation of future K-12 teachers of mathematics and science	4
Develop a program to support new science and math teachers in their first year in the classroom	0

Note: Total number of Administrators=8.

Also in response to question 2, two administrators expressed the belief that the major purposes of STEMTEC changed after the first year. During the first year, they thought the emphasis was on improving postsecondary math and science instruction. In subsequent years, they thought the focus was predominantly on recruiting new teachers.

<u>Question 3: Do you think STEMTEC has been successful in accomplishing its goals on your campus?</u>

The administrators' responses to this question were mixed. One of the administrators thought STEMTEC fell short of accomplishing its goals, but the other seven administrators acknowledged success in at least one area: getting postsecondary teachers excited about teaching math or science and helping them improve their teaching. Four of the administrators thought that, in general, STEMTEC was a success. The other three administrators cited successes in some areas and lack of success in others.

Two specific areas of success cited for STEMTEC were being "a catalyst for changing the science and math teaching culture" and encouraging faculty to "think about their teaching and motivate their students to think like a scientist." The administrator who believed that STEMTEC was not successful on her/his campus stated that there was "not much curricular reform at the college level." More details regarding specific strengths and weaknesses cited by the administrators are reported in the next two sections.

Question 4: What do you think are the most important things that STEMTEC has accomplished?

The responses to this question generally reiterated the perception that STEMTEC improved science and math instruction at the postsecondary level. Several administrators mentioned that STEMTEC facilitated active student learning. As one administrator put it, the most important thing STEMTEC accomplished was "making active learning for students possible in every type and level of science and math class at the university." Three administrators thought that the camaraderie among math and science teachers from different campuses one of STEMTEC's greatest accomplishments.

The perception that STEMTEC was effective in introducing teaching as a career option for math and science undergraduates was also reiterated in some of the responses to this question. One of the administrators commented that one of the most important things STEMTEC accomplished was "creating better early awareness among young students that teaching is a career option if you are interested in science or math." Another administrator commented that an important accomplishment was the support STEMTEC provided for students interested in teaching science.

Question 5: What are the limitations or failures of STEMTEC? Has it been disappointing in any way?

There was no consensus limitation/failure that emerged from the responses to this question, but seven of the eight administrators mentioned at least one limitation (the remaining administrator did not cite any limitations or failures). Two administrators lamented that STEMTEC did not spread to non-STEMTEC faculty. They hoped STEMTEC would have a broader effect on their math and science teaching. Two administrators (from the same school) expressed the belief that the teacher workshops were ineffective in that they were "touchy-feely" or that they taught strategies that were already well known. Similarly, one administrator expressed dissatisfaction that there was no recognition about how much some schools, particularly community colleges, had already done in improving math and science teaching.

One administrator commented that STEMTEC failed to build a collaborative. He or she felt that it was "dominated by UMASS, which has different issues and needs." Another administrator commented that the periodic surveys that were distributed focused on teacher recruitment rather than reformed teaching practices. Finally, one administrator stated that the lack of explicit structure for "developing larger pools of K-12 teachers" was a failure.

Question 6: Do you think that the positive changes begun by STEMTEC will continue?

All of the administrators expressed some degree of uncertainty regarding the lasting effects of STEMTEC, but six of the eight administrators expressed hope that the positive changes, particularly those related to improved pedagogy, would persevere. Reasons for uncertainty included the loss of funding associated with the end of the STEMTEC contract during a difficult budget crisis on some campuses. Areas of optimism stemmed from "the bubble of new teachers" created by STEMTEC that would “put its mission to work.” One administrator summed up the general optimism noted in the responses to this question by stating “there is a good mix of young and veteran faculty who remain committed at the grassroots level to maintaining the cultural shift” (i.e., culture of active student learning). Another administrator noted that some STEMTEC funds were used to purchase important instructional material and equipment that would still be used. However, one administrator stated “some good things have come out of it, but there won’t be lots of math and science teachers as a result.”

Question 7: Do you think STEMTEC has helped increase the ethnic and gender diversity of students planning to become math or science teachers?

The most popular response to this question was “don’t know,” which was expressed by five of the eight administrators. Two of the other administrators thought that STEMTEC did not help to increase the ethnic or gender diversity of students planning to become math or science teachers; the remaining administrator though STEMTEC had some positive effect in this area.

Question 8: Do you have any other comments about STEMTEC?

Five of the eight administrators provided additional comments at the conclusion of the interview. Two of these administrators were extremely positive. One stated: “UMASS did a great job. What was attempted was heroic and largely accepted,” while the other reported “we got a lot out of it…for people here, it was positive and beneficial.” Two other administrators expressed the opinion that STEMTEC was a great idea, but lamented that it was not as effective as they hoped. The other administrator reiterated his dissatisfaction with the recruitment focus of STEMTEC, but mentioned that STEMTEC was successful in building some collegiality across campuses.

Discussion

The results of the interviews of senior administrators at six of the eight STEMTEC campuses highlights some of the strengths and weaknesses of STEMTEC that were noted in other evaluation activities, and provides some unique insights regarding STEMTEC’s effectiveness in accomplishing its goals. It is interesting to observe that the strengths and weaknesses noted by the administrators were not consistent across campuses—in fact, many contradictions arose when comparing the impressions from different administrators. One administrator complemented STEMTEC for building collegiality across campuses while another complained about the lack of collegiality. Seven of the eight administrators praised STEMTEC for reinvigorating teaching practices on their campus, but the remaining administrator expressed the opinion that one of STEMTEC’s greatest weaknesses was its inability to reform teaching practices on her/his campus. These observations suggest that the effects of STEMTEC varied from campus to campus and were greatly affected by characteristics of the student population (e.g., readiness for school, class sizes, etc.), characteristics of the faculty (e.g., years of experience, familiarity with new teaching approaches, etc.), and instructional resources on the campus (e.g., other teaching support, technology resources, etc.).

Given the small number of respondents, it is difficult to uncover themes that may be related to institutional factors such as two-year versus four-year schools or public versus private schools.

However, our analysis of the interviews and other data suggests that the private schools, which are more selective in admitting students, were less interested in teacher recruitment and more interested in pedagogical support, relative to the other schools. This tentative conclusion must be qualified by the fact that two of the four private schools in the collaborative—Hampshire College and Mount Holyoke College—were not represented in this study.

The results of the interview reveal both strengths and limitations of STEMTEC. On the positive side, the results indicate that all administrators were familiar with the major goals of STEMTEC, with the exception of "developing a program to support new science and math teachers in their first year in the classroom." The administrators believed that STEMTEC led to improved postsecondary instruction, and several also believed that STEMTEC did a good job of introducing the teaching profession to math and science undergraduates.

On the negative side, there was little evidence that the administrators noticed an increase in the women or minorities who were considering teaching careers in math or science. In addition, almost all administrators seemed to have at least one complaint about some aspect of the project. Perhaps that is not surprising for a project of this magnitude, but these complaints should be considered as STEMTEC initiatives are extended or as efforts are made to keep the STEMTEC mission alive by facilitating collaboration among the campuses.

Perhaps the most important information obtained in the interviews is that there were different schools of thought across the campuses about where STEMTEC should focus its energy and resources. Some administrators were clearly interested in teacher recruitment activities while others were not. Thus, the challenge for the extension of STEMTEC and for future collaborations is how to either engage all campuses in a common mission or how to tailor the various initiatives to best serve each campus.

Analysis of 2002 Core Faculty Survey Data

Stephen G. Sireci

Analysis of 2002 Core Faculty Survey Data

Introduction

The Center for Applied Research and Education Improvement (CAREI) in the College of Education and Human Development at the University of Minnesota is coordinating an evaluation of all the Collaborative for Excellence in Teacher Preparation (CETP) programs that are funded by the National Science Foundation. The Science, Technology, Engineering, and Mathematics Teacher Education Collaborative (STEMTEC) is one of these CETP programs. As part of the national evaluation of CETP, CAREI developed several "core" surveys, one of which is a survey of CETP faculty. This report is a summary of the data from this survey for all participating STEMTEC faculty.

Method

Description of Survey

The core Faculty Survey was developed by CAREI to help with its CETP evaluation. As stated by CAREI[a], the CETP core evaluation focuses on the following question:

> What evidence exists that the changes instituted as part of the Collaboratives have indeed resulted in a substantial increase in the number of students who know more, and are more competent at teaching mathematics and the sciences using the mathematics and science standards as a guide and employing the new technologies available?

The CAREI faculty survey consisted of 53 items, several of which asked respondents to explain their answers. Most of the items asked the respondent to select a response along a predefined rating scale (e.g., agreement scale, frequency scale, etc.). The topics addressed by the items included demographic information; questions about students and colleagues; questions about teaching style, teaching philosophy, and teaching practices; and questions about recent changes in teaching practices. A complete copy of the survey is presented in Appendix E. It was estimated that faculty would take about 45 minutes to complete the survey.

As illustrated in Appendix E, a central focus of the survey was discovering changes in teaching practices over the STEMTEC project period (see survey items 14 through 24). Seventeen items asked the respondents to rate the frequency with which they used specific teaching practices before and after STEMTEC.

We were unable to locate documentation that described the various dimensions the faculty survey was designed to measure. Therefore, we evaluated all survey questions for their relevance to the evaluation of STEMTEC. Two items that seemed to measure teaching philosophy were discarded from our analyses (items 31a and 31b—see Appendix E) because the structure of the rating scale did

[a] Downloaded from the CAREI web site (http://www.coled.umn.edu/carei/CETP/default.html) on August 25, 2002.

not allow for substantive interpretation of the data. Another item that measured the weight of teaching in the tenure and merit processes (item 8) was also omitted from analysis due to a flaw in the list of response options.

Participating STEMTEC Faculty

A total of 32 STEMTEC faculty completed at least a portion of the survey. However, there were about 12 omits per survey item, which yielded a response rate of about 20 faculty per item. Although all STEMTEC campuses were represented, almost half of the respondents (44%) were from the University of Massachusetts. There were between one and five respondents at each of the non-UMASS schools. Seven respondents (22%) were from a two-year school. About 70% of the respondents were science faculty, about 20% were math faculty, and about 10% were computer science/engineering or technology faculty. With respect to sex, 14 respondents were men, 9 were women, and 9 omitted their sex. With respect to academic rank, 2 respondents were instructors or adjunct professors, 1 was an assistant professor, 4 were associate professors, 14 were full professors, and 11 did not provide a rank.

Procedure

On February 18, 2002, CAREI sent an e-mail to all STEMTEC faculty. This e-mail informed them of the purpose of the survey and included the URL at which the survey was located. All participating faculty completed the survey over the web. In June 2002, CAREI sent the survey data to the STEMTEC evaluation team.

Results

As mentioned earlier, no documentation could be found regarding the structure of the faculty survey for the purposes of reporting results. The explicit structure of the survey allowed for some logical groupings of items, such as those that dealt with current teaching practices. To facilitate interpretation of the results, some survey items were grouped together based on the constructs that we presumed they measured. Therefore, our presentation of the results is organized around dimensions of teaching philosophy, impressions of students, current teaching practices, recent changes in teaching practices, interactions with colleagues, and other areas pertinent to the evaluation.

Current Teaching Practices

A central focus of the survey was to ascertain the current teaching practices used by STEMTEC (CETP) faculty. Three survey items asked specifically about current teaching practices and seventeen items inquired about current and past teaching practices. A summary of the responses to the three items that asked only about current teaching practices is presented in Table 6.1. These items asked about (a) students' voice in decisions regarding class activities, (b) whether instruction is based on what students already know, and (c) whether instruction is integrated with assessment. The responses to these items were varied, but for the most part, these STEMTEC faculty appear to at least occasionally use the instructional approaches advocated by STEMTEC.

Table 6.1

Summary of Responses to Items Regarding Current Teaching Practices

Item	Response Frequency					
	Never	Seldom	Occasionally	Regularly	Omit	Median Response
How often do students have a voice in decisions about course activities?	5	6	7	2	12	Seldom
How often is new information based on what students already knew about the topic?	1	4	13	2	12	Occasionally
How often are student assessment results used to modify what is taught and how?	2	3	10	4	13	Occasionally

The data for the seventeen items inquiring about current and previous teaching practices are reported in Table 6.2. These items aimed toward measurement of the degree to which participation in STEMTEC affected these teachers' teaching practices. The response frequencies are presented for each item and the median response is highlighted for both past and current practice. In addition, dependent-samples t-tests were conducted on each item. Those items that exhibited statistically significant "change" (at $p < .01$) from past to current practice are emphasized using italics and an asterisk. Given the small sample sizes for these analyses, and the fact that seventeen independent tests were conducted, the inferences drawn from these statistical tests should be conservative. That said, it is interesting to note that of the seventeen practices listed, the median changed in the direction of more student centered learning on thirteen items. Furthermore, the change was statistically significant at $p <.01$ on nine of these items. These results suggest that the teaching practices taught and encouraged throughout the STEMTEC project are being implemented in STEMTEC classrooms.

One other question directly addressed the issue of changes to teaching practice. This item asked "In the past few years, have you made substantial changes in your teaching style?" The response options to this item were "yes" and "no." Fourteen of the twenty teachers who responded to this question (i.e., 70%) responded "yes." Taken with the results for the seventeen "change" items, this result suggests that the majority of STEMTEC teachers have instituted changes in their teaching practices that enhance student learning in ways congruent with the STEMTEC teaching philosophy.

Table 6.2

Summary of Responses Regarding Current and Prior Teaching Practices

Frequency BEFORE STEMTEC					**Teaching Strategy**	**Frequency AFTER STEMTEC**				
Never	**Seldom**	**Occasionally**	**Regularly**	**Almost Always**	**In your current science, mathematics or education courses, how often do students:**	**Never**	**Seldom**	**Occasionally**	**Regularly**	**Almost Always**
	15*	5			***Work with other students where the whole group gets one grade?……………………………………………………..*		8	7*	5	
	14*	4	2		***Participate in whole-class discussions during which the teacher talks less than the students?………………………….*		3	8*	9	
	7	6*	6	1	*** Use or make models, e.g., physical, conceptual or mathematical models?…………………..………………..*		2	6	10*	2
	12*	2	3	2	Write descriptions of their reasoning?……...………………..		6	6*	5	2
	4	8*	5	3	***Work on problems related to real world or practical issues?..*		2	3	12*	3
	11*	3	3	1	*** Evaluate the extent of their own learning?….…………..…..*		4	5*	7*	2
					Complete assessments/ assignments that include:					
	4	7*	5	4	a. problems with complex solutions ?……………………..…..		2	6	8*	4
	17*	1	1		b. portfolios?………………………………………………		13*	4	1	1
	9	4*	3	4	c. multiple choice/short answer items?……………………		11*	2	5	2
	7	7*	4	1	d. full-length papers/reports?……………………………		6	7*	5	1
					Use technology, e.g., computers, calculators:					
	7	10*	2	1	***a. to understand or explore concepts taught in class in more depth?……………………………………..……*		1	7	11*	1
	8	6*	4		***b. as a tool in investigations to gather and analyze scientific or mathematical data?……………..………..….*		4	7*	8	
	16*	2	1	1	***c. as a tool for assessment?……………………..……..*		10*	3*	6	1
	13*	3	2	2	***d. as a tool to communicate with you or with other students?…………………………………………......*			4	9*	7
	5	9*	6		Perform investigative activities that include data collection, and analysis?………………………………..………………		3	7*	9*	1
	3	6	10*	1	Make connections to other fields (science, technology, engineering, and mathematics (STEM) and non-STEM)?…...		1	7	10*	2
	6	7*	2	3	Design and make presentations that help them learn class concepts?..……………………………………………………		3	6*	7*	2

*Indicates median response. Adjacent asterisks indicate the median is between the categories.
**Difference between before and after STEMTEC is statistically significant at $p < .01$.

Teaching Philosophy

There were three survey items that seemed to deal directly with teaching philosophy (items 28, 35, and 36). The first item asked the faculty to express their agreement with the statement "It is important for students to help establish criteria by which their work will be assessed" along a four point agreement scale (strongly disagree, disagree, agree, strongly agree). A "not applicable" response option was also provided. There was no consensus among the respondents to this question (3 strongly disagree, 5 disagree, 5 agree, and 7 strongly agree), but the median response was "agree." The next item in this category asked the respondents to express their agreement with the statement "Truly understanding science in the science classroom requires special abilities that only some people possess" using the same agreement scale. The third item in this category was a parallel question that twice substituted the word "mathematics" for science. For both items, all but one respondent expressed disagreement, and the median response for both items was "disagree."

Faculty Impressions of Students

Four survey questions asked the respondents to rate the knowledge or ability of certain groups of students. The specific questions and the results are summarized in Table 6.3. In general, the faculty rated their students adequate in each area.

Table 6.3

Faculty Impressions of Student Groups

Please rate the quality of the following.	**Less than adequate**	**Adequate**	**More than adequate**	**Exceptional**	**Not Applicable**
a. The ability of the students in the teacher preparation programs at your institution		7*	3	3	7
b. The ability of the students in the science, technology, engineering, and mathematics (STEM) programs at your institution		6	10*	3	2
c. The STEM knowledge of your students at your institution	1	11*	7	1	1
d. The pedagogical knowledge of your students at your institution	4	8*	5	1	2

*Indicates median response.

Gender & ethnic diversity

One survey item asked respondents to "Briefly describe specific efforts, if any, that have been taken to increase the level of gender and ethnic diversity among students in the teacher preparation programs at your institution." Only seven faculty responded to this question, one of whom just remarked that the survey was poorly designed. One respondent mentioned faculty participation in an unspecified STEMTEC project and another faculty mentioned scholarships and the recruitment of minority faculty. Another respondent remarked that changes in teaching styles and assessment formats to “encourage a broad spectrum of learners” was being examined. Another respondent mentioned participation in the “METS” program. The other two respondents remarked that gender diversity was not an issue because they taught at a college for women, and they acknowledge the difficulty in recruiting a diverse student body.

Interaction with colleagues

The survey included seven questions that asked about interaction with faculty colleagues or their impression of their colleagues. The data were missing on one of these questions (item 5c). Two questions asked whether there was any change in the way “you and your colleagues interact” over the past five years. The first of these questions asked about faculty in other institutions; the second asked about faculty “in the area(s) of education at your institution.” These questions used a yes-or-no answer format and invited respondents to explain their answers. With respect to interaction with faculty at other institutions, fourteen of twenty-one faculty (67%) answered “yes.” With respect to the second question, thirteen of twenty respondents (65%) answered “yes.” The explanations provided by the respondents mentioned the formal STEMTEC workshops and summer institutes, as well as informal follow-ups to those activities. In explaining their response to the second question, several faculty mentioned enriching on-campus activities coordinated by the STEMTEC campus coordinator.

Another survey item that addressed interaction with colleagues asked “In the past few years have you ever observed any colleagues teaching and then discussed your observations with them (or vice versa)?” This item also used a yes-no format, but included two follow-up questions regarding frequency of such discussions and reasons motivating the discussion. Twenty-one faculty responded to this question, with nine responding “yes.” Six of the nine respondents provided frequency data that ranged from twice to 100 times per year. Three reasons were listed for why these discussions occurred: team teaching situations, learning communities, and serving as a mentor to junior faculty.

An additional question asked whether the respondent’s “course(s) influenced changes in other courses in your institution?” This question also used the yes-no format and provided an opportunity for respondents to explain their answers. Eighteen faculty responded to the question with twelve (67%) responding affirmatively. Explanations accompanying these responses included sharing instructional technological innovations with colleagues and innovations in assessment.

The final two questions in this area asked the respondents to comment on their colleagues “shared vision of effective instruction” and the degree to which they were informed about national education standards. Forty percent of the respondents disagreed or strongly disagreed that faculty members had a shared vision of effective instruction, but 60% agreed or strongly agreed. With respect to their colleagues’ knowledge of national education standards, 80% of the respondents disagreed (with more than half of them strongly disagreeing).

Time Spent on Curricular Reform

Two items asked about the time spent improving teaching or reforming their curriculum. The first item asked about the amount of time the respondent spent in these areas and the second item asked about the amount of time the respondent thought her/his colleagues spent in these areas. The respondents. On average, the STEMTEC faculty reported that they spent between 60% and 70% of their professional time on these activities and they estimated that their colleagues spent between 30% and 40% of their time on these activities.

Other Questions

As illustrated in Appendix E, the respondents were asked questions on a variety of other areas. One item asked whether the respondents "responsibilities include any formalized interaction with K-12 schools." Of the twenty-one respondents to this question, only seven (33%) answered "yes."

Another item inquired about field site experiences. Five of the twenty-one respondents indicated that they were involved in such experiences. One respondent reported one class field experience and three others reported two.

The survey also included an item on barriers that may inhibit faculty "from teaching mathematics and/or science in ways most beneficial for student learning." Nine respondents indicated the existence of such barriers and gave examples such as inadequate student preparation, lack of infrastructure for instructional technology, lack of specific educational resource materials, large class sizes, and lack of time to properly prepare for instruction.

Respondents were also asked about course development/reform money and other resources they may have received in the past "few years." Fifteen of the twenty-one faculty responding to this question indicated that they did receive such money or resources. Nine of these respondents specifically mentioned STEMTEC-related support. Others reported leave time, technology grants from their institutions, and other NSF-funded grants. One respondent received funding through a post-tenure multiyear review process.

The final, "miscellaneous" question reported here was an opinion question regarding how "most of the important scientific advances" came about (item 34—see Appendix E). The median response to this item, which was chosen by10 of the eighteen respondents (56%), was "the interaction of ideas and experiments in the solution of problems."

Discussion

Our analysis of the CAREI survey data provided limited, but useful, information regarding the effectiveness of STEMTEC for improving student learning and recruiting new math and science teachers. In general, the results are positive. They strongly support the conclusion that reformed teaching practices are being incorporated into STEMTEC classrooms. The data on current and prior teaching practices indicates that the faculty who responded to this survey made significant changes to their teaching and that these changes were in a positive direction. The items regarding inter- and intra-campus collaborations were also encouraging. It appears that many STEMTEC faculty have connected with colleagues within their institution as well as with colleagues on other STEMTEC campuses.

There are several limitations associated with this study, most notably, the small number of STEMTEC faculty who responded to the survey items. Nevertheless, the responses that were provided, for the most part, are congruent with the goals of STEMTEC. It may be illuminating to compare the responses for these STEMTEC faculty to those obtained from the remaining CETPs to gauge how different the STEMTEC faculty experience may be from other CETPs.

Analysis of Student Learning Survey: Fall 2001

Lindsay DeCecco and Sharon Cadman Slater

Analysis of Student Learning Survey: Fall 2001

Introduction

At the end of the fall 2001 semester, a brief survey was administered to undergraduates in a sample of STEMTEC mathematics and science courses at the eight institutions involved with the STEMTEC Collaborative Program. The purpose of this survey was to determine the degree to which STEMTEC courses represent reformed teaching styles and support the recruitment and retention of future mathematics and science teachers. In developing this survey, members of the evaluation team reviewed previous questionnaires used in the STEMTEC evaluation as well as the student questionnaires developed by the Core Evaluation team in Minnesota. The final version of this survey used in the study contained 34 selected-response questions. The survey gathered demographic information about the students (e.g., school, sex, race/ethnicity), inquired about their familiarity with STEMTEC, and asked about the teaching and assessment methods they experienced in the class. The primary goal of the survey administered in the fall, hereinafter referred to as the Student Learning Survey (SLS), was to determine the types of learning activities students experienced in a sample of STEMTEC classes. (The survey itself can be found in Appendix F.)

Demographics

A total of 818 students responded to the SLS survey, which was handed out by the instructors of the courses listed in Table 7.1. The sample of students was predominantly Caucasian (78%) and female (66%). Ethnicity/race information for the SLS survey is presented in Table 7.2.

Table 7.1 Courses Included in the Student Learning Survey, Fall 2001

College	Course
Hampshire	NS 353: Seminar in Conservation Ecology
	NS 288: Interdisciplinary Teaching
	NS 164: Physics Outdoors
HCC	NS 121: Human Biology
	LC 102: "What is Life?"
	LC 107: "What Matters: Old Myths and New Paradigms in Science and Literature
	LC 110: On the Brink of Extinction: Science Politics and the Fate of the Earth
Mount Holyoke	BIOL 327:Microbiology
	CHEM 202: Organic Chemistry II
STCC	MATH 078: Pre Algebra
	BIOL 102: Principles of Biology I (Section 5)
	BIOL 102: Principles of Biology I (Section 7)
	BIOL 121: Microbiology
	MATH 123: Math for Early Childhood and Elementary School

College	Course
STCC	STAT 142: Statistics I
UMASS	EDUC 197A: Teaching Math and Science
	BIOCHEM 421: Biochemistry Lab
	GEO 101: The Earth
	GEO 103: Introductory Oceanography (Sections 1 & 2)
GCC	CHE 111: General Chemistry I
	GEO 104: Introduction to Oceanography

Table 7.2 Ethnicity and Race Information of the SLS Survey Respondents (n=787)

Ethnicity or Race	# of Female Respondents	# of Male Respondents	Percent
Caucasian or White	436	206	77.5
African American or Black	39	16	6.7
Hispanic or Latino/a	20	6	3.1
Asian	10	35	5.4
Native or American or Alaskan Native	5	4	1.1
Native Hawaiian or Other Pacific Islander	3	3	0.7
Other	23	12	4.2

The SLS respondents included sixty-two percent of students who were in their first or second year of college. There were 115 Freshman, 402 Sophomores, 140 Juniors, 108 Seniors, and 31 “Other.” Seventy percent of the SLS respondents were earning a bachelor’s degree and twenty-one percent were earning an associate’s degree. In addition, approximately seventy percent of the respondents indicated that they enrolled in the course because it was required for their major or was a general graduation requirement.

This group of survey respondents was offered nine options when asked about their declared or intended majors. The nine choices were business, computer science/technology, education, engineering, humanities/art/music, mathematics/statistics, natural sciences, social sciences, and “other.” Two of the most popular academic majors selected by the SLS students were natural sciences and “other.” The number and percentage of SLS students choosing each academic major is reflected in Table 7.3.

Table 7.3 Academic Majors of SLS Survey Respondents

Academic Major	Number of Students	Percent
Natural Sciences	199	23.9
Other	195	23.4
Social Sciences	104	12.5
Business/Economics	97	11.7
Humanities/Art/Music	79	9.5
Missing	78	9.4
Education	41	4.9
Engineering	16	1.9
Computer Science/Technology	15	1.8
Math/Statistics	8	1

SLS Respondents' Opinions on Teaching as a Career

Sixty-nine percent of all SLS respondents indicated they were not planning on enrolling in a teacher certification program. When asked in which areas students were considering a career, approximately twenty-one percent of the SLS respondents (172 students) indicated they were considering a career in education/teaching. These students were then asked about the particular level and/or subject that they were interested in teaching. While thirty percent of students indicated that they were not interested in teaching, six percent of students indicated they were interested in teaching science and two percent indicated they were interested in teaching mathematics. Particularly, teaching at the elementary (10.5%) and high school (10.9%) levels were the most popular choices with this specific group of students (see Table 7.4).

Table 7.4 Number and Percent of SLS Students Indicating Particular Subjects and Levels They Would Like To Teach

Teaching Option	Number of Students Considering	Percent
Science	47	5.6
Mathematics	18	2.2
Preschool	39	4.7
Elementary School	87	10.5
Middle School	44	5.3
High School	91	10.9
College	64	7.7
Not Interested In Teaching	252	30.3

Careers Being Considered by SLS Respondents

A career in Biology/Medicine and “Other” were the two most popular potential careers with this group of students. Table 7.5 shows the percentages of SLS students considering various career options. As highlighted previously, the number of students (21 percent) considering Education/Teaching as a career ranked third most favorably among the options of choice. While considering that education is among the more favorable career of choice, it is interesting that when students were asked to indicate their declared or intended major, only five percent of respondents chose education as their major of choice. Furthermore, it is also interesting that approximately seventy percent of respondents indicated that they were not planning on enrolling in a teacher certification program.

Table 7.5 Percent of SLS Students Considering Careers in Various Fields

Career Option	% of Students Considering
Biology/Medicine	24.5
Education/Teaching	20.8
Art/Music/Humanities	12.9
Psychology	13.7
Business/Economics	16.3
Social Services	9.3
Law	7.9
Computer Science	3.4
Chemistry	3.4
Engineering	3.4
Geology	2.3
Physics	0.8
Other	21.8

SLS Student Responses Regarding Classroom Activities

The SLS students were asked to rate how often a classroom activity occurred during the semester using a five-point rating scale where "1" equaled "never" and "5" equaled "every class." The responses to the fifteen statements inquiring about classroom activities were mixed (see Table 7.6). Fifty-five percent of the students indicated that they listened to lecture every class, while twenty-one percent indicated that lectures occurred in almost every class. This finding was further expanded upon when sixty-nine percent of the students responded that their teacher never or rarely talked less than the students enrolled in the course.

Table 7.6 Mean Ratings of SLS Student Responses to Frequency of Classroom Activities

In This Course, How Often Did:	Mean*
you listen to lecture?	4.31
you feel encouraged to ask questions in class?	3.71
the teacher use educational technology?	3.44
you work on in-class problem-solving and/or open-ended questions?	3.44
you work in small groups?	3.39
you have opportunities to give feedback to the instructor?	3.24
you work on problems related to real-world or practical issues?	3.14
you make connections to other fields or disciplines?	2.71
you participate in hands-on activities?	2.58
you discuss learning and/or teaching strategies?	2.13
you have discussions in which the teacher talked less than the students?	2.11
you have opportunities to work on long-term projects?	2.08
you hear the instructor speak about teaching as a career?	1.68
other students teach a portion of this class?	1.46
you collaborate with K-12 teachers and/or students?	1.26

*The scale ranged from 1 (never) to 5 (every class)

When students were asked how often they worked in small groups, three-quarters of the students responded with a rating of 3 or more, suggesting that this occurred quite often. Regarding work on problems that related to real-world or practical issues and in-class problem-solving and/or open-ended questions, approximately 25 percent of the respondents indicated this type of work occurred often by rating this statement 3 or 4, ("3"=often; "4"=almost every class). The mean ratings for the statements "work on problems that relate to real-world issues" and "in-class problem solving" were 3.14 and 3.44, respectively. Additionally, students were asked to rate how often educational technology (e.g., computers, VCRs) was used in the classroom, seventy-one percent of students responded with a rating of 3 or more, suggesting that this occurred quite often as well.

A total of eighty-three percent of the respondents often felt encouraged to ask questions in class (mean=3.71, see Figure 7.1). Of those students, 28 percent indicated they felt that way during every class. When students were asked how often they had opportunities to give feedback to the instructor, approximately three-quarters of SLS students responded with a rating of 3 or more, suggesting that this occurred quite often (mean=3.24, see Figure 7.2). Using a rating scale that ranged from “1” for “strongly disagree” to “5” for “strongly agree, ” when students were asked to indicate their agreement with the statement that the course encouraged discussion among students and teacher, seventy-one percent responded with a rating of 4 or 5, suggesting that there was quite a strong agreement (mean=4.00, see Figure 7.3).

Figure 7.1 Percentage of SLS Student Ratings of Feeling Encouraged to Ask Questions in Class

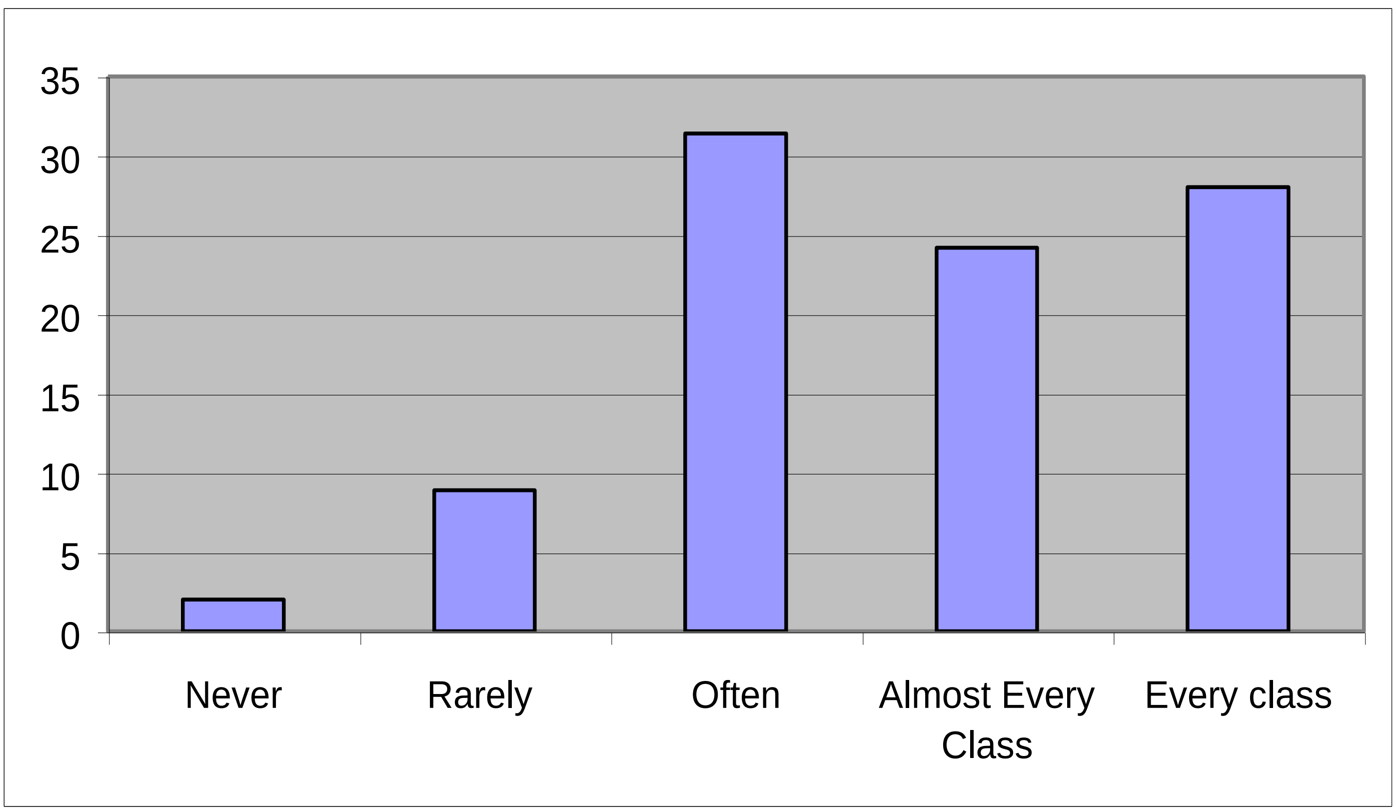


Figure 7.2 Percentage of SLS Student Ratings of Opportunities to Give Feedback to the Instructor

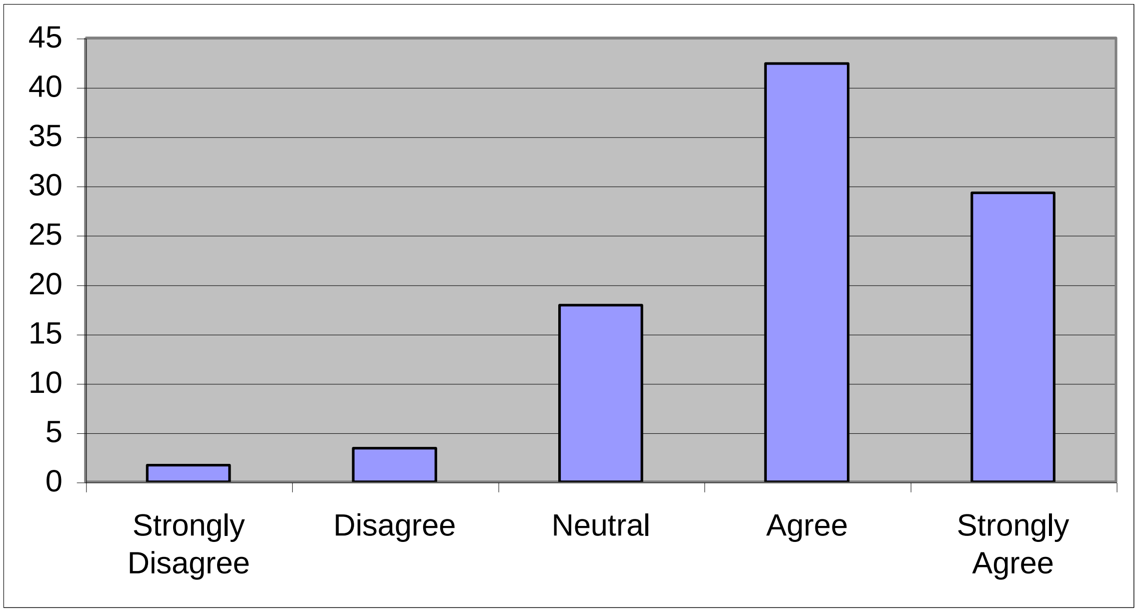
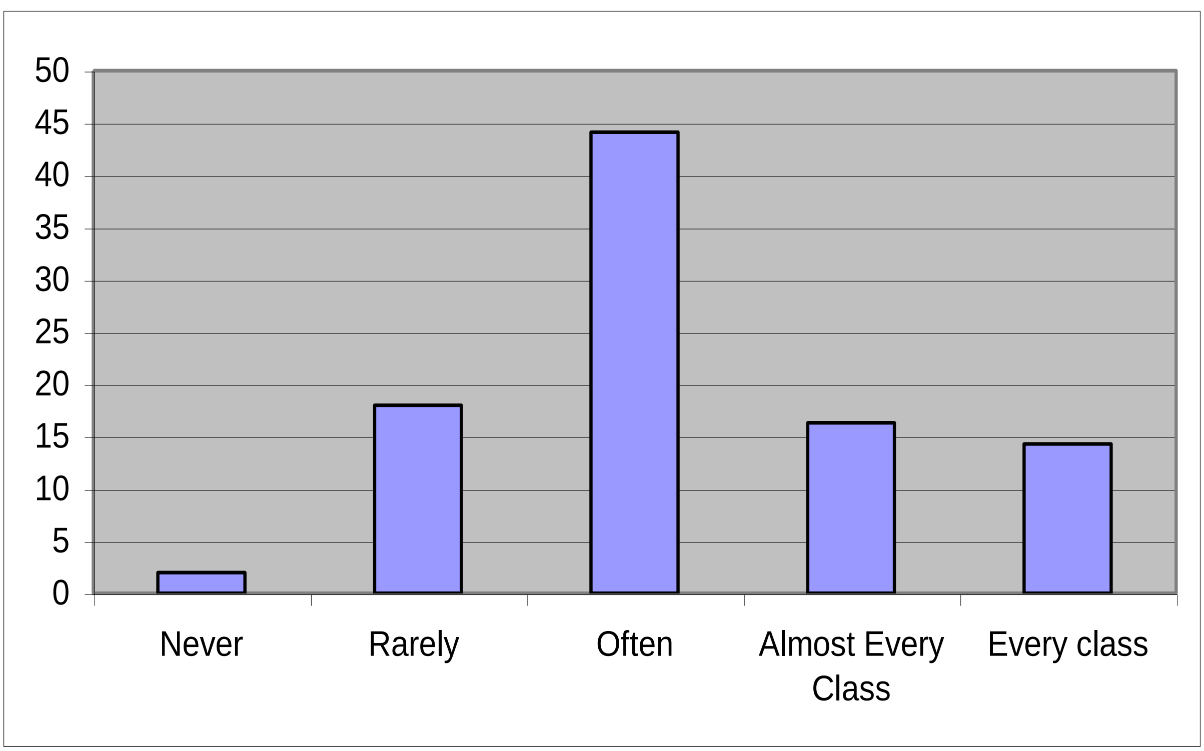


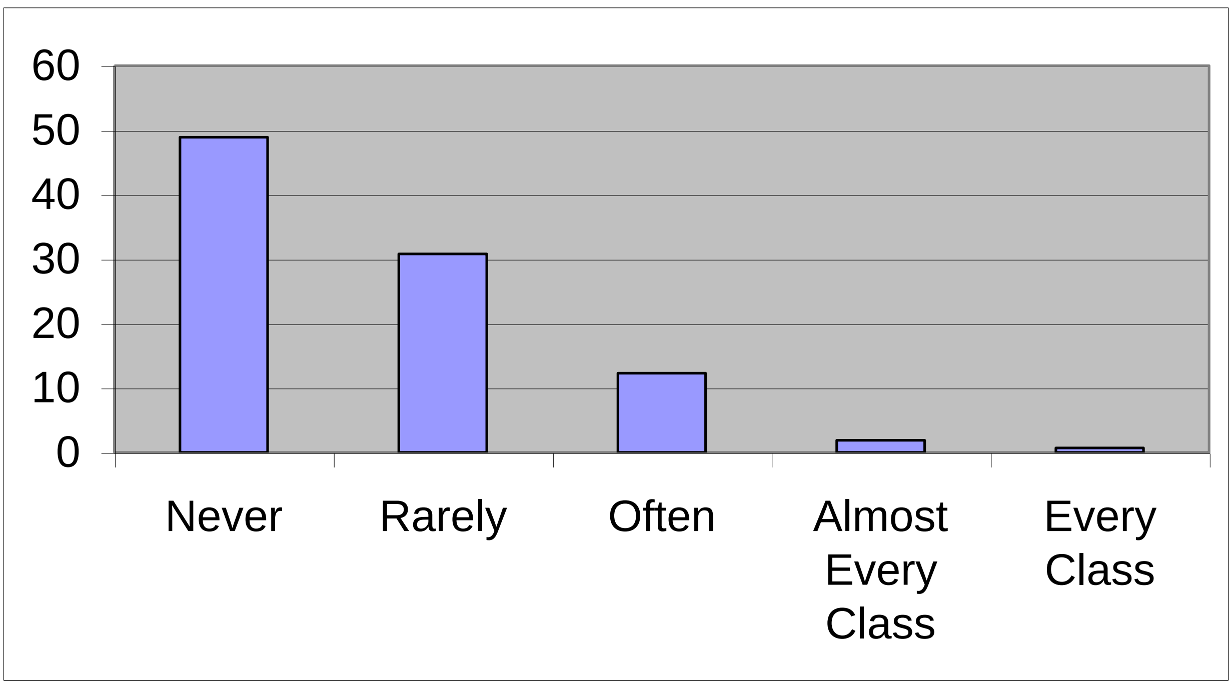
Figure 7.3 Percentage of SLS Student Ratings for Encouraged Discussion among Students and Teacher



Classroom activities related to teaching as a career

Highlighting student responses is an important component in the evaluation of the STEMTEC program's effect on attracting and recruiting qualified teachers. Eighty-percent of those surveyed in the fall indicated that their instructor rarely or never mentioned teaching as a career (mean=1.68), where "1" equaled "never" and "5" equaled "every class" (see Figure 7.4). Additionally, a similar proportion of students rarely or never taught a portion of the class (mean=1.46). Furthermore, more than three-quarters of the respondents indicated that they never collaborated with K-12 teachers and/or students (mean=1.26), and sixty-five percent of students indicated they rarely or never discussed learning and/or teaching strategies.

Figure 7.4 Percentage of SLS Student Ratings for Hearing Instructor Speak about Teaching as a Career



SLS Student Response to Interest in Subject/Content Area

Students were asked to rate seven statements pertaining to the manner in which course material was presented in class and whether or not completing the course increased their interest in the subject manner. A five-point scale ranging from "1", strongly disagree, to "5", strongly agree, was used to rate each statement. Approximately eighty percent of the SLS students agreed or strongly agreed that the course helped them to learn the course material (mean = 4.04), there was sufficient time to respond to questions in class (mean = 4.03), and the course encouraged discussion among students and teacher (mean = 4).

In addition, approximately half of the respondents agreed or strongly agreed (mean = 3.66) that the course increased their interest in the subject. When students were asked to rate their agreement with the statement "this course increased my interest in becoming a teacher", almost half of the survey respondents disagreed (rating of 1 or 2) with this statement and another thirty-three percent remained neutral (rating of 3). The mean rating for this statement was 2.41. See Table 7.7 for mean ratings with corresponding survey statements.

Table 7.7 Mean Ratings of SLS Student Responses to Interest in Subject/Content Area

Statements about the course:	Mean*
This course helped me learn the course material	4.04
There was sufficient time for me to respond during this class	4.03
This course encouraged discussion among students and teacher	4
This course increased my interest in the subject	3.66
I look forward to take more courses in this subject area	3.58
This course encouraged me to think about my own learning	3.45
This course increased my interest in becoming a teacher	2.41

*The scale ranged from 1 (strongly disagree) to 5 (strongly agree)

SLS Student's Familiarity with STEMTEC program

The SLS survey also asked students about their familiarity with the STEMTEC program. Eighty-two percent of these students were not familiar with STEMTEC. With regards to the students who said that they were familiar with STEMTEC, these students were then asked how important it is for them to choose a STEMTEC course over an equivalent Non-STEMTEC course. Of these particular students (n=112), forty-one percent indicated that choosing a STEMTEC course as opposed to a Non-STEMTEC course was moderately important, important, or very important to them.

Discussion

The information presented from the Student Interest Surveys (SLS) provides meaningful evaluative indicators of STEMTEC's impact on a sample of college students enrolled at six of the eight higher education institutions involved in the project, allowing insight into the extent that reform teaching practices are occurring across multiple STEMTEC courses and affiliated institutions. Resulting in an encouraging reflection of the goals and objectives of STEMTEC, these analyses highlighted some very positive aspects of the program's effectiveness on student learning.

The analyses conducted on the SLS survey clearly indicate there were some very positive activities occurring in STEMTEC classrooms. In particular, working in small groups, working on real-world or practical issues, and working on in-class problem solving was popular among respondents. In addition, students, for the most part, received instruction that connected classroom activities to other fields or disciplines and participated in hands-on activities. It is evident that students were very comfortable asking questions in class and felt that educational technology was used an adequate amount of time by their instructors in class. In terms of students' opportunities to give feedback to instructors and/or respond to questions in class, the analyses indicated that students felt that they had been given a sufficient amount of opportunity.

However, the results also indicate that teaching as a career was rarely mentioned or discussed in STEMTEC classes. Students rarely indicated collaboration with K-12 teachers and/or students and, in general, they did not report that their coursework included a teaching component. Furthermore, students did not indicate that the course increased their interest in becoming a teacher. Finally, there was a definite lack of familiarity with the STEMTEC program among respondents. Thus, STEMTEC could do more to stress teaching as a career within STEMTEC courses and better advertise the benefits of the program.

When taking these results into consideration, it is evident that instructors must discuss more frequently and openly about the STEMTEC project with students. Instructors need to take a proactive approach in making students aware of the positive and beneficial affects that the project has on course instruction and student learning, while, at the same time, making students aware of the great support system that STEMTEC has to offer and the many teaching scholarships that are available as well.

Conclusion

In conclusion, the Student Learning Survey was clearly an important step in obtaining students' perspectives on the effect that STEMTEC had on classroom activities and its success in offering students the opportunity to consider teaching as a career and/or participate in teaching activities while enrolled in STEMTEC courses. The program must strive to continue putting forth great initiative with regards to recruiting and retaining qualified science and mathematics professionals. While the findings discussed in this paper have important implications for higher education students and faculty, these implications are of significant importance in terms of STEMTEC's long-term success.

Report on the Teaching Interest Survey: Fall 2001

Melissa Brown and Sharon Cadman Slater

Report on the Teaching Interest Survey: Fall 2001

One of the goals of STEMTEC is to "recruit and retain promising students into the teaching profession, with special attention to underrepresented groups." Three strategies were implemented by the Collaborative to increase student interest in teaching math and science: (a) modeling different reformed teaching styles in STEMTEC courses, (b) providing opportunities for students to participate in teaching activities, and (c) engaging students in events sponsored by the STEMTEC Student Services program.

To determine if STEMTEC is having an effect on student attitudes toward teaching, it is important to identify the career interests of students early in their undergraduate education. At some later point in the students' undergraduate education or even after graduation, career interests of the students can be obtained again and compared to their earlier career interests to examine how these interests have changed. In cases where a change occurs, students can be questioned about what they believe influenced their shift in career goals. Namely, students can be asked what, if any, influence the STEMTEC program had on their career decisions.

Description of Survey

At the beginning of the Fall 2001 semester, a brief survey was administered to undergraduates in a sample of STEMTEC courses at the eight post-secondary institutions that comprise the STEMTEC Collaborative (see Table 8.1 for the list of courses surveyed). The purpose of the survey was to identify students' interest in teaching early in the semester. Questions on the survey asked students to identify their intended or declared major, and which areas they were considering a career. Also, students were asked to rate the attractiveness of a career in teaching, and the likelihood of teaching in the area of math or science. Students were also asked to identify which subjects and in which settings they might like to teach. As well, students were asked to provide their names and student identification numbers to provide us with the opportunity to collect longitudinal data on these same students in the future to determine whether their interest level in teaching has changed. (Refer to Appendix G for a copy of the survey.) The baseline data collected by this survey will facilitate the tracking of students to determine if STEMTEC did indeed have the intended effect of increasing student interest in teaching math and science. Approximately 70% of respondents (217 students) provided the necessary identification information to include them in a more longitudinal study of their interests in teaching as a profession.

Results

Demographics

A total of 313 students responded to the surveys that were handed out by the instructors of the courses listed in Table 8.1. The response rate was 43% (313 out of 715 surveys distributed). The predominant reason for the low response rate is that no surveys were returned from a University of Massachusetts course with enrollment of 300 students. The sample of students was predominantly Caucasian (70.6%) and female (67.7%). Ethnicity and race information is presented in Table 8.2.

Table 8.1. STEMTEC Courses Administered the Teaching Interest Survey in Fall 2001

College	Course	Number of Respondents
Amherst College	Chemistry 11: Introduction to Chemistry	58
Greenfield Community College	Chemistry 111: General Chemistry I Geology 101: Physical Geology	32 27
Hampshire College	Natural Science 108: Marine & Freshwater Ecology and Conservation Natural Science 121: Human Biology	8 14
Holyoke Community College	Biology 104: Biology Today I Physics 101: General Physics	14 0
Mount Holyoke College	Chemistry 202: Organic Chemistry II	92
Springfield Technical Community College	Math 078: Pre-Algebra Statistics 142: Statistics I	17 43
University of Massachusetts-Amherst	Astronomy 100: Exploring the Universe Education 197A: Teaching Math & Science	0 8

Table 8.2. Ethnicity and Race Information of Survey Respondents

Ethnicity or Race	Number of Respondents	Percent
Caucasian or White	221	70.6%
African American or Black	33	10.5
Asian	29	9.3
Hispanic or Latino/a	29	9.3
Native American or Alaskan Native	6	1.9
Missing/ No Response	5	1.5
Native Hawaiian or Other Pacific Islander	1	0.3

The majority of respondents were in their freshman (35.8%) or sophomore year (38.3%) of college (total percentage of 74%), so it is not surprising that the majority of students selected "undecided" or "other" (37.7%) as their intended or declared major. The other choice selected by many respondents was "Biology" (22%). The intended or declared academic major results are presented in Table 8.3.

Table 8.3. Declared or Intended Academic Majors of Survey Respondents

Academic Major	Number of Respondents	Percent
Other	73	23.3
Biology	69	22.4
Undecided	45	14.4
Business/Economics	21	7.0
Marked more than one choice	18	5.7
Psychology	16	5.1
Engineering	13	4.2
Computer Science/ Technology	10	3.2
Chemistry	9	2.9
Law	7	2.2
Natural Resources/ Food Science	6	1.9
Education	5	1.6
Physics	4	1.3
Mathematics/ Statistics	3	1.0
History	3	1.0
Geology/ Geosciences	3	1.0
Sociology	2	0.6

In addition, half of the students (51.4%) responded that they are earning a bachelor's degree from the institution they are currently attending, with 29.7% responding that they were earning an associate's degree. Also, only 5 other students responded that they were earning a degree other than a bachelor's degree from the institution they currently attended. Two students (0.6%) responded that they are pursuing a master's degree, and two students (0.6%) responded that they are pursuing a doctoral degree. The other student responded that he/she is pursuing a "post-grad" degree (0.3%). Another two students responded in the "Other" selection that they are "transfers" and did not check off a box as to which degree they are pursuing at their respective institutions. Only one student responded that he/she is a high school student (0.3%).

Careers Being Considered

The most popular career chosen by students was "Biology/Medicine" (51.1%). The second most popular career, however, was "Education/Teaching" (18.2%). This finding is interesting because only eight respondents were enrolled in the only class surveyed that was geared specifically toward teaching (EDUC 197A: Teaching Math and Science -- See Table 8.1 for the list of classes surveyed.) Therefore, the finding isn't due to overrepresentation of education courses in the subset of courses included in the sample. Table 8.4 shows the number and percentage of students considering various career choices.

Table 8.4. Career Areas Being Considered by Survey Respondents

Career Option	Number of Respondents	Percent
Biology/Medicine	160	51.1
Education/Teaching	57	18.2
Other	38	12.1
Art/Music/Humanities	58	18.5
Business/Economics	35	11.2
Psychology/Counseling	34	10.9
Chemistry	23	7.3
Computer Science/Technology	23	7.3
Engineering	23	7.3
Law	21	6.7
Social Services	19	6.1
Physics	9	2.9
Geology	7	2.2

Further, it is important to note the second most popular career choice was "Education/Teaching," even though only 5 students indicated Education as their major. Table 8.5 reflects the indicated majors of the students that chose "Education/Teaching" as a possible career option and provides a more detailed look at the academic interests of students that are considering a career in teaching.

Table 8.5. Academic Majors of Students that Selected "Education/Teaching" as a Considered Career

Major	Number of Responses	Percentage
Biology	14	24.6%
Undecided	7	12.3%
Other	7	12.3%
Marked More than one	6	10.5%
Education	5	8.8%
Psychology	4	7.0%
Engineering	3	5.3%
Mathematics/Statistics	3	5.3%
Geology/Geosciences	2	3.5%
Natural Resources/Food Sciences	2	3.5%
English/Communications	1	1.8%
Physics	1	1.8%
Computer Science/Technology	1	1.8%
History	1	1.8%

Opinions on Teaching as a Career

Overall, the ratings for teaching math or science as a career were negative. Ratings were on a scale of 1 to 6, where 1 was least favorable and 6 was the most favorable. The average rating of attractiveness of a career in teaching was 2.95 and the average likelihood of teaching a math or science course was 2.49 (not very attractive). These results are displayed below in Figures 8.1 and 8.2.

Figure 8.1. Attractiveness Ratings of a Career in Teaching Math or Science

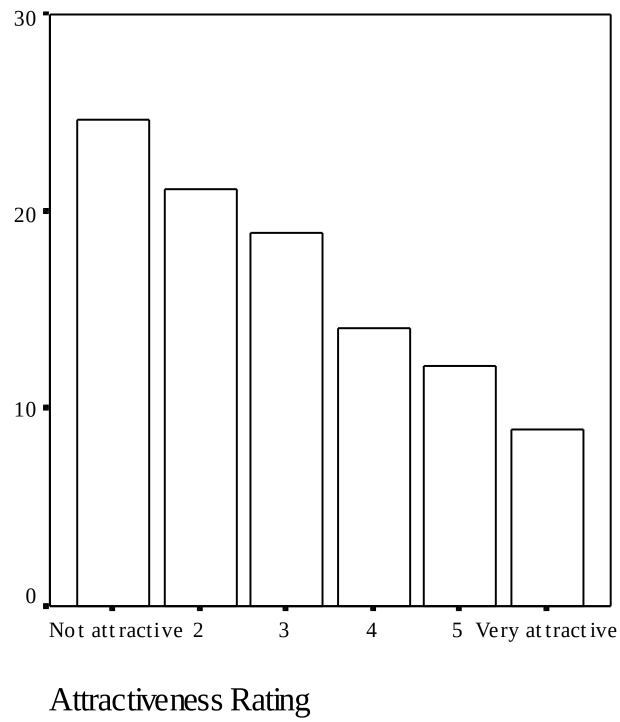
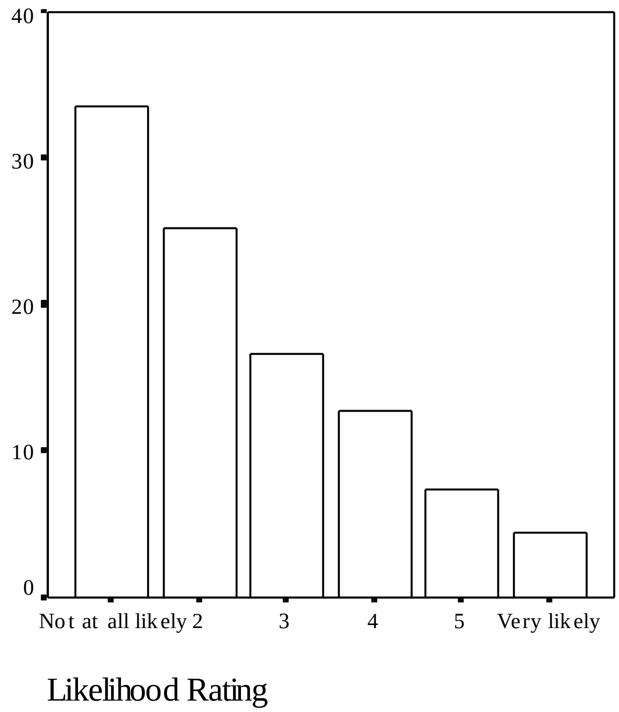


Figure 8.2. Likelihood Ratings of a Career in Teaching Math or Science



In contrast, and not surprisingly, the average ratings of attractiveness and likelihood are much higher for the students that indicated a career choice of “Education/Teaching”: 4.28 for attractiveness of a career in teaching science or math, and 3.79 for likelihood of teaching a math or science course. In other words, on average the students that selected a career in “Education/Teaching” responded more favorably than the rest of the group. This result indicates more desirability towards a career in teaching math/science and a greater possibility of teaching a math or science course.   See Figures 8.3 and 8.4 for the distribution of responses regarding attractiveness and likelihood of teaching math or science for those who are considering a career in the teaching profession.

Figure 8.3. Attractiveness Ratings of a Career in Teaching Math or Science for Students Considering a Career in Teaching

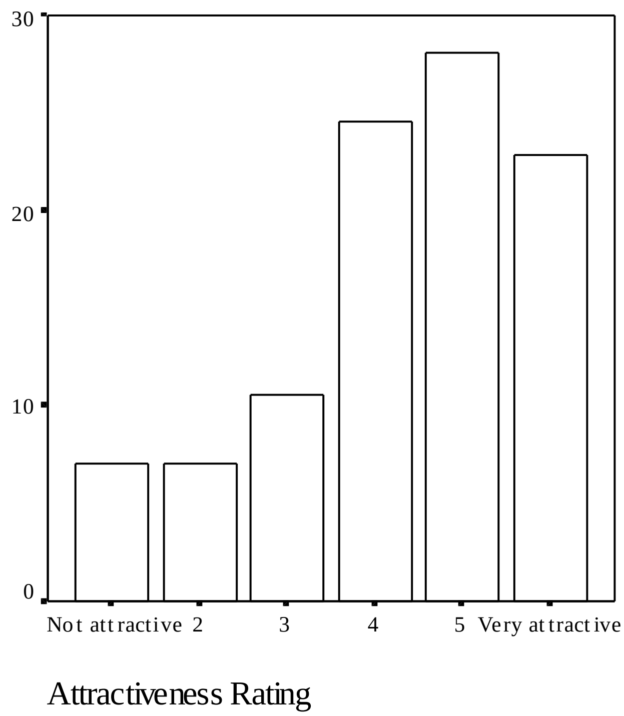
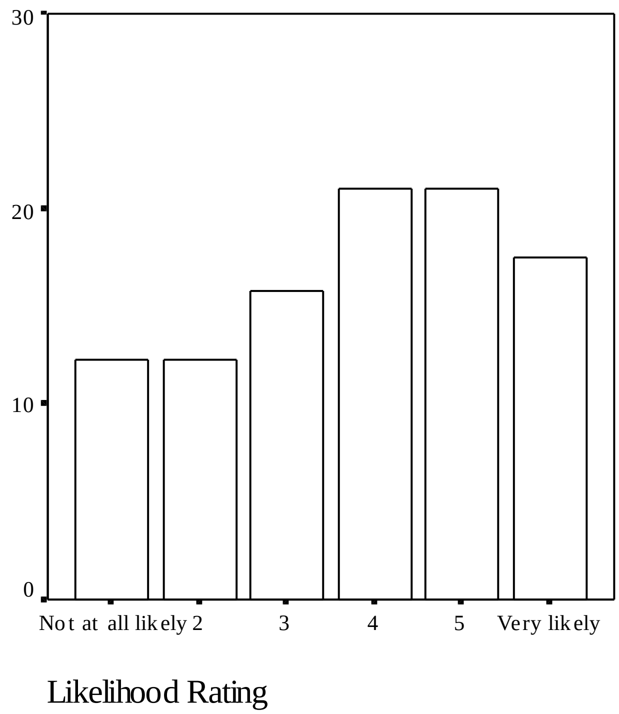


Figure 8.4. Likelihood Ratings of a Career in Teaching Math or Science for Students Considering a Career in Teaching



In regards to the subjects of teaching, science was the more popular subject chosen by respondents interested in teaching (33.2%) over math (13.1%). Also, of the students interested in a teaching career, the two most popular settings that they would like to teach in were high school (22.4%) and college (25.9%). See Table 8.7 below.

Table 8.7. Settings in Which Students Would Consider Teaching

Setting	Number of Students	Percent
College	81	25.9
High School	70	22.4
Elementary School	41	13.1
Middle School	38	12.1
Preschool	20	6.4

Plan for Tracking Students

Follow-up surveys will be sent to students who provided their names and student identification numbers on the Teaching Interest Surveys, given that contact information can be obtained for them from their institutions. In addition to asking many of the same questions from the original survey again, new items will be included that specifically address STEMTEC courses. Students will be asked to indicate if they have taken any of the specific STEMTEC courses offered during the time between the original Teaching Interest Survey and the follow-up survey. They will also be asked if any STEMTEC course or instructor had a particular influence on their career goals, and whether or not their experience in the course encouraged them to consider teaching as a profession. Further, students will be asked if any of their STEMTEC courses included opportunities to gain K-12 classroom experience, and if that experience had a positive impact on their attitudes toward teaching as a career.

Conclusions

It is not possible for this survey alone to determine if STEMTEC is meeting its goal to "recruit and retain promising students into the teaching profession." Findings from the follow-up survey in conjunction with these results will present a clearer picture of the impact of STEMTEC courses on the career considerations of current students. However, administration of the Teaching Interest Survey was an important first step toward establishing a database of students whose interests can be studied and tracked over time.

Analysis of 2002 Core Dean/Department Chair Survey Data

Stephen G. Sireci

Analysis of 2002 Core Dean/Department Chair Survey Data

Introduction

The Center for Applied Research and Education Improvement (CAREI) in the College of Education and Human Development at the University of Minnesota is coordinating an evaluation of all the Collaborative for Excellence in Teacher Preparation (CETP) programs that are funded by the National Science Foundation. The Science, Technology, Engineering, and Mathematics Teacher Education Collaborative (STEMTEC) is one of these CETP programs. As part of the national evaluation of CETP, CAREI developed several "core" surveys, one of which is a survey of Deans and Department Chairs from CETP institutions. This report is a summary of the data from the Deans and Department Chairs from STEMTEC campuses who responded to the survey.

Method

<u>Description of Survey</u>

The core Dean/Department Chair Survey was developed by CAREI to help with its CETP evaluation. As stated by CAREI[a], the CETP core evaluation focuses on the following question:

> What evidence exists that the changes instituted as part of the Collaboratives have indeed resulted in a substantial increase in the number of students who know more, and are more competent at teaching mathematics and the sciences using the mathematics and science standards as a guide and employing the new technologies available?

The CAREI Dean/Department Chair survey consisted of 15 selected response items, 10 of which involved follow-up questions where respondents were asked to explain their responses. Three items focused on the degree to which the department or school valued and supported teaching. Other questions inquired about specific activities and programs such as collaborations with K-12 schools and programs designed to increase student diversity. The respondents were also asked to rate specific programs and groups of students in their school with respect to overall quality and ability. The entire survey is presented in Appendix H.

<u>Participating STEMTEC Deans and Department Chairs</u>

A total of nine respondents completed at least a portion of the survey. However, only six deans/chairs responded to each question. In addition, only five of the eight STEMTEC campuses were represented. There were three respondents from Springfield Technical Community College, two respondents from Greenfield Community College, and one respondent each from Amherst College, Greenfield Community College, Hampshire College, and Smith College. In

[a] Downloaded from the CAREI web site (http://www.coled.umn.edu/carei/CETP/default.html) on August 25, 2002.

addition, one respondent was from Five Colleges, Inc., which is an inter-campus organization that coordinates selected courses for students at Amherst College, Hampshire College, Mount Holyoke College, Smith College, and the University of Massachusetts Amherst (UMASS). There were no respondents from Holyoke Community College, Mount Holyoke College, or UMASS. Two of the respondents were department chairs, the remaining seven were deans. Only four respondents reported their academic area. Two of the respondents were from science departments, one was from mathematics, and one was from academic affairs.

Procedure

During the spring 2002 semester, CAREI sent an e-mail to all deans and department chairs at STEMTEC affiliated schools or departments. This e-mail informed them of the purpose of the survey and included the URL at which the survey was located. All participating faculty completed the survey over the web. In June 2002, CAREI sent the survey data to the STEMTEC evaluation team.

Results

One survey question asked the deans and chairs if they had heard of STEMTEC, and if so, to indicate the extent to which they thought the goals of the program had been met. All six respondents to this question were familiar with STEMTEC. Four of the respondents selected the response “to a small extent” when asked whether it met its goals, while two selected “to a moderate extent.” However, it should be noted that the response options for this question did not include a negative response such as “it has not met its goals” (see item 10 in Appendix H).

Value of Teaching

There were four survey items that inquired about the degree to which teaching was valued and supported. The first survey item asked whether any new faculty were hired over the past five years to teach math, science, or math/science education, and if so, the degree to which teaching skills were important in the hiring decision. Six respondents answered this question, with five answering in the affirmative. Only two respondents answered the follow-up question about the importance of teaching in the hiring decision. Both responded “very important.”

The next question in this area asked whether promotion/tenure or merit criteria include work on instructional improvement process. Four respondents answered “yes,” and two answered “no.” Only one respondent indicated that these criteria changed recently, and the reason given was “union contract.”

When asked “do you see any barriers to having excellent teaching in your college or department?”, four of the deans/chairs answered “no” and two answered “don’t know.” When asked whether the college or department provided institutional funds for course development or improvement, all six respondents answered affirmatively. Examples of institutional support included summer money for course development, professional development funds, and sabbatical opportunities.

Perceptions of Teaching Changes and Practices

One survey item asked whether there was any change in the way the faculty taught or perceive their responsibilities as teachers over the past few years. If respondents answered affirmatively, they were asked to describe the nature of the change and state what caused it. Five of the six respondents to this question indicted that there were such changes over the past few years. Descriptions of the nature of the change included more student-centered classes, more active learning activities, more group work, increased use of technology in the classroom, and curricular workshops. Two respondents listed STEMTEC as a cause of the change, another listed workshops, and another cited administrative leadership.

The survey also included an item that asked "do members of your faculty interact with faculty from other institutions of higher education about improving education?" Five of six respondents answered "yes" to this question. When asked a follow-up question about whether changes in such interaction have occurred in recent years, four of the six respondents answered affirmatively. Examples of such changes given were grant opportunities, professional meetings, workshops, on-line, and "AAC+U." Three respondents provided information regarding what they thought caused such changes. Two respondents listed STEMTEC, the other credited administrative leadership.

Another survey item asked whether faculty had formal interaction with K-12 schools. Four of the six respondents indicated that such interaction did occur, one responded "no," and the other responded "don't know." Descriptions of the nature of such interactions included dual enrollment programs, "2+2" programs, support of students interning in K-12 schools, and on-campus activities for urban youth. The survey asked whether faculty were compensated for such interactions. Three respondents answered "yes" and one answered "don't know." A follow-up question asked whether any follow-up support was provided for students who graduated from the institution and went into K-12 teaching. Four deans/chairs responded to this question. One responded "yes," two responded "no," and the fourth didn't know.

The survey also inquired about field-based experiences in K-12 "educational settings." Five of six respondents indicated that some classes did have such experiences.

Programs to Increase Diversity

An item on the survey asked whether "any special programs designed to increase the ethnic and gender diversity of students who study in your area" were offered. Five of six respondents indicated that such programs were offered. One respondent indicated that the first time such a program was introduced was 1990. When asked "what caused your college or department to put them in place?", explanations included a desire for a more diverse community, a desire to achieve minority representation in all programs, a desire to increase opportunities for women in the sciences, and a desire to institute bilingual programs for the large Latino community.

Perceptions of Students and Programs

The survey concluded with five items that asked the deans/chairs to rate specific programs and groups of students using a four-point scale (see items 11a through 11e in Appendix H). Response options ranged from "less than adequate" to "exceptional," and included a "not applicable" category. First, they were asked to rate the overall quality of the science, technology, engineering, and mathematics (STEM) programs at their institution. Three respondents selected "exceptional" and three selected "more than adequate." Next, they were asked to rate the overall quality of the initial licensure secondary STEM teacher education programs at their school and the initial licensure elementary education program at their school. These questions were applicable to only 2 respondents. For the secondary licensure program, one respondent reported "more than adequate," and one reported "adequate." For the elementary program, both respondents selected "adequate." The next item was again relevant to only the two respondents with teacher preparation programs. It asked for a rating of the ability of the students in these programs. Both respondents selected "adequate." The last item in this set asked the respondents to rate the ability of students in the STEM programs. Five respondents selected "more than adequate," and one selected "adequate."

Discussion

The CAREI Dean/Department Chair survey provided limited information regarding the effectiveness of STEMTEC for improving student learning and recruiting new math and science teachers. It was encouraging that all deans and department chairs were familiar with STEMTEC and that some of them listed STEMTEC as the cause for positive changes such as positive changes in teaching practices and increasing inter-campus collaboration. It appears as though student-centered, active, teaching has increased on most of these campuses since the initiation of STEMTEC and that STEMTEC may be the cause of the increase on some of these campuses. It was also encouraging to see formal K-12 partnerships mentioned by four of six respondents.

There were two glaring limitations of the survey. First, there was no representation from three of the eight campuses involved in STEMTEC. Second, the survey was not targeted to evaluating the successes and limitations of STEMTEC. The results from the senior administrator interviews, reported in a separate chapter of this report, provide more valuable information in this area. Nevertheless, the limited information provided by these survey data are congruent with the conclusions drawn from other data sources. For example, these administrators noted curricular reform and increased collegiality, which are two goals that STEMTEC hoped to accomplish. As with the CAREI faculty survey, it may be illuminating to compare the responses for these STEMTEC administrators to those obtained from the remaining CETPs to gauge how different the perceptions of these administrators are from those of administrators from other CETPs.

Report of Dissemination and Public Awareness

Strategies and Activities

Lindsay DeCecco

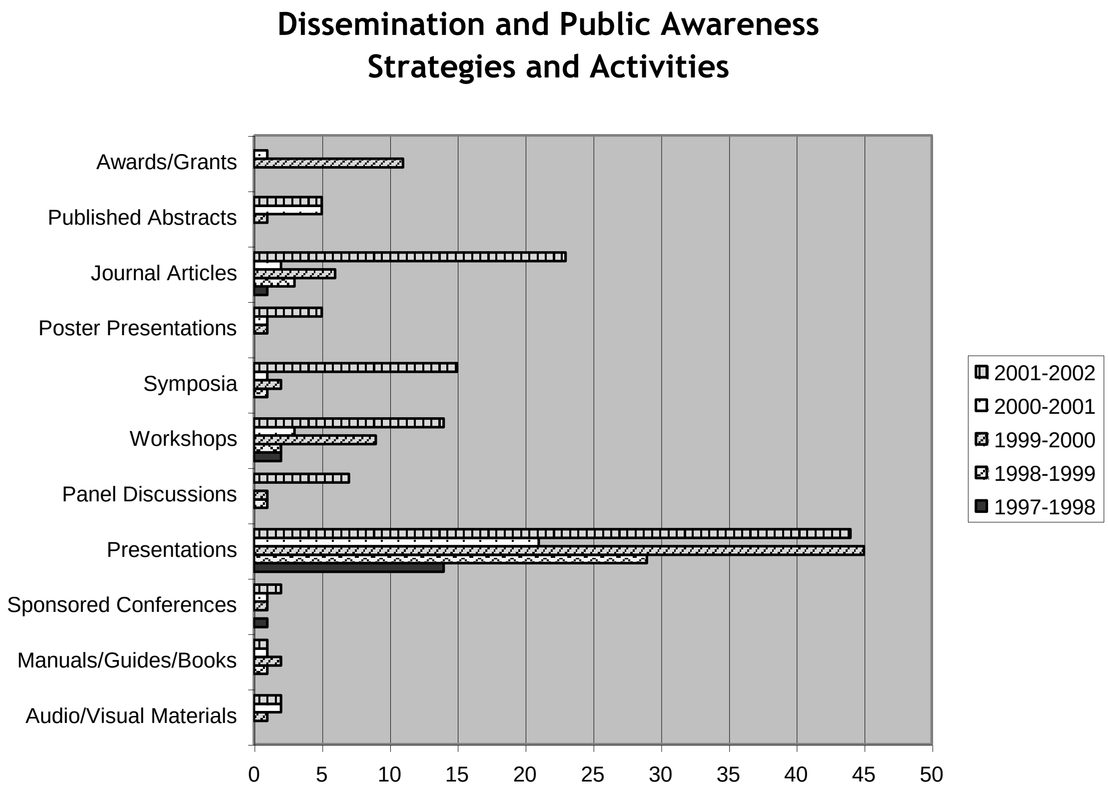
Report of Dissemination and Public Awareness Strategies and Activities

Since STEMTEC's beginning in the fall of 1997 through the spring of 2002, the project's affiliates have disseminated an extensive array of information across the nation and beyond. In particular, these dissemination and public awareness activities include involvement in paper presentations, panel discussions, symposia, workshops, and poster presentations. Additionally, members of STEMTEC continue to publish abstracts, journal articles, and books, receive grants, develop guides and manuals, and attend conferences all over the world. In doing so, these actively involved instructors, students, and teaching scholars continue to spread the word informing others of STEMTEC's initiative, goals, and success. Through this notable effort, over the past five years, STEMTEC has facilitated learning and promoted continued educational and professional development. (Please see Appendix I for a complete list of STEMTEC dissemination and public awareness strategies and activities. Refer to Figure 1 for the total number of activities listed per year, and refer to figure 2 for a graphic representation of the material).

Figure 1. Total Number of STEMTEC Dissemination and Public Awareness Strategies and Activities Per Year From 1997 - 2002

Dissemination and Public Awareness Strategies and Activities	**1997-1998**	**1998-1999**	**1999-2000**	**2000-2001**	**2001-2002**
Audio/Visual Materials	0	0	1	2	2
Manuals/Guides/Books	0	1	2	1	1
Sponsored Conferences	1	0	1	1	2
Presentations	14	29	45	21	44
Panel Discussions	0	1	1	0	7
Workshops	2	2	9	3	14
Symposia	0	1	2	1	15
Poster Presentations	0	0	1	1	5
Journal Articles	1	3	6	2	23
Published Abstracts	0	0	1	5	5
Awards/Grants	0	0	11	1	0

Figure 2. Graphical Representation of STEMTEC Dissemination and Public Awareness Strategies and Activities Per Year from 1997 - 2002



STEMTEC Year 5 Evaluation Summary and Recommendations

STEMTEC Year 5 Evaluation Summary and Recommendations

The Year 5 evaluation of STEMTEC was extremely comprehensive, involving surveys of students, faculty members and administrators, interviews with faculty and senior administrators, and classroom observations in K-12 and postsecondary settings. The findings from this year's evaluation are quite consistent with last year's assessment as the initiative appears to have continued achieving many of its goals. Many accomplishments of the program remained evident, some new strengths were identified, and some limitations continue. On balance, the strengths outweigh the weaknesses. Suggestions for improvement have also been documented in case they can be used to inform future activities of on-going STEMTEC efforts and perhaps assist other collaborative efforts in future endeavors.

With respect to its strengths, the results conclusively indicate that STEMTEC has had a positive effect on getting math and science teachers to reform their teaching to facilitate student-active learning. The faculty survey, the student surveys, the administrator interviews, and the classroom observations all provide data that the STEMTEC teaching philosophy is being successfully applied in STEMTEC classrooms. The results also suggest that STEMTEC is providing rewarding teaching experiences for many math and science students. The teaching scholars once again rated their teaching experiences highly. Preliminary indications from classroom observations of STEMTEC graduates suggest that reform teaching practices are being used by students once they become teachers in public schools. The evaluation of the new Faculty Fellows program indicates promising results from this new initiative.

Success in recruiting underrepresented minorities into the math and science teaching profession remains a weakness of STEMTEC. Although the difficulty of this task is acknowledged, there are still virtually no activities specifically targeted to this project goal. The failure to accomplish this goal may also be attributed to a lack of awareness about STEMTEC among students. This lack of knowledge about the program is clearly evident from the student surveys and from information received from teaching scholars. The teaching scholars also expressed concern that there was too little contact with K-12 educators.

To summarize our findings, we revisit the evaluation priorities around which the evaluation was organized. Subsequently, we provide recommendations for improving STEMTEC during its follow-on funding.

(a) Has STEMTEC conducted a strong program of evaluation and assessment?

The level of support for this evaluation for the second consecutive year indicates strong support for evaluation and assessment by STEMTEC. The evaluation and assessment component of STEMTEC continues to be plagued by lack of baseline data from the inception of the project and inconsistency in the evaluations for the first three years.

(b) Has STEMTEC improved the preparation of K-12 math and science teachers?

The preliminary indications from limited observations of new teachers suggest that reformed teaching practices are being used in their own classroom instructional practice. However, the data are limited to a few individuals and no baseline information exists that would provide evidence of improvement in this area. However, the teaching scholars did indicate satisfaction with their level of preparation.

(c) Has STEMTEC recruited new math or science teachers?
(d) Has STEMTEC improved the retention of math or science teachers?
(e) Has STEMTEC recruited under-represented minorities into the math/science teaching profession?
(f) Has STEMTEC improved the retention rates among under-represented minority math/science teachers?

It is also difficult to provide unequivocal answers to these evaluation questions since baseline data regarding the production of math and science teachers by the STEMTEC campuses are unavailable. While the Teaching Scholars program appears to have some limited success in recruiting new teachers into the profession, the student surveys indicate that STEMTEC courses are doing little to explicitly promote education as a profession. The lack of attention to the recruitment and retention of under-represented minorities continues to be a major concern.

With respect to retention of math and science teachers, no data exist to answer this question. It may take several years after the STEMTEC project ends to evaluate its longer-term effects regarding retention of math and science teachers.

(g) Has STEMTEC effectively supported math and science teachers in the first year of teaching?
(h) Has STEMTEC facilitated redesign of the science and math curricula on the campuses?
(i) Has STEMTEC facilitated the incorporation of new pedagogies on the campuses?
(j) Has STEMTEC established mechanisms for supporting faculty in their course redesign?

The evaluation results suggest affirmative answers to these questions. All sources of evaluation data that addressed these questions (i.e., faculty surveys, student surveys, classroom observations, administrator interviews, faculty interviews) resoundingly supported the conclusion that STEMTEC has invigorated teaching within science and math classrooms and has resulted in more student-active learning.

(k) Has STEMTEC been effectively disseminated?

The amount of dissemination activities that have been conducted internally and externally suggest that STEMTEC has effectively disseminated information about the initiative to a variety of key internal and external audiences. The lack of knowledge about STEMTEC among undergraduates at participating institutions indicates that this is the one key group that has not been effectively reached through dissemination efforts.

(l) Is the collaborative fully implemented?
(m) Is the collaborative running efficiently?

The Collaborative is operating on all eight campuses and is achieving some level of participation on all campuses. However, at this juncture, it appears that the program is running well on each individual campus, but the inter-campus aspects of the program could be improved.

(n) What are the strengths and weaknesses of the STEMTEC program?

Many of the strengths and weakness of the program are evident from the answers to the previous questions. In general, STEMTEC has had a positive effect on getting math and science teachers to reform their teaching to facilitate student-active learning and is providing rewarding teaching experiences for many math and science students. Reform teaching practices also seem to be used by students once they become teachers themselves. Weaknesses primarily exist in the area of recruiting new students, particularly under-represented minorities, into the teaching profession.

(o) What improvements can be made?

The evaluation data provided several suggestions to be considered for improving STEMTEC or other similar efforts in the future. These suggestions include:

- Develop program initiatives to recruit underrepresented minorities into the math and science teaching professions. Hire staff whose specific responsibilities are to implement and coordinate these recruitment efforts.
- Use the STEMTEC administration to coordinate connections between STEMTEC and K-12 classes.
- Provide more K-12 teaching opportunities for students in STEMTEC classes.
- When appropriate, faculty should more clearly identify their courses as being part of STEMTEC and more actively promote teaching as a profession.
- Integrate the Teaching Scholars Program with the other STEMTEC activities. A relationship should be initiated between the Campus Coordinators and the teaching scholars on their campuses. The teaching scholars should be made more aware of STEMTEC course offerings.
- Provide more feedback to STEMTEC faculty regarding the success of their reformed teaching practices.
- Come up with a systematic procedure for identifying STEMTEC courses on campus and for advertising these courses to students.
- Develop handouts on teaching careers for STEMTEC instructors to disseminate in their classrooms.
- Provide STEMTEC faculty with training on the assessment of student work.

- Find ways to continue successful elements of the initiative, including the Teaching Scholars and Faculty Fellows Programs.

We hope these suggestions are helpful as STEMTEC evolves in its supplemental funding phase.

Appendix A:

Evaluation Matrix

STEMTEC 2001-2002 Evaluation Planning Document

As STEMTEC begins Year 5, some of the project goals have already been accomplished, while less progress has been made toward other goals. In the final year of the STEMTEC project, the evaluation will shift its primary focus to assessing the effect STEMTEC has had on the college students (i.e., the future teachers). Another focus will be an evaluation of the support STEMTEC provides to new K-12 science and math teachers. Further, the redesign of STEMTEC courses will remain an important aspect of the evaluation. The seven STEMTEC goals have been reprioritized in terms of the evaluation for Year 5 of the project as described below.

Priority One:	Conduct strong programs of evaluation and assessment (Goal 7).
Priority Two:	Improve the preparation of future K-12 teachers of mathematics and science (Goal 3).
Priority Three:	Recruit and retain promising students into the math and science teaching profession, with special attention to underrepresented groups (Goal 4).
Priority Four:	Develop program to support new science and math teachers in their first year in the classroom (Goal 5).
Priority Five:	Redesign the science and math curricula on the campuses of the Collaborative to incorporate new pedagogies and establish mechanisms for supporting faculty in their course redesign (Goal 2).
Priority Six:	Establish dissemination mechanisms (Goal 6).
Priority Seven:	Establish a functional educational collaborative (Goal 1).

Evaluation Activities

Priority One: <u>Evaluating Goal 7, "Conduct strong programs of evaluation and assessment."</u>

This evaluation plan is designed to address Goal 7. The plan outlined here, and the activities associated with it, constitute a comprehensive plan for assessing the strengths, weaknesses, successes, and failures of STEMTEC.

Priority Two: Evaluating Goal 3, "Improve the preparation of future K-12 teachers of mathematics and science."

Goal 3 focuses on how well STEMTEC has improved the preparation of K-12 math and science teachers. Our evaluation of Goal 3 will involve surveys of K-12 teachers who received STEMTEC training. In addition, the evaluation will attempt to include an equivalent cohort of K-12 teachers who did not receive STEMTEC training. Further, we will survey a small number of elementary and secondary administrators to determine if they perceive a difference between their teachers who received STEMTEC training and those who do not. The teacher surveys will focus on specific teaching and assessment practices used by the teachers, as well as their adherence to national standards in math and science (e.g., NCTM, NSTA). Also, we will survey or interview K-12 teachers who are serving as mentors to the student teachers from the STEMTEC program. We will inquire about the strengths and weaknesses of the program as well as any perceived differences in STEMTEC versus non-STEMTEC students, if possible.

Priority Three: Evaluating Goal 4, "Recruit and retain promising students into the math and science teaching profession, with special attention to underrepresented groups."

Goal 4 will be evaluated by tracking the number of STEMTEC participants of various underrepresented groups. We will compare these numbers to campus demographics and perhaps with data from other CETP sites. The evaluation will also document the specific efforts and events targeted at recruiting members of underrepresented groups. Focus groups may be necessary to determine the effect that STEMTEC has directly had on various groups.

- Work closely with Sharon Palmer to document what has been done to recruit students, and to track STEMTEC demographics throughout the 5 years of the project.
- Document diversity of students in various majors at the eight Collaborative institutions.

Priority Four: Evaluating Goal 5, "Develop program to support new science and math teachers in their first year in the classroom."

Evaluation of Goal 5 will focus on documenting participation rates in each of the STEMTEC sponsored programs and events designed to support new teachers. Some of these new teachers will be included in the surveys conducted as part of the evaluation of Goal 3 ("Improve the preparation of future K-12 teachers…"); some will participate in a focus group designed to assess the kinds of support new teachers would find helpful. Specific questions will inquire about the strengths and weaknesses of the support these teachers receive from STEMTEC.

Priority Five: Evaluating Goal 2, "Redesign the science and math curricula on the campuses of the Collaborative to incorporate new pedagogies and establish mechanisms for supporting faculty in their course redesign."

Goal 2 has been a strong focus of the evaluation in each year of the project, and will remain as such in Year 5. However, in this final year of the project the focus will be on determining whether incorporated changes to curricula have been maintained, and what changes are expected to persist after the conclusion of the project.

As in previous years, surveys will be developed to measure progress toward Goal 2, including, a STEMTEC course evaluation survey to be administered to college students. In addition, classroom observations will be conducted of approximately 15 classes to obtain a sample of the teaching practices that are being used in STEMTEC classrooms.

A further aspect to this part of the evaluation will include an examination of the faculty self-reports about course redesign. We will look at the analyses already done with these reports, and if useful, will conduct a further content analysis of these data.

Priority Six: Evaluating Goal 6, "Establish dissemination mechanisms."

Goal 6 refers to the degree to which STEMTEC effectively communicates its success and lessons learned at the local, regional, national, and international levels. We will document and evaluate STEMTEC's previous and planned dissemination activities.

Priority Seven: Evaluating Goal 1, "Establish a functional educational collaborative."

At this stage in the project, evaluation of Goal 1 will obviously not involve formative feedback. For all intents and purposes, a functional collaborative has successfully been established. However, any extensions of the Collaborative over this final year will be documented. Also, an assessment of the strengths and weaknesses of the way the Collaborative currently functions will be reported.

- The campus coordinator interviews were helpful in Year 4 for evaluating the functioning of the collaborative. Brief follow-up phone interviews with campus coordinators will be conducted.
- Administrators involved with the Collaborative will be interviewed to help gain a broader perspective on how the collaboration is functioning.

Appendix B

Teaching Scholars Survey

2000/2001 STEMTEC Teaching Scholar

Please take a few minutes to provide your **CONFIDENTIAL** responses to the questions below. Your answers will help us to evaluate the strengths and weaknesses of the STEMTEC Teaching Scholars Program. Please contact Bill Tyler at 545-0626 if you have any questions regarding this report.

1. Name: ____

2. Permanent Address: ____

   ____

3. Permanent Telephone #: ____

4. Email Address: ____

5. What is your race / ethnicity? (Please select **ALL** that apply.)

9	African American or Black	9	Native American or Alaskan Native
9	Asian	9	Native Hawaiian or Other Pacific Islander
9	Caucasian or White	9	Other ____________________________
9	Hispanic or Latino/a		

6. Expected Graduation Date (month/year): ____________________________________

7. If you are graduating this semester, briefly describe what your future plans are at this time. In particular, please indicate if you plan to teach. If you have a teaching job, please indicate the location, subject, and grade level.

____

8. What level(s) are you interested in teaching? (Please select **all** that apply.)

9 Elementary 9 Middle School 9 High School 9 College 9 Other/Not Sure

9. What subject(s) are you interested in teaching? ____

____

10. Campus: 9 Amherst College 9 Greenfield CC 9 Hampshire College 9 Holyoke CC
9 Mt. Holyoke 9 Smith College 9 STCC 9 UMASS

11. The statements below reflect different opinions some students have had about their experience in the Teaching Scholars Program. Please circle the response that best matches your level of agreement with each statement.

Statement	Strongly Disagree	Disagree	Neutral/ No Opinion	Agree	Strongly Agree
I was very committed to becoming a teacher **before** I participated in the Teaching Scholars Program.	SD	D	N	A	SA
I am more likely to become a teacher now, than I was at the beginning of this school year.	SD	D	N	A	SA
My **STEMTEC teaching experience** (the teaching activity I participated in during the award period) increased my interest in teaching math or science.	SD	D	N	A	SA
The **STEMTEC Teaching Scholar activities** (i.e., workshops, talks) increased my interest in teaching math or science.	SD	D	N	A	SA
My **STEMTEC teaching experience** provided me with knowledge or skills that will make me a more effective math or science teacher.	SD	D	N	A	SA
The **STEMTEC Teaching Scholar activities** provided me with skills or knowledge that will make me a more effective math or science teacher	SD	D	N	A	SA
One or more STEMTEC faculty members helped me to reach my teaching goals.	SD	D	N	A	SA
The STEMTEC Teaching Scholar workshops were a good use of my time.	SD	D	N	A	SA

12. Using the scale below, please indicate how attractive a career in teaching science or math sounds to you.

1	2	3	4	5	6
Not at all attractive					Very Attractive

13. Using the scale below, please indicate likely it is that you will someday teach a math or science course.

1	2	3	4	5	6
Not at all likely					Very Likely

14. How many STEMTEC courses have you taken? ___________ courses

15. How important was it for you to take STEMTEC affiliated courses?

9 Not at all important 9 Somewhat important 9 Very Important

16. Some STEMTEC teaching scholar activities that occurred during the past year are listed below. For each activity that you attended, please provide your opinion regarding (a) whether it helped you become a better teacher, and (b) whether it increased your interest in teaching by circling the response that best matches your opinion. **Be sure to circle an (a) response and a (b) response for each activity**.

Activity	**Location**	**Did Not Attend**	**(a) Helped Me Become A Better Teacher**			**(b) Increased My Interest in Teaching**		
			Yes	No	Not Sure	Yes	No	Not Sure
Patterns and Relationships: Algebra and Real World Examples	Mount Holyoke College		Y	N	NS	Y	N	NS
Science as Inquiry	Hitchcock Center, Amherst, MA		Y	N	NS	Y	N	NS
Certification Information Session	UMass Amherst		Y	N	NS	Y	N	NS
Science Through the Multiple Intelligences: Patterns That Inspire Inquiry	Smith College		Y	N	NS	Y	N	NS
When *You* Are the Teacher (Part I)	Bridge St. School, Northampton		Y	N	NS	Y	N	NS
When *You* Are the Teacher (Part II)	Hampshire College		Y	N	NS	Y	N	NS
Environmental Education Society Annual Conference	Worcester, MA		Y	N	NS	Y	N	NS
Project Wild and Aquatic (Part I)	UMass Amherst		Y	N	NS	Y	N	NS
Full Court Press	Basketball Hall of Fame		Y	N	NS	Y	N	NS
The Teaching Experience	Mount Holyoke College		Y	N	NS	Y	N	NS
Workshop on Astronomy Resources	Amherst College		Y	N	NS	Y	N	NS
Various STEM Institute talks	UMass Amherst		Y	N	NS	Y	N	NS
The teaching that was modeled in STEMTEC courses	Various		Y	N	NS	Y	N	NS
K-12 classroom experience	Various		Y	N	NS	Y	N	NS

17. Are you currently enrolled in a certification program? 9 yes 9 no

If yes, please indicate Level(s): ______________________ Subject area(s): _____________________

18. Did you complete a certification program in 2000/2001? 9 yes 9 no

If yes, please indicate Level(s): ______________________ Subject area(s): _____________________

19. If you have not completed a certification program, or if you are not currently enrolled in one, are you planning to enroll in one? 9 yes 9 no

20. Did you reapply for a STEMTEC Teaching Scholarship for next year?   9 yes   9 no

If no, please indicate the reason(s) why: 9 will complete degree/certification requirements this year

9 not eligible   9 not interested in teaching   9 transferring to a non-STEMTEC school

9 other (please specify)____

____

21. Did the STEMTEC Teaching Scholarship allow you to do anything that you would not have been able to do otherwise? 9 yes   9 no   If yes, please describe. _____________________________

____

____

22. How did you find out about STEMTEC and the Teaching Scholars Program? _________________

____

23. What do you think are the **STRENGTHS** of the STEMTEC Teaching Scholars program?

____

____

____

24. What do you think are the **WEAKNESSES** of the STEMTEC Teaching Scholars program?

____

____

____

25. If there were only **one** activity that the STEMTEC Student Services Program could continue providing in the future, what should it be? ____

____

____

26. Did you complete a teaching experience (i.e., a formal or informal teaching activity on your own campus, another campus, or a K-12 classroom)? 9 Yes 9 No

If yes, answer a-g. If no, answer h only.

a. Location (school name, town): ____________________

b. Estimate the total hours involved: ____________________

c. Grade level: ____________________

d. Subject area/topic: ____________________

e. Contact person name: ____________________

f. Contact person phone number or email: ____________________

g. What kinds of activities were involved with your teaching experience? (Select **all** that apply.)

9 Lecturing	9 Small group work
9 Tutoring	9 Hands-on activities
9 Preplanning	9 Teaching assistantship
9 Observation	9 Other ____________________

h. If you did not complete a teaching experience, briefly explain why. (Attach additional sheet if necessary)

____

____

27. Please provide a brief description of your teaching experience. (If necessary, use the back of this sheet, or attach an additional sheet.) In your description, please address the questions listed below. In addition, indicate whether or not you would allow us to use excerpts from this written description of your teaching experience in STEMTEC publications, such as brochures or newsletters.

- What were your responsibilities?
- How did this experience affect your attitude / commitment towards teaching?

THANK YOU FOR COMPLETING THIS SURVEY!!!

Please return this survey in the envelope provided or mail to:

Bill Tyler, STEMTEC Student Services, 217 Hasbrouck Lab, UMass, Amherst, MA 01003

Appendix C

Classroom Observation Protocol

CETP – CORE EVALUATION CLASSROOM OBSERVATION PROTOCOL

I. Background Information

A. Observer

1. Name: ____
2. CETP: ______________ Institution Name: ________________________
3. Date of Observation: _____________________________
4. Length of observation: __________________________
5. Was the teacher informed about this observation prior to the visit? O Yes O No

B. Teacher/Faculty

1. Name: ____

2. CETP Teacher? O Yes O No

3. Gender: O Male O Female

4. K-12: Licensure/certification____

OR College Rank: (*Check one*.)

O Instructor/Adjunct Faculty
O Assistant Professor
O Associate Professor
O Full Professor
O TA: primary responsibility?____________________________
O Other:

II. Classroom Demographics

A. What is the total number of students in the class at the time of the observation?

O 15 or fewer
O 16–20
O 21–25
O 26–30
O 31–40
O 41–60
O 61–100
O 101 or more

B. Was a paraprofessional or teaching assistant in the class?

O Yes O No

C. 1. Grade Level (K-12)_________

OR

2. Student Audience (majority of students. *Check all that apply*):

(a) O Prospective teachers: (1) O Elementary (2) O M.S. (3) O H.S.
(b) O Liberal Arts Majors
(c) O Mathematics/Science Majors

D. Subject Observed/Descriptive Course Title: ____

E. Scheduled length of class:_____________(minutes)

III. Classroom Context

Rate the adequacy of the physical environment for facilitating student learning.

	1	2	3
1. Classroom resources: (from "sparsely equipped" to "rich in resources")	O	O	O
2. Room arrangement: (from "inhibited interactions among students" to "facilitated interactions among students")	O	O	O

IV. Class Description and Purpose

A. Classroom Checklist:

Please fill in the instructional strategies (*not* the instructor's actual activities, in case they are correcting papers or something non instructional), student engagement, and cognitive activity used in each five-minute portion of this class in the boxes below. There may be one or more strategies used in each category during each interval. For example, SGD, HOA, and TIS often occur together in a five-minute period, but SGD and L do not.

Type of Instruction

L	lecture/presentation	CL	coop learning (roles)
PM	problem modeling	LC	learning center/station
SP	student presentation (formal)	TIS	teacher/faculty member interacting w/ student
LWD	lecture with discussion	UT	utilizing digital educational media and/or technology
D	demonstration	A	assessment: Please describe.
CD	class discussion	AD	administrative tasks
WW	writing work (if in groups, add SGD)	OOC	out-of-class experience
RSW	reading seat work (if in groups, add SGD)	I	interruption
HOA	hands-on activity/materials	OTH	Other: Please describe.
SGD	small group discussion (pairs count)		

Student Engagement:

HE high engagement, 80% or more of the students engaged.
ME mixed engagement
LE low engagement, 80% or more of the students off-task.

Cognitive Activity:

1 **Receipt of Knowledge** (lectures, worksheets, questions, observing, homework).
2 **Application of Procedural Knowledge** (skill building, performance).
3 **Knowledge Representation** (organizing, describing, categorizing).
4 **Knowledge Construction** (higher order thinking, generating, inventing, solving problems, revising, etc.).
0 **Other**: e.g., classroom disruption, please describe.

Time in minutes:

	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60
Instruction												
Student												
Cognitive												

	60-65	65-70	70-75	75-80	80-85	85-90	90-95	95-100	100-105	105-110	110-115	115-120

I												
S												
C												

B. In a few sentences, describe the lesson you observed and its purpose. Include where this lesson fits in the overall unit of study, syllabus, or instructional cycle. Note: This information needs to be obtained from the teacher/faculty member.

V. Ratings of Key Indicators

In this section, you are asked to rate each of a number of key indicators as descriptive of the lesson in five different categories, from 1 (not at all) to 5 (to a great extent). Note that any one lesson may not provide evidence for every single indicator; use DK, "Don't Know," when there is not enough evidence for you to make a judgment. Use N/A, " Not Applicable," when you consider the indicator inappropriate given the purpose and context of the lesson.

1. This lesson encouraged students to seek and value alternative modes of investigation or of problem solving………..……………………...…….	1	2	3	4	5	DK	N/A
2. Elements of abstraction (i.e., symbolic representations, theory building) were encouraged when it was important to do so…....…………..………	1	2	3	4	5	DK	N/A
3. Students were reflective about their learning…………………...…..……	1	2	3	4	5	DK	N/A
4. The instructional strategies and activities respected students' prior knowledge and the preconceptions inherent therein……….………....…	1	2	3	4	5	DK	N/A
5. Interactions reflected collaborative working relationships among students (e.g., students worked together, talked with each other about the lesson), and between teacher/faculty member and students..………	1	2	3	4	5	DK	N/A
6. The lesson promoted strongly coherent conceptual understanding……..	1	2	3	4	5	DK	N/A
7. Students were encouraged to generate conjectures, alternative solution strategies, and ways of interpreting evidence…………………...……….	1	2	3	4	5	DK	N/A
8. The teacher/faculty member displayed an understanding of mathematics/science concepts (e.g., in his/her dialogue with students)…	1	2	3	4	5	DK	N/A
9. Appropriate connections were made to other areas of mathematics/ science, to other disciplines, ….……………………..…………………………….	1	2	3	4	5	DK	N/A

10. Appropriate connections were made to real-world contexts, social issues, and global concerns………………………..…………………………………	1 2 3 4 5 DK N/A

For the following questions, select the response that best describes your overall assessment of the *likely effect* of this lesson in each of the following areas.

10. Students' understanding of mathematics/science as a dynamic body of knowledge generated and enriched by investigation………..…………..	1 2 3 4 5 DK N/A
11. Students' understanding of important mathematics/science concepts…..	1 2 3 4 5 DK N/A
12. Students' capacity to carry out their own inquiries……………………..	1 2 3 4 5 DK N/A

Appendix D

Faculty Fellows Survey

STEMTEC FACULTY FELLOWS SURVEY

Dear Colleague: The purpose of this survey is to provide base-line data for determining the effects of the Faculty Fellows program on classroom instructional practices, and other aspects of faculty member's teaching and professional careers.

We would greatly appreciate it if you could take a few minutes to complete this questionnaire. Your responses will be kept completely confidential. Thank you very much for your time and consideration.

Question: Is there any good reason to ask sex, position, race, time in position? With 15 faculty members, all of whom are assistant professors or lecturers, not

sure what we would do with the data?

Introduction

1. Why did you apply to participate in the Faculty Fellows program?

____

____

____

2. What is your greatest joy in teaching first or second year math, science, and/or engineering courses?

____

____

____

____

What is your greatest frustration?

____

____

____

3. Please check the statement that best characterizes your satisfaction with your work as a teacher?

Very satisfied ☐
Somewhat satisfied ☐
Somewhat unsatisfied ☐
Very unsatisfied ☐

4. What is your greatest strength as a teacher?

____

____

____

In what area would you most like to improve?

____

____

____

Professional Development

5. How would you rate your own professional development in each of the following areas:

	High	Good	Okay	Poor
Skills as a teacher	☐	☐	☐	☐
Understanding of how students learn	☐	☐	☐	☐
Commitment to teaching	☐	☐	☐	☐
Collegial contacts	☐	☐	☐	☐
Philosophy of teaching	☐	☐	☐	☐
Design of courses	☐	☐	☐	☐
Overall professional development as a university faculty member	☐	☐	☐	☐
Knowledge of resources for teacher education in math/science	☐	☐	☐	☐
Comfort level with sharing teaching strategies with colleagues	☐	☐	☐	☐
Self-confidence as a teacher	☐	☐	☐	☐
The credentials you have collected to demonstrate teaching excellence for promotion/tenure	☐	☐	☐	☐
Publication record	☐	☐	☐	☐
Involvement with networks committed to teacher preparation in math/science	☐	☐	☐	☐

Active-Learning Teaching Strategies

6A.Listed below are various teaching strategies. For each strategy, please mark your degree of familiarity and use. (Use occasionally =1-3 times per semester; Very Often = 3-5 times per semester)

	Not Familiar	**Familiar, but have not Used**	**Use occasionally**	**Use very often**
lecture	☐	☐	☐	☐
lecture w/ discussion	☐	☐	☐	☐
class discussion	☐	☐	☐	☐
hands-on activity	☐	☐	☐	☐
utilizing digital educational media	☐	☐	☐	☐
utilizing other technology	☐	☐	☐	☐
assessment	☐	☐	☐	☐
reading seatwork	☐	☐	☐	☐
writing work	☐	☐	☐	☐
teacher demonstration	☐	☐	☐	☐
cooperative learning	☐	☐	☐	☐
teacher's interacting with students in groups	☐	☐	☐	☐
learning centers/stations	☐	☐	☐	☐
out-of class experiences	☐	☐	☐	☐
student presentations	☐	☐	☐	☐

6B. Please mark the degree to which each of the statements represents your **past experiences** with the course that you will be redesigning as part of the STEMTEC program.

	Strongly Agree	Agree	Disagree	Strongly Disagree
The course encouraged students to seek and value alternative modes of investigation or problem solving.	☐	☐	☐	☐
Elements of abstraction (i.e., symbolic representations, theory building) were encouraged when it was important to do so.	☐	☐	☐	☐
Students had opportunities to reflect about their thinking.	☐	☐	☐	☐
The course was designed to engage students as members of a learning community.	☐	☐	☐	☐
The instructional strategies and activities respected students' prior knowledge and the preconceptions inherent therein.	☐	☐	☐	☐
Interactions reflected collaborative working relationships among students (e.g. students worked together, talked with each other about the lesson), and between teacher/instructor and students.	☐	☐	☐	☐
Intellectual rigor, constructive criticism, and the challenging of ideas were valued.	☐	☐	☐	☐
The lesson promoted strongly coherent conceptual understanding.	☐	☐	☐	☐
Students were encouraged to generate conjectures, alternative solution strategies, and/or different ways of interpreting evidence.	☐	☐	☐	☐
As teacher, you displayed an understanding of mathematics/science concepts (e.g. in your dialogue with students).	☐	☐	☐	☐
Appropriate connections were made to other areas of mathematics/science, to other disciplines and/or to real-world contexts, social issues, and global concerns.	☐	☐	☐	☐

Collaboration with Colleagues

7. To what degree would you say your department colleagues employ active learning methods in their classes?

Often ☐
Sometimes ☐
Seldom ☐
Never ☐
No Idea ☐

8. How comfortable do you feel discussing teaching strategies with department colleagues?

Very comfortable ☐
Comfortable ☐
Not comfortable ☐

9. Please indicate your extent of involvement:

I consider myself an advocate within my university for activities to promote better teaching and/or for faculty development activities focused on improving teaching.

To a great extent ☐
To some extent ☐
To a little extent ☐
Not at all ☐

10. Have you ever served on any departmental or institutional committees that relate in some way to teaching? Yes ☐ No ☐

If so, which ones?

11. Are you currently involved in any teacher education committees or networks committed to the preparation of K-12 teachers in math/science? Yes ☐ No ☐

If so, which ones?

12. In the past few years have you received money (or other resources such as release time) for course development or reform? Yes ☐ No ☐

If yes, what were the sources, and kind of support provided?

Student Learning

13. To what extent have you used student assessment results to modify what is taught and how?

To a great extent ☐
Somewhat ☐
Very Little ☐
Not at all ☐

15. In your courses to date, how often, if at all, do you provide students with information about teaching in grades K-12?

Often ☐
Sometimes ☐
Seldom ☐
Never ☐

Conclusion

16. Do you have any concerns about your participation in the Faculty Fellows program this semester?

Thank you for taking the time to complete this survey. Best wishes for the semester.

Appendix E

CAREI Faculty Survey

CAREI FACULTY SURVEY – PRE & POST

Thank you for completing this survey. Please read each item carefully and answer candidly based on your experiences/instruction during the current school year. The information will be used to improve the preparation of science and mathematics teachers across the nation. Your cooperation is greatly appreciated.

1. What is your position?

- ○ Instructor/Adjunct Faculty
- ○ Associate Professor
- ○ Teaching Assistant
- ○ Assistant Professor
- ○ Full Professor
- ○ Other:

2. What is your gender? ○ Female ○ Male

3. Please rate the quality of the following.	**Less than adequate**	**Adequate**	**More than adequate**	**Exceptional**	**Not Applicable**
a. The ability of the students in the teacher preparation programs at your institution……..……………………………………………………………….	○	○	○	○	○
b. The ability of the students in the science, technology, engineering, and mathematics (STEM) programs at your institution…………..………...….…….	○	○	○	○	○
c. The STEM knowledge of your students at your institution..…………...………..	○	○	○	○	○
d. The pedagogical knowledge of your students at your institution..…………..…..	○	○	○	○	○

4. Briefly describe specific efforts, if any, that have been taken to increase the level of gender and ethnic diversity among students in the teacher preparation programs at your institution.

5. In the past five years has there been any change in the way you and your colleagues interact:

a. [All faculty] With the faculty in other institutions?
○Yes ○No
Please describe the nature of the change and what caused it.

b. [Only answer if you are a science, technology, engineering, and mathematics (STEM) faculty member]
With the faculty in the area(s) of education at your institution?
○Yes ○No
Please describe the nature of the change and what caused it.

c. [Only answer if you are an education faculty member] With the faculty in the areas of science, technology,
engineering, and mathematics (STEM) at your institution?
○Yes ○No
Please describe the nature of the change and what caused it.

6. Do your responsibilities include any formalized interaction with K-12 schools?
○Yes ○No
- If yes, please describe the interaction.

7. Are you involved in any classes in your college/department that have field site experiences?
○Yes ○No
- If yes, please answer questions a-c.

a. How many classes have field site experiences? ________.

Answer questions b and c about the course you think provides the most substantial field experience.

b. What is a descriptive title of the course?	
c. What is the nature of the field experience?	

8. To what extent do you think teaching in a broad sense, e.g., expertise or working on instructional improvement, is valued
by your department in terms of tenure/promotion or merit? (*Choose one*.)
○ Teaching is less valued than research.
○ Teaching is valued equally with research.
○ Teaching is more valued than research.
○ Teaching is valued very little.
○ Research is valued very little.

9. What percent of your professional time do you expend on teaching and/or curriculum reform?
○ <10% ○ 40-49% ○ 80-89%
○ 10-19% ○ 50-59% ○ 90-100%
○ 20-29% ○ 60-69%
○ 30-39% ○ 70-79%

10. What percent of your faculty colleagues are actively involved in improving their teaching and/or in reforming curriculum?
○ <10% ○ 40-49% ○ 80-89%
○ 10-19% ○ 50-59% ○ 90-100%
○ 20-29% ○ 60-69%
○ 30-39% ○ 70-79%

11. In the past few years have you ever observed any colleagues teaching and then discussed your observations with them (or vice versa)?
○Yes ○No
- If yes, please answer questions a and b.
  a. Approximately how many times per year? ________.
  b. Why did you do it?

12. Are there any barriers that inhibit you from teaching mathematics and/or science in ways most beneficial for student learning?

○Yes ○No

- If yes, describe the barriers.

13. In the past few years have you received money, or other resources (such as released time), for course development or
reform?

○Yes ○No

- If yes, what were the <u>sources</u> and the <u>amounts</u> of money or other support provided?

Please rate the frequency of use of the following strategies prior to [Date] and again since [Date].

Frequency Prior to [Date]				**Strategy**	**Frequency After [Date]**			
Never	**Seldom**	**Occasionally**	**Regularly**	**In your current science, mathematics or education courses, how often do students:**	**Never**	**Seldom**	**Occasionally**	**Regularly**
○	○	○	○	14. Work with other students where the whole group gets one grade?………………………………………………….…..	○	○	○	○
○	○	○	○	15. Participate in whole-class discussions during which the teacher talks less than the students?…………………………	○	○	○	○
○	○	○	○	16. Use or make models, e.g., physical, conceptual or mathematical models?……………………...………………..	○	○	○	○
○	○	○	○	17. Write descriptions of their reasoning?……...………………..	○	○	○	○
○	○	○	○	18. Work on problems related to real world or practical issues?..	○	○	○	○
○	○	○	○	19. Perform investigative activities that include data collection, and analysis?……………………………...……………….	○	○	○	○
○	○	○	○	20. Make connections to other fields (science, technology, engineering, and mathematics (STEM) and non-STEM)?…...	○	○	○	○
○	○	○	○	21. Design and make presentations that help them learn class concepts?..……………………………………………………	○	○	○	○
○	○	○	○	22. Evaluate the extent of their own learning?…..……………...	○	○	○	○
				23. Complete assessments/ assignments that include:				
○	○	○	○	a. problems with complex solutions ?…………………….…..	○	○	○	○
○	○	○	○	b. portfolios?……………………………………………	○	○	○	○
○	○	○	○	c. multiple choice/short answer items?…………………….	○	○	○	○
○	○	○	○	d. full-length papers/reports?………………………………	○	○	○	○
				24. Use technology, e.g., computers, calculators:				
○	○	○	○	a. to understand or explore concepts taught in class in more depth?……………………………………...……	○	○	○	○
○	○	○	○	b. as a tool in investigations to gather and analyze scientific or mathematical data?……………….……….….	○	○	○	○
○	○	○	○	c. as a tool for assessment?……………………………….…….	○	○	○	○
○	○	○	○	d. as a tool to communicate with you or with other students?…………………………………………….....	○	○	○	○

How often do the following strategies characterize your current science, mathematics or education courses?	Never	Seldom	Occasionally	Regularly
25. Students have a voice in decisions about course activities……………………………….	○	○	○	○
26. New information is based on what students already knew about the topic……………...	○	○	○	○
27. Student assessment results are used to modify what is taught and how………………….	○	○	○	○

Indicate how much you disagree or agree with each of the following statements about teaching and learning mathematics and science.	Strong Disagree	Disagree	*Agree*	*Strongly Agree*	*Not Applicable*
28. It is important for students to help establish criteria by which their work will be assessed…………………………………………………………………………………...	○	○	○	○	○
29. In this institution, faculty members have a shared vision of effective instruction……….	○	○	○	○	○
30. In this institution, faculty are well informed about the national education standards, e.g., AAAS, NRC, and NCTM, for the courses they teach………………………………	○	○	○	○	○

31. Different instructors have described very different teaching philosophies to researchers. For each of the following pairs of statements, choose the circle that best shows how closely your beliefs compare to each of the statements in a given pair. The more you agree with a particular statement, the closer the circle you should choose. *Please darken only one circle for each pair.*

a. "I mainly see my role as a facilitator. I try to provide opportunities and resources for my students to discover or construct concepts for themselves."	O	O	O	O	O	O	"Investigation is very nice, but students really won't learn the subject unless you go over the material in a structured way. It's my job to explain, to show students how to do the work, and to assign specific practice."
b. "The most important part of instruction is the content of the curriculum. That content is the field's judgment about what students need to be able to know and do."	O	O	O	O	O	O	"The most important part of instruction is that it encourages 'sense-making' or thinking among students. Content is secondary."

32. In the past few years have you made substantial changes in your teaching style?
○Yes ○No

33. Have your course(s) influenced changes in other courses in your institution?
○Yes ○No
If yes, please describe how the course(s) have affected other courses.

34. Most of the important scientific advances have come about as a result of: (*Choose the single best answer—darken one circle only*.)
O a. The development of new and more significant sets of ideas.
O b. The interaction of ideas and experiments in the solution of problems.
O c. The dedication of an extraordinary person to the investigation of a particular specialty.
O d. An interaction between a chance observation of a new phenomenon and an alert mind.

Indicate how much you disagree or agree with the following statements.	**Strongly Disagree**	**Disagree**	**Agree**	**Strongly Agree**
35. Truly understanding science in the <u>science</u> classroom requires special abilities that only some people possess…………………………………………………………………………	O	O	O	O
36. Truly understanding mathematics in the <u>mathematics</u> classroom requires special abilities that only some people possess……………………………………………………………….	O	O	O	O

Appendix F

Student Learning Survey

Survey of STEMTEC Students -- Fall 2001

This survey is designed to discover your opinions of how well this course engaged you in the learning experience. In addition, we want to discover your career interests and plans. Your responses will be completely ANONYMOUS and will have absolutely no bearing on your performance in this course. Thank you for taking the time to complete this survey.

1. Course Title and Number: ____

2. At which school are you enrolled?

O Amherst College
O Greenfield Community College
O Hampshire College
O Holyoke Community College
O Mount Holyoke College
O Smith College
O Springfield Technical Community College
O University of Massachusetts Amherst

3. Please select the reason that best describes why you are taking this course?

O I am interested in this subject.
O It is a requirement for my major.
O It is a prerequisite for another course.
O It is required for teaching certification.
O It fulfills a general graduation requirement.
O It was recommended by a faculty member.
O It was recommended by a friend.
O Other

4. In what year of school are you currently enrolled?

O First year O Second year O Third year O Fourth year O Other

5. What type of degree are you earning? O Associate's O Bachelor's O Other

6. Please read the following statements and rate the how often the activity occurred during the course of this semester.

In this course, how often did:	**Never**	**Rarely**	**Often**	**Almost Every Class**	**Every Class**
you work in small groups and/or pairs?	O	O	O	O	O
you listen to lecture and take notes?	O	O	O	O	O
you participate in class discussions where the instructor talked less than the students?	O	O	O	O	O
you work on problems related to real world or practical issues?	O	O	O	O	O
your instructor use educational technology (computers, videodisks, VCR's, etc.)?	O	O	O	O	O
The class work on in-class problem solving and/or open-ended questions?	O	O	O	O	O
you participate in hands-on activities?	O	O	O	O	O
you make connections to other fields or disciplines?	O	O	O	O	O
you have opportunities to give feedback to the instructor?	O	O	O	O	O
you feel encouraged to ask questions in class?	O	O	O	O	O
you have opportunities to work on long-term projects?	O	O	O	O	O
The class discuss learning and/or teaching strategies and approaches?	O	O	O	O	O
you collaborate with K-12 teachers and/or students?	O	O	O	O	O
students teach a portion of this class?	O	O	O	O	O
Did the instructor speak to you or the class about teaching	O	O	O	O	O

as a career?					

7. Listed below are some statements about this class. Please indicate your agreement with each statement using the rating scale provided.

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
There is sufficient time for me to respond to questions in class.	O	O	O	O	O
This course encourages discussion among students and between students and the teacher.	O	O	O	O	O
This class helped me to learn the course material.	O	O	O	O	O
This course has increased my interest in this subject.	O	O	O	O	O
I look forward to taking more courses in this subject area.	O	O	O	O	O
This course encouraged me to think about my own learning.	O	O	O	O	O
This course increased my interest in becoming a teacher.	O	O	O	O	O

8. To the best of your knowledge, approximately what percent of your final grade in the course is based on the following categories?

	0%	**Less than 25%**	**25 to 49%**	**50 to 75%**	**More than 75%**
Multiple-choice exams or quizzes	O	O	O	O	O
Non-multiple-choice exams or quizzes	O	O	O	O	O
Pyramid exams	O	O	O	O	O
Reports on projects	O	O	O	O	O
Laboratory reports	O	O	O	O	O
Essays or other papers	O	O	O	O	O
In-class presentations	O	O	O	O	O
Journals	O	O	O	O	O
Portfolios	O	O	O	O	O
Homework	O	O	O	O	O
In-class assignments	O	O	O	O	O
Class participation	O	O	O	O	O
Community-based projects	O	O	O	O	O
Teaching experiences	O	O	O	O	O
Ability to work effectively in groups	O	O	O	O	O

9. What is your sex? O Female O Male

10. What is your race/ethnicity? (Please select **ALL** that apply.)

O African American or Black
O Asian
O Caucasian or White
O Hispanic or Latino/a
O Native American or Alaskan Native
O Native Hawaiian or Other Pacific Islander

11. Please indicate your declared or intended major. (Select only **ONE** response.)

O Business
O Computer Science / Technology
O Math / Statistics
O Natural Sciences
O Engineering
O Social Sciences
O Humanities / Art / Music
O Education

O Other

12. In which of the following areas are you considering a career? (Select ALL that apply.)

O Art/Music/Humanities
O Biology/Medicine
O Business/Economics
O Chemistry
O Computer Science/Technology
O Education/Teaching
O Engineering
O Geology
O Law
O Physics
O Psychology
O Social Services
O Other

13. If you selected Education/Teaching in the previous question, is there a particular level or subject you are interested in teaching? (Select ALL that apply):

O Math O Science O Preschool O Middle School O High School O College O Elementary School

14. Are you planning to enroll in a teacher certification program? O Yes O No

15. Are you familiar with the STEMTEC (Science, Technology, Engineering, and Math Teacher Education Collaborative) program? O Yes O No

16. If you are familiar with STEMTEC, how important is it to you to choose a STEMTEC course over an equivalent Non-STEMTEC course offering?

O Very Important
O Important
O Moderately Important
O Of Little Importance
O Unimportant

Thank you for taking the time to respond to this survey.

Appendix G

Teaching (Career) Interest Survey

Career (Teaching) Interest Survey

Please take a moment to complete the following questions. Your responses will help us to determine student interest in particular majors and career paths. All answers will be kept confidential. Thank you for your time.

What is your name? (Last, First) ______________________________

What is your student ID number? ______________________________

What is your sex? O Female O Male

What is your race/ ethnicity? (Please select ALL that apply.)

O African American or Black
O Asian
O Caucasian or White
O Hispanic or Latino/a
O Native American or Alaskan Native
O Native Hawaiian or Other Pacific Islander
O Other

At which school are you enrolled?

O Amherst College
O Greenfield Community College
O Hampshire College
O Holyoke Community College
O Mount Holyoke College
O Smith College
O Springfield Technical Community College
O University of Massachusetts Amherst

What type of degree are you earning? O Associate's O Bachelor's O Other

Please indicate your declared or intended major. (Select only **ONE** response.)

O Astronomy
O Biology
O Business/Economics
O Chemistry
O Computer Science/Technology
O Education
O Engineering
O English/Communications
O Geology/Geosciences
O History
O Law
O Mathematics/Statistics
O Natural Resources/Food Science
O Physics
O Psychology
O Sociology
O Undecided
O Other __________________

In which of the following areas are you considering a career? (Select ALL that apply.)

O Art/Music/Humanities
O Biology/Medicine
O Business/Economics
O Chemistry
O Computer Science/Technology
O Education/Teaching
O Engineering
O Geology
O Law
O Physics
O Psychology
O Social Services
O Other _______________

Using the scale below, please indicate how attractive a career in teaching science or math sounds to you.

O 1 Not at all attractive
O 2
O 3
O 4
O 5
O 6 Very attractive

Using the scale below, please indicate how likely it is that you will someday teach a math or science course.

O 1 Not at all likely
O 2
O 3
O 4
O 5
O 6 Very likely

If you think you may become a math or science teacher someday, please indicate the particular subjects and settings in which you would like to teach. (Please select ALL that apply):

O Math	O Preschool	O Middle School	O College
O Science	O Elementary School	O High School	

Appendix H

CAREI Dean/Department Chair Survey

CAREI DEAN/DEPARTMENT CHAIR SURVEY

Please read each item carefully and answer candidly based on your experiences/instruction during the current school year. Thank you for completing this survey. The information will be used to improve the preparation of science and mathematics teachers across the nation.

1. Do any of your promotion/tenure or merit criteria include work on instructional improvement projects?

O Yes O No O Don't Know

- If yes, please answer questions a and b.
  a. Have these criteria changed recently?
     O Yes O No O Don't Know

- b. If yes, what caused the change?

2. Do you see any barriers to having excellent teaching in your college or department?
   O Yes O No O Don't Know

   - If yes, please describe.

3. Does your college or department provide institutional funds (or other resources such as released time) for course development or improvement?

   O Yes O No O Don't Know
   - If yes, please describe the amount of money or other support that your college or department provided last year for course development or improvement.

4. Do classes in your college or department have field-based experiences in K-12 educational settings?
   O Yes O No O Don't Know

5. Does your college or department offer any special programs designed to increase the ethnic and gender diversity of students who study in your area?

O Yes O No O Don't Know

- If yes, please answer questions a-b.
  a. What year were these programs put in place?

  b. What caused your college or department to put them in place?

6. In the past few years has there been any change in the way the faculty in your college or department teach or perceive their responsibilities as teachers?

O Yes O No O Don't Know

- If yes, please answer questions a-b.
  a. Please describe the nature of the change.

  b. State what caused the change.

7. Do members of your faculty interact with faculty from other institutions of higher education about improving education?

O Yes O No O Don't Know

- If yes, please answer question a.
  a. Have there been changes in recent years in the way members of your college or department interact with faculty from other institutions?

     O Yes O No O Don't Know

     - If yes, please answer questions b-c.

  b. Describe the nature of the change.

  c. State what caused the change.

8. Do members of your faculty have any formalized interaction with K-12 schools?

O Yes O No O Don't Know

- If yes, please answer questions a-c.
  a. Describe the nature of the interactions.

  b. Does work with K-12 schools get compensated in any way, e.g., promotion/tenure, merit pay, released time, etc.?

     O Yes O No O Don't Know

  c. Is any ongoing support provided for students who graduated from your institution and went into K-12 teaching?

     O Yes O No O Don't Know

9. Are you familiar with a program called [*Collaboratives for Excellence in Teacher Preparation (CETP)] and its goals? *Insert your CETP name.

O Yes O No

- If yes, to what extent do you believe the goals of that program have been met?

  O To a small extent
  O To a moderate extent
  O To a great extent

10. Please rate the overall quality of the following at your institution:	**Not Applicable**	**Less than Adequate**	**Adequate**	**More than Adequate**	**Exceptional**
a. The science, technology, engineering, and mathematics (STEM) programs at your institution…………………………………………………………..	O	O	O	O	O
b. The initial licensure secondary STEM teacher education programs at your institution………………………………………………………………...	O	O	O	O	O
c. The initial licensure elementary school teacher education program at your institution………………………………………………………………...	O	O	O	O	O
d. The ability of the students in your teacher preparation programs………...	O	O	O	O	O
e. The ability of the students in your STEM programs……………………...	O	O	O	O	O

Appendix I

List of Dissemination Activities

Appendix I:

Dissemination and Public Awareness Strategies and Activities

Audio/Visual Materials

How Change Happens: Breaking the "Teach as You Were Taught" Cycle in Science and Math (video for college faculty), completed December 1999.

*Inventing the Future: The K–16 Connection in Scienc*e (video for College Faculty), 2002.

Little, D., (Cycle 1, GCC) produced with STEMTEC funds the video "The Rise and Fall of Lake Hitchcock" which has premiered around the valley to sell out crowds on campuses and meetings of non-profit organization (2000).

Turning on to Teaching Science and Math (video for high school and college students), 2001.

The STEMTREK annual newsletter: February 1999, March 2000

Manuals/Guides/Books

"A Guide For Advising Future Math and Science Teachers". An extensive collection of information on pre-education, certification, scholarship, and career issues. 2002.

Condit, C., 2000, A Dynamic Digital Map of Massachusetts. Department of Geosciences Publication. This CD-ROM, supported by a STEMTEC course-redesign grant, is now in an improved version that provides interactive computer-based annotations of popular geological field excursions that are common in the region of the Collaborative.

Leckie, R. Mark and Yuretich, R. 2000, Investigating the Ocean: An Interactive Guide to the Science of Oceanography (2nd Edition). McGraw-Hill, New York, 196 p. This updated and revised volume contains in-class investigations and information developed as a result of the STEMTEC course re-design process.

The STEMTREK annual newsletter: February 1999, March 2000

Sponsored Conferences

4/18/02-4/21/02, Pathways to Change 2002, an International Conference on Transforming Math and Science Education in the K16 Continuum, Arlington, VA.

3/1/02 – Transforming Practice with Technology, A Five College Conference and Multimedia Fair, University of Massachusetts Amherst

6/28/01, Pathways to Change 2001, A Research Conference on Science and Mathematics Teaching and Learning, Umass Amherst.

6/28/00–6/29/00, Pathways to Change 2000, A Research Conference on Science and Mathematics Teaching and Learning, Hampshire College.

1997-1998, Feldman, Allan, in collaboration with PALMS (Partnerships Advancing the Learning of Mathematics and Science, the NSF systemic state initiative) and MA DOE, is helping organize an April conference at Worcester State on science education reform

Presentations

Year 5 – 2001/2002

Browne, Sheila – Featured Speaker: Sheila Browne, Mount Holyoke College, "Women and Minorities in Science"

Burrows, Elizabeth – Long Paper: Linda B. Selleck, South Hadley Middle School, Elizabeth H. Burrows, Mt. Holyoke College, STEMTEC Scholar, "Email Correspondence Connects Middle School Students with College Student Researcher". Pathways to Change Conference 2002.

Crane, Gregory (Keynote Address), Professor of Classics at Tufts University and Editor in Chief of the Perseus Project will present "Reading in a Digital Age. Pathways to Change Conference 2002.

Brush, Edward J., American Chemical Society Northeastern Regional Meeting, University of New Hampshire, June 24-27, 2001. "Getting Started with Student-Active Learning in the Introductory Chemistry Curriculum".

Capobianco, B. Donna Canuel-Browne (Northampton High School), Susan Lincoln, (Northampton H.S.), Ruth Trimarchi (Amherst RHS). AERA April 1-5, 2002, New Orleans, LA. Examining the experiences of three generations of teacher researchers through collaborative science teacher inquiry.

Capobianco, B. NARST April 9. 2002, New Orleans, LA. Examining the voices and experiences of science teachers as researchers on feminist pedagogy.

Capobianco, B. M., University of Massachusetts Amherst; Donna Canuel-Browne and Susan Lincoln, Northampton Public Schools; Norm Pierce, Amherst Regional Public Schools; Ruth Trimarchi, Amherst Public Schools. Examining the experiences of three generations of teacher researchers through collaborative science teacher inquiry.

Capobianco, B. Donna Canuel-Browne (Northampton, H.S.), Susan Lincoln, (Northampton H.S.), Ruth Trimarchi (Amherst RHS), Norm Pierce (Amherst RHS), Reina Horowitz (Springfield – The HS of Commerce), NEERO (New England Research Org.), April 24-25, 2002. Science Teachers as researchers examining inclusive pedagogy through collaborative action research.

Capobianco, Brenda, University of Massachusetts Amherst. Examining the Voices and Experiences of Science Teachers as Researchers on Feminist Pedagogy.

Davis, K.S. Taking it to the field: Integrating science and technology in meaningful ways. Presentations at the Annual Meeting of the Massachusetts Environmental Education Society, Worcester, MA.

Davis, K.S., Bray, P., & Weiss, T. Science and mathematics education reform: Implications for inclusive pedagogy, University of Massachusetts Amherst.

Davis, K.S., Feldman, A., Irwin, C., Pedevillano, E.D., Capobianco, B, Weiss, T., & Bray, P. Wearing the Letter Jacket: Legitimate Participation in a Collaborative Science, Mathematics, Engineering, & Technology Education Reform Project. The Journal of School Science and Mathematics.

Davis K.S. & Irwin C. Building a bridge for females to equitable, inclusive, and participatory science activity. Paper presented at the Annual Meeting of the National Association of Research in Science Teaching, St. Louis, MO.

Davis, K.S. & Whitworth, J.M. Technology: A link to the mountains and beyond. Paper presented at the Annual International Meeting of the Association for the Education of Teachers in Science, Costa Mesa, CA.

Davis, Kathleen, University of Massachusetts. Elementary Science Educators as Pedagogy Experts in a Post-Secondary Science Education Reform Project.

Dray, Tevian – Long Paper: Tevian Dray, Mount Holyoke College, Corinne Manogue, Mount Holyoke College, “Bridging the Vector Calculus Gap”. Pathways to Change Conference 2002.

Dufresne, B. Gerace, B., Leonard, & Mestre, J. “Creating an item for in-class formative assessment.” The Interactive Classroom [Newsletter for Interactive Classroom Teaching and Learning], pp. 1.3 (Spring 2001).

Little, R.D. “Introduction to Connecticut Valley Geology” Northeastern Geological Society of America Annual Meeting, March 26, 2002.

Margulis, Lynn – Featured Speaker: Lynn Margulis, University of Massachusetts Amherst, “From Gaia to Microcosm – and Back”

McMenamin, M. “Emerging Themes in Geology: New Approaches to Evolution in Earth Science Education.” Northeastern Geological Society of America Annual Meeting, March 26, 2002.

Mestre, J. “Using Learning Research to Transform the Way We Teach Science,” and “The Context Dependence of Student Reasoning and Alternatives for Assessing Conceptual Understanding in Physics.” Given as “The Philips Lectures,” Haverford College, Haverford, PA, Feb. 26-27, 2001.

Mestre, J. “Using Learning Research to Transform the Way We Teach.” First Annual Rensselaer Colloquium on Teaching and Learning. Rensselaer Polytechnic Institute, Troy, NY, May 7, 2001

Mestre, J. “Using Learning Research to Transform the Way We Teach Science,” and “Designing Research Studies in Science Learning.” Presented at the 2001 Summer Academy, Maine Mathematics and Science Teaching Excellence Collaborative, June 25-28, Bates College, Lewiston, ME.

J. Mestre gave testimony before the US House Science Committee’s Subcommittee on Research at a hearing titled “Classrooms as Laboratories: The Science of Learning Meets the Practice of Teaching.” Washington, D.C., May 10, 2001. (see http://www.house.gov/science/research/reshearings.htm and http://www.house.gov/science/research/may10/mestre.htm).

Mestre.J., Dufresne, R., Gerace, W., & Leonard, W. The multidimensionality of assessing for understanding. AAPT Announcer, 30, #4, 2000, 118. Presented at Winter Meeting of the American Association of Physics Teachers, Jan. 5-11, San Diego, CA.

Murray, Tom – Long Paper: Tom Murray, Hampshire College, Larry Winship, Hampshire College, Ayala Galton, Hampshire College, Neil Stillings, Hampshire College
Peter Shaughnessy, Hampshire College, “SimForest: Curriculum and Software for Inquiry Learning in Forest Ecology”.

Pedevillano, Elizabeth Dolly Culture and Identity in a Science Teacher Education Reform Project, Allan Feldman, Brenda Capobianco, Tarin Weiss, University of Massachusetts.

Peelle, Howard – Long Paper: Howard A. Peelle, University of Massachusetts Amherst ”Alternative Modes for Teaching Mathematics”. Pathways to Change Conference 2002.

Prince, Gregory – Keynote Speaker: Gregory Prince, Hampshire College ”Reform or Revolution: Science Education and Civic Responsibility”

Selleck, Linda – Long Paper: Linda B. Selleck, South Hadley Middle School, Elizabeth H. Burrows, Mt. Holyoke College, STEMTEC Scholar, "Email Correspondence Connects Middle School Students with College Student Researcher". Pathways to Change Conference 2002.

Slakey, Linda – Keynote Speaker: Linda Slakey, Commonwealth College, University of Massachusetts, "Institutionalizing Grant-Funded Innovations in Teaching: the Role of the Dean"

Slater, Sharon C. – Long Paper, Sharon Cadman Slater, Umass, Joseph Berger, Umass, Stephen Sireci, Umass, "Assessing the impact of STEMTEC on organizational culture". Pathways to Change Conference 2002.

Tyson, J., 222nd American Chemical Society National meeting in Chicago in August 2001, "Problems with problem-based learning: Evaluating students as students rather than analytical chemists".

Tyson, J., 222nd American Chemical Society National meeting in Chicago in August 2001, "Collaborative learning through project work: the impact of two NSF awards on Chem 312, "Analytical chemistry for non-chemistry majors".

Tyson, J., 28th Annual conference of the Federation of Analytical Chemistry and Spectroscopy Societies, "Problem-based co-operative learning situations in the analytical chemistry teaching laboratory and classroom: making the most effective use of class time?"

Weiss, Tarin H., Allan Feldman, Dolly E. Pedevillano, Brenda Capobianco, University of Massachusetts. The Annual Meeting of the National Association for Research on Science Teaching. The implications of Culture and Identity: A Professor's Engagement with a Reform Collaborative

Whitworth, J.M., Davis, K.S., Doubler, S., Emery, C., & Murray, S. Researching out to teachers: Is on-line professional development the answer? Annual Meeting of the American Educational Research Association, New Orleans, LA, April 1-5, 2002.

Year 4 – 2000/2001

Bray, Paige. "Preservice Elementary Teachers: What Empowers Them to Enact Inclusive Pedagogy," National Association of Research in Science Teaching, St. Louis, March 25-28, 2001

Bruno, M. "Student-Active Learning in a Large Class Setting," based on her involvement with STEMTEC. Project Kaleidoscope (PKAL) Summer Institute in Keystone, CO. (see http://demeter.hampshire.edu/~mbruno/PKAL2000a.html.

Bruno, M. "Human Biology: A Case Based Course for First Year Students". National Center for Case Study Teaching in Science at the University of New York at Buffalo, October 2000.

Davis, K., "Building a Bridge for Females to Equitable, Inclusive, and Participatory Science Activity," National Association of Research in Science Teaching, St. Louis, MO., March 25-28, 2001.

D'Avanzo, C., Grant, B. W., & Musante, S., 2000. ESA sponsors a web site and CD-ROM that integrates student-active teaching with topical issues for big and small ecology courses. Ecological Society of America Annual Meeting, August 6-10, Snowbird, Utah.

D'Avanzo, C. "Ecological Issues on the web: student-active teaching in large courses." Ecological Society of America annual meeting, Snowbird, Utah. August 10-17, 2000.

D'Avanzo, C. "Course Evaluation: A primer on what it is and why you should do it." Submitted to the Ecol. Soc. Of Amer. Bull, 2000.

Dufresne, R., Gerace, W., Mestre, J. & Leonard, W. Assessing to learn (A2L): Research on teacher implementation of continuous formative assessment. AAPT Announcer, 30, #4,119. Presented at Winter Meeting of the American Association of Physics Teachers, Jan. 6-11, 2000, San Diego, CA.

Gaillat, A. (Cycle 2, Campus Coordinator) of Greenfield Community College presented a paper at the International Chemical Education Conference in Ann Arbor, Michigan in the Summer of 2000 on her experiences revising her chemistry courses. The title was "Knowing, Reclaiming, Owning: Basic Chemistry for Non-Majors at a Community College."

Goodman, A. "Everyday Racialisms: From Science Practice to Science Protest: teaching with the Amherst Regional Middle Scholl", American Anthropological Association at their meeting in San Francisco, CA, November 2000.

Grant, B.W., D'Avanzo, C., & Musante, S., 2000. Experiments to teach ecology: A new ESA-sponsored web site and CD-ROM for undergraduate ecological education. Ecological Society of America Annual Meeting, August 6-10, Snowbird, Utah.

Little, R.D. and Yuretich, R., STEMTEC Faculty from Greenfield Community College and, PI, respectively, co-presented a paper on STEMTEC teaching at the Geological Society Conference at Rutgers University in March 2000.

Porteous, Jessica, fourth-year student and STEMTEC Teaching Scholar, is one of the authors of "From PETS to Storykit: Creating New Technology with an Intergenerational Design Team", presented at the workshop on Interactive Robotics and Entertainment 2000 (Wire 2000).

Sternheim, M. and Sternheim, H. "Planet Earth: A Science and Methods Course for K12 Teachers", The Twelfth International Conference On College Teaching And Learning, Jacksonville FL, April 17-21, 2001.

Sternheim, M. "STEMTEC: More and better-prepared science and math teachers," The Twelfth International Conference On College Teaching And Learning, Jacksonville FL, April 17-21, 2001.

Sternheim, M. "Strategies for Improving Science Teaching in the Schools", University of Connecticut, April 10, 2001.

Tyson, J. (Cycle 1, UMass) presented "STEMTEC Catalyzed Contacts between an Undergraduate Analytical Chemistry Class and Some K-12 Classes: Visits and a Research Project" at the New England Association of Chemistry Teachers 482nd Meeting at Mount Holyoke College on December 2, 2000.

Tyson, J. presented a talk at the 27th Federation of Analytical Chemistry and Spectroscopy Societies Annual Meeting in Nashville, TN in October 2000 entitled "Measuring Arsenic in Soils Near Pressure Treated Decks and Other (equally ambitious) Projects in the Undergraduate Teaching Laboratory."

Weiss, Tarin. "Revised Introductory Level Science Course: Steps Toward an Inclusive Pedagogy," National Association of Research in Science Teaching, St. Louis, March 25-28, 2001

Weiss, Tarin "A Revised Introductory Level Science Course: Steps Toward an Inclusive Pedagogy," AETS Annual Conference, Costa Mesa CA, Jan 18-22, 2001.

Weiss, T., STEMTEC Graduate Student and part time lecturer for project, presented a paper "A Revised Introductory Level College Science Course: Steps Toward an Inclusive Pedagogy" at the annual meeting of the Association of for the Education of Teachers in Science in Costa Mesa, California, January 2001.

Year 3 - 1999/2000

Beffa-Negrini, P., Cohen, N.L., and Sternheim, M. UMass Instructional Technology ITC 99 Conference, Boxborough, MA. 1999. "A Comparison of Internet-Based Education of Teachers and Nontraditional Undergraduate Students: The Nutrition Online Experiences."

Browne, Sheila, March 18, 2000, 4th Annual Rappahannock Region Professional Development Conference K-12 Teachers, "Motivating All Children to Succeed."

Browne, S. (Cycle 1, Campus Coordinator) of Mount Holyoke College gave a lecture at Greenfield Community College entitled “The New Millennium: Finding Directions for Women in Science." The GCC Women’s Studies Steering Committee and STEMTEC sponsored the lecture.

Browne, Sheila, March 18, 2000, 4th Annual Rappahannock Region Professional Development Conference K-12 Teachers, “Motivating All Children to Succeed.” Practices that promote self-esteem, respect for each other, and create excitement in exploring new ideas and concepts.

Capobianco, B., STEMTEC Graduate Student and part time lecturer presented a paper on diversity and equity in math and science education at the Fifth Annual Institute for Science Education Forum, May 2000.

Capobianco, B., STEMTEC Graduate Student and part time lecturer presented a paper on science teaching at the National Association of Research in Science Teaching Meeting in New Orleans, Louisiana, April 2000.

Cheney, Jack, presented “Teaching Pedagogy in the Utilization of Electron Microscopy and in-situ Chemical Analysis via Energy Dispersive Spectrometry” at the fall 1999 American Geophysical Union conference

Condit, C. "Dynamic Digital Map Field Trips." Presentation by Chris Condit at the Five Colleges Multimedia Fair. Cycle I college faculty.

Davis, K. S. “Engaging women in inquiry and discourse: The pedagogy of an elementary science education web course.” National Association of Research in Science Teaching, New Orleans, LA. April 2000.

Davis, K. S. “Making stone soup: Elementary teachers constructing a vision of inquiry and science teaching through a science education web course.” American Educational Research Association. New Orleans, LA. April 2000.

D'Avanzo. C. "Student-active approaches in ecology courses". Ecological Society of America annual meeting, August, Baltimore, MD

D'Avanzo, C. "Project-based Teaching" Ecological Society of America train-the-trainer program FIRST, Archbold Biological Research Station, Florida.

D'Avanzo, C. “Ecological Issues on the web: student-active teaching in large courses.” Ecological Society of America annual meeting, Snowbird, Utah. August 10-17, 2000.

Dickerman, Robert presented “Field biology in the required science course: How’s this bug going to get me a job?” at the STEM Institute Seminar on December 7, 1999.

Emery, C., and Bryan, L. "Using the National Science Education Standards in a College Science Course." NSTA National Convention, Orlando, FL. April 7-8, 2000.

Feldman, A. and Capobianco, B. “The STEMTEC Consultancy: Formative evaluation and pedagogical content knowledge.” Presented at the Annual Meeting of the American Educational Research Association, April 2000, New Orleans, LA

Feldman, A. and Capobianco, B. “Facilitating the New Reform: Helping College Science and Mathematics Faculty Engage in Formative Evaluation of Their Practice.” Presented at the Annual Meeting of the National Association of Research in Science Teaching, April 2000, New Orleans, LA

Feldman, Allan, Angus Terry Dun (Franklin County Technical School), and Mary Reardon (University of Hartford), “Teaching and Learning Science with Computers: The Development of Instructional Technology Pedagogical Content Knowledge.” To be presented in April 24-28, 2000 American Educational Research Association national convention in New Orleans.

Feldman, A. “Complete this analogy—Pre-Ed is to Pre-Med as...” A presentation at the Annual Meeting of the Association of Educators of Science - Northeast, October 1999, Syracuse, NY.

Feldman, A. and Capobianco, B. “The STEMTEC Consultancy: Formative evaluation and pedagogical content knowledge.” Annual Meeting of the American Educational Research Association, April 2000, New Orleans, LA.

G. L'Heureux, B. Hagenbuch, "Our Changing Universe: Understanding the Nature of Nature: A Cross Disciplinary Approach to Teaching College Science." Lilly Conference on College and University Teaching in Boston, October 1-2, 1999.

G. L'Heureux, B. Hagenbuch, NSF Short courses for college teachers, NSF Div. Of Undergraduate Education, 5/2000, Chautauqua conference at Temple Univ., Philadelphia, PA “The Nature of Nature: A cross-disciplinary Approach to Teaching College Science”

G. L’Heureux “Evaluation of Cross-Disciplinary and Interdisciplinary Approaches to Teaching Introductory College Science,” State Board of Community and Technical Colleges on “Assessment and Educational Transformation: Influencing Organizational Change”, Vancouver, WA May 2000.

G. L'Heureux, B. Hagenbuch, NSF Short courses for college teachers, NSF Div. Of Undergrad Education, 5/2000, Chautauqua conference at Temple Univ., Philadelphia, PA “The Nature of Nature: A cross-disciplinary Approach to Teaching College Science”.

Hart, D., Slakey, L., Woolf, B. (2000). Using OWL to Improve Instruction and Reduce Costs in Large-Enrollment Classes. To be presented at the Syllabus 2000 Educational Technology Conference, Santa Clara, CA. July, 2000.

Khan, S., & Clement, J. (2000, April). Strategies to Revitalize Student Interest in Chemistry and Recruit Future Science Teachers. Presented at the American Educational Research Association, New Orleans, LA.

Khan, S., & Clement, J. (2000, April). A Pathway To Recruit Future Science Teachers From a College Science Course. Presented at the National Association for Research in Science Teaching, New Orleans, LA.

Kibbe, Janice S., Sumner Avenue Magnet School, Springfield. “Living and Working in Space.” Workshop, March 2, 2000, at WGBY (PBS) in Springfield.

Miller, B., Beffa-Negrini, P., Cohen, N.L., and Sternheim, M. Society for Nutrition Education Annual Conference, Baltimore MD. 1999. “Teaching undergraduate nutrition education on-line: an alternative to large classroom environments.”

Murray, S., and Emery, C. "Electricity and Magnetism for Elementary/Middle School Preservice Teachers." NSTA National Convention, Orlando, FL. April 7-8, 2000.

Murray, Steve, Holyoke Public Schools, “Formative and Summative Evaluation,” Seventh Annual Spring Conference “Science is Elementary,” Center for Science and Math Education, Purchase College, SUNY, March 4, 2000.

O’Hara, Pat, presentation: Nov 9, 1999, Springfield College: Colloquium on Science Teaching

O’Hara, Pat presentation: Nov 17, 1999, UMass Series: The Engaged Campus: Community Based Learning in the Sciences.

Schneider, Stephen, NASA Earth Science Education Forum, Austin, Texas. November 15, 1999, "UMass Planet Earth,"

Smith, Andri, presentation: Nov. 1999, Invited Speaker for National Chemistry Week, American Chemical Society, Princeton, NJ Chapter: “An Interactive CD-ROM for Learning Organic Chemistry.” The CD-ROM includes tutorials on several different topics—including nomenclature, mechanisms, chemical reactivity, multistep synthesis, and spectroscopy.

Sternheim, Morton, “How to train effective science teachers.” invited presentation, joint New England sectional meeting of the American Physical Society and the American Association of Physics Teachers, April 14-15, 2000.

Sternheim, M. "How to train effective science teachers." invited presentation, joint New England sectional meeting of the American Physical Society and the American Association of Physics Teachers, April 14-15, 2000.

Sternheim, M., and Emery, C. "STEMTEC: The Science, Technology, Engineering, and Mathematics Teacher Education Collaborative." NSTA National Convention, Orlando, FL. April 7-8, 2000.

Sternheim, M. and Emery, C. NSTA National Convention, Orlando, FL. April 7-8, 2000. "STEMTEC: The Science, Technology, Engineering, and Mathematics Teacher Education Collaborative."

Vining, W., Woolf, B., & Hart, D. (1999). Web-based Intelligent Tutoring for General Chemistry. Presentation at the 27th Annual FIPSE Project Director's Meeting, Washington, D.C., October 8-10, 1999.

Woolf, B., Hart, D., Day, R., Botch, B., & Vining, W. (2000). Improving Instruction and Reducing Costs with a Web-based Learning Environment. Proceedings of the International Conference on Mathematics/Science Education & Technology. Pp. 410-415.

Yuretich, R., Schneider, S, Sternheim, M, Wolpin, A., Hargraves, H. and Dun, A., 1999, American Geophysical Union, Transactions, v. 80, No. 46, p. F128. This was presented at the AGU Fall meeting in San Francisco on December 17, 1999. "Successful Strategies for Introducing Earth Systems and Planetary Sciences into the K12 Curriculum."

Yuretich, R., (PI, UMass) gave a Professional Seminar at UMass, on February 4, 2000 titled "How Change Happens: Breaking the Teach as you were Taught Cycle in Science and Math".

Yuretich, R. and Little, R, conveners, "Effectiveness of K16 Collaboration in Geoscience Education." Geological Society of America, Northeastern Section Annual Meeting, New Brunswick, NJ, March 14, 2000.

Year 2 – 1998/1999

Brady, John, presented a paper at the Spring 1999 American Geophysical Union conference on his use of STEMTEC approaches in his courses.

Brady, John will present in Boston "Strategies for successful undergraduate Student/Faculty Research Projects," John Brady, J.T. Cheney, C.A. Manduca. American Geophysical Union.

Browne, S. "The effect of mentoring and changes in teaching science on retention of women and minorities," Materials Research Science and Engineering Center Annual Review, with faculty, graduate students and industrial sponsors, October 20, 1998 (Cycle I college faculty)

Browne, S. "Retention of minorities in science," Presidential Award for Excellence in Science, Mathematics, and Engineering in Mentoring Symposium, Washington, D.C., September, 1998.

Browne, S., "What is working at Mount Holyoke College", Conference on Mentoring in Science, Mathematics, and Engineering for Underrepresented Populations, First Meeting of Presidential Award Winners, Duke University, Nov 16-17, 1998.

Browne, Sheila, March 3-4, 1999, Bayer, West Haven, CT: Bayer Corporation National Council on Diversity, Plenary Speaker, "Mentoring and Enhancing Confidence in Science Courses", and participant in round table discussions on increasing diversity.

Browne, Sheila, April 8-9, 1999, Minority Engineering Program of the University of Massachusetts, Fourth Annual Teacher/Counselor Workshop Keynote Address, "Affective Measures and Peer Mentoring in Science Classes and Labs", and a Panel "What is Working at Mount Holyoke College".

Browne, Sheila, Summer 1999, NSF VCEPT (the Virginia Collaborative for Excellence in the Preparation of Teachers) Conference for Science Faculty in the State of Virginia, Mathematics and Science Colloquium at Mary Washington in Fredericksburg, VA: Plenary Talk, "How to Make Science Courses Inviting to Women and Minorities: Mentoring and Enhancing self-confidence".

Bruno, Merle, (6/4/99), "Use of Technology in a Case-based First Year College Course: Selected Topics in Human Biology " at the Technology '99 conference at Hampshire College.

Camp, C. "Using active learning strategies to deal with preconceptions in Newtonian mechanics". AAPT workshop. Yale. Fall, 1998 (Cycle II K12 faculty)

Condit, C. "Dynamic Digital Map Field Trips." Presentation by Chris Condit at "Technology 2008" conference, Boston, MA, November 1998. Cycle I college faculty.

Clement, John, and Khan, Samia, (1999). Strategies Reducing Science Anxiety in Female University Chemistry Students. Presented at the meetings of the National Association for Research in Science Teaching, Boston, 3/99.

D'Avanzo, C. "Project-based Teaching: Genuine Research Projects in Introductory Science Courses". Faculty Development Workshop, Smith College, June 16, 1999.

D'Avanzo, C. "Project-based teaching in first yeas courses at Hampshire College." Keynote speaker at workshop on community-based teaching in introductory courses, July 26, 1999

Davis, K. The authentic integration of computer technology in elementary preservice science teacher education." Northeast regional meeting of the Association of Educators of Teachers of Science, Syracuse, NY, October 1998.

Eisenberg, Murray, June 11, 1999, Northeast Section of the Mathematical Association of America, Colby College, ME: Active Learning, High-Tech and Low, In Class and Out (50 min. invited lecture)

Feldman, A., Dun, A. (Franklin County Technical School), and Rearick, M. (University of Hartford.) "Teaching and Learning Science with Computers: The Development of Instructional Technology Pedagogical Content Knowledge." Presented at the Annual Meeting of the National Association for Research on Science Teaching, Boston, MA, March 1999.

Feldman, A. and Flores-Cotte, E. “Stories of Faith, Fundamentalism, and Constructivism in Science Education.” A paper presented at the Annual Meeting of the American Educational Research Association, April 19-23, 1999, Montreal, Canada.

Feldman, Allan, “What Have We Learned from STEMTEC,” NSTA National Convention, Boston, March 26, 1999.

G. L'Heureux; B. Hagenbuch, “Our Changing Universe: Understanding the Nature of Nature: A cross-disciplinary Approach to Teaching College Science.” 3rd Annual Lilly Conference on College Teaching (Atlantic) Towson, Maryland 4/99

Gibson, Helen L.; Brewer, Lauren K.; Magnier, Jean-Marie; McDonald, James A.; Van Strat, Georgena A. “The Impact of an Innovative User-Friendly Mathematics Program on Preservice Teachers' Attitudes Toward Mathematics.” Annual Meeting of the American Educational Research Association, Montreal, Quebec, Canada, April 19-23, 1999).

Hart, D., Woolf, B., Day, R., Botch, B., & Vining, W. (1999). OWL: An Integrated Web-Based Learning Environment. Proceedings of the International Conference on Math/Science Education & Technology (M/SET 99), San Antonio, TX. March 1999. Pp. 106-112.

Hart, D., Slakey, L., Woolf, B., & Vining, W. (1999). Online Web-Based Learning (OWL): A Powerful Electronic Homework Model. Abstract and presentation at the Syllabus 99 Educational Technology Conference, Santa Clara, CA. July, 1999

Khan, S. & J. Clement. "Tracking participation and 'richness' in computer-mediated discourse in a college science course for teachers." Presentation by Samia Khan and John Clement (based on their analysis of the use of a course listserve), at conference on "Creating Alternative Learning Cultures: Culture, Cognition, and Learning," SUNY-New Paltz, November 1998. STEMTEC PI and evaluators.

Khan, S. and Clement, J. (1998), Tracking Participation and 'Richness' in Computer-Mediated Discourse in a College Science Course for Teachers. The Institute for the Study of Postsecondary Pedagogy, SUNY Eighth Annual Conference, Creating Alternative Learning Cultures: Culture, Cognition, and Learning. Ellenville, NY, 12/98.

Khan, Samia, and John Clement (1999). Listservs in the College Science Classroom: Tracking Participation and “Richness” in Computer-Mediated Discourse. Presented at the meetings of the National Association for Research in Science Teaching, Boston, 3/99.

Khan, Samia, and John Clement (1999). Strategies Creating a Classroom Community Designed to Improve Confidence in Female Chemistry Students. Paper presented at the Annual Meeting of the American Educational Research Association, Montreal, 4/99.

Leckie, M. and R. Yuretich. "Inquiry-based teaching in very large enrollment classes:

Examples from an oceanography course." Annual meeting of the Geological Society of America, Toronto, October 1998. Cycle I college faculty and PI.

Morelli, Meisha and Sandler,Adriane, presented a paper on the pesticide project, “Pesticide Levels in Drinking Water”, at the National Meeting of the Council of Undergraduate Research – 4/16/99. They also presented the same on 4/14/99 at the Capitol Building in Washington D.C.

Smith, Andri, presentation: Aug. 25, 1999, 218th Annual American Chemical Society National Meeting, New Orleans, LA: “CD-ROM-Based Interactive Tutor as a Pedagogical Tool for the Learning of Mechanisms in Organic Chemistry.” A.L. Smith, V.M. Rotello, D. Bak, W.J. Vining (UMass STEMTEC).

Year 1 - 1997/1998

Brewer, S. "Scaffolding faculty use of instructional technology." Conference on "Models from the Field: Teaching and Technology in the University." Boxborough MA, April 1998. (Cycle I technology team)

Browne, S. "The use of project based and community learning in science classes," Leadership Steering Committee presentation, Mount Holyoke College, April 1998.

Browne, S. " The value of mentoring and increased confidence for succeeding in science, Smith College Current Students/Future Scientists and Engineers Workshop Program (for K-12 teachers and guidance councilors in New England), July 14, 1998.

Browne, S. "Mentoring and enhancing confidence in science courses," Bayer Corporation National Council on Diversity meeting, and participant in round table on increasing diversity at

Condit, C. "Dynamic Digital Map Field Trips: A Hypermedia Based Earth Science Experience." Presentation by Chris Condit at Models from the Field: Teaching and Technology in the University," Boxborough, MA, April 1998. Cycle I college faculty.

Feldman and Sternheim, presentation about STEMTEC and led a panel discussion on incorporating curricular frameworks in preparing teachers of science and technology at the Massachusetts Department of Education (MA DOE) conference, “Integrating Curriculum Frameworks and Principles of Effective Teaching into Teacher Preparation” (Mount Holyoke College, October).

Members of the STEMTEC Chemistry Curriculum Team participated in a live, interactive satellite television seminar sponsored by the American Chemical Society and titled “Undergraduate curriculum reform: Its effects on high school and college level teaching.” STEMTEC sponsored the satellite link at the University of Massachusetts Amherst. (November).

Little, Dick of Greenfield Community College (Cycle I Geology Team Chair) is organizing the 1998 meeting of the National Association of Geoscience Teachers. The meeting will be held in May at GCC and members of Cycle I and Winter Series geology teams will make presentations about their STEMTEC experience.

Hart, D. "Software tools for creating interactive computer-based instructional systems." Models from the Field: Teaching and technology in the University, Boxborough, MA, April 1998. Cycle I technology team.

Kahn, S., Stoffolono, J., & Thayer, F. "Using insects in the classroom: A distance learning course." Presentation by Samia Khan (STEMTEC grad case study evaluator), John Stoffolano, and Faith Thayer (based on case study of Stoffolano's course "Insects in the Classroom") at conference on "Models from the field: Teaching and technology in the university," Boxborough, MA, April 1998. Cycle I college faculty, grad assistants.

O'Hara, P. "Service learning in the sciences". Wellesley College, Feb. 1998 . Cycle I faculty.

Robinson, M., L. Brewer, & A. Wolpin. "The STEMTEC Collaborative." Conference/ workshop sponsored by Mathematics and Education Reform, "Developing Leadership and Middle School Mathematics Education." Chicago, IL., May 1998. Cycle I college and K-12 faculty.

Sternheim and Thrasher met with Franklin County superintendents of schools and other K12 school administrators to describe the project, its impact on K12 faculty, and potential college-K12 collaborations (September).

Panel Discussions

Year 5 – 2001/2002

Davis, Kathleen – Panel: Kathleen S. Davis, University of Massachusetts, Amherst, Nancy Rapoport, Springfield Technical Community College, Tarin Weiss, University of Massachusetts, Amherst, Paige Bray, University of Massachusetts, Amherst, "Engaging Students in Equitable, Inclusive, and Participatory Science Activity: The Role of the Teacher, Pedagogy, and Educational Reform".

Pathways to Change Conference 2002.

Leckie, R.M., Goodwin, S., Weiss, T. & Little, R.D. "Effective Teaching and Learning through STEMTEC", Northeastern Geological Society of America Annual Meeting, March 26, 2002.

Whitworth, J.M., Davis, K.S., Doubler, S., Emery, C., & Murray, S. Researching out to teachers: Is on-line professional development the answer? Annual International Meeting of the Association for the Education of Teachers in Science, Charlotte, NC.

Year 3 – 1999/2000

Brush, Edward and Nelson, Greg, Center for the Advancement of Research and Teaching (CART), Bridgewater State College, Dec. 2, 1999. "Effective Teaching of College Level Science and Mathematics: A Panel Discussion by Members of the Bridgewater State College Science, Technology, Engineering and Mathematics Teacher Education (STEMTEC) Team,"

Year 2 – 1998/1999

Gerace, W., W. Leonard, C. Camp, C. and C. Emery. " Aligning perspectives and expectations for physical science curricula in high school and college." Panel presentation by Bill Gerace and Bill Leonard (UMass), Charles Camp and Chris Emery (Amherst Regional High School) at a conference on "The new high school graduate: What colleges can expect." Milford, MA December 1998. Cycle I college and K12 faculty.

Workshops

Year 5 – 2001/2002

Bruno, Merle – Workshop: Merle S. Bruno, Hampshire College, Christopher Jarvis, Hampshire College, Laura Wenk, Hampshire College, 1.5-2.0 hours, "Freshman Human Biology Students Solve Medical Cases Through Small Group Work". Pathways to Change Conference 2002.

Dufresne, Robert – Workshop: Robert J. Dufresne, University of Massachusetts Amherst, William J. Gerace, University of Massachusetts Amherst, William J. Leonard, University of Massachusetts Amherst, 3 hours, "Assessing-To-Learn (A2L): Reflective Formative Assessment Using a Classroom Communication System". Pathways to Change Conference 2002.

Engelson, Carol – Workshop: Patricia O'Hara, Amherst College, Wayne St. Peter, Hall High School, Carol Engelson, West Springfield High School, 1 hour, "Turning on the Light: Fluorescence Illuminates Science". Pathways to Change Conference 2002.

Gerace, William – Workshop: Robert J. Dufresne, University of Massachusetts Amherst William J. Gerace, University of Massachusetts Amherst, William J. Leonard, University of Massachusetts Amherst, 3 hours, "Assessing-To-Learn (A2L): Reflective Formative Assessment Using a Classroom Communication System". Pathways to Change Conference 2002.

Greeney, Bob and McChesney, Tom. "Seeing the Light" (integration of SEM 130 – Topics in Science with MTH 155 – Topics in Mathematics).

Hagenbuch, Brian. "Fantastic Voyage: Exploring the Diversity of Life" (integration of BIO 104 – Biology Today II with ENG 102 – Language and Literature II).

Hagenbuch, Brian. "On the Brink of Extinction: Science, Politics, and the Fate of the Earth" (integration of SEM 130 – Topics in Science with GVT 101 – Introduction to Political Science).

Hird, Anne. CART (Center for Advancement of Research and Teaching). Celebration of Teaching and Research V, Bridgewater State College, May 16, 2001. "Alternative Tools for Assessment".

Leonard, William – Workshop: Robert J. Dufresne, University of Massachusetts Amherst William J. Gerace, University of Massachusetts Amherst, William J. Leonard, University of Massachusetts Amherst, 3 hours, "Assessing-To-Learn (A2L): Reflective Formative Assessment Using a Classroom Communication System". Pathways to Change Conference 2002.

O'Hara, Patricia – Workshop: Patricia O'Hara, Amherst College, Wayne St. Peter, Hall High School, Carol Engelson, West Springfield High School, 1 hour, "Turning on the Light: Fluorescence Illuminates Science". Pathways to Change Conference 2002.

Peelle, Howard – Workshop: Howard A. Peelle, University of Massachusetts Amherst, “Teaching Mathematics with Computing”. Pathways to Change Conference 2002.

Year 4 – 2000-2001

Browne, S., (Cycle 1, Campus Coordinator) of Mount Holyoke College traveled to Jeddah, Saudi Arabia as a guest lecturer and advisor to a new Science College for Women (Effat College) being opened in 2001.

D’Avanzo, C., co-organizer, New England Science Faculty Enhancement Collaborative workshop, Hampshire College, June 20, 2000.

D’Avanzo, C. Faculty development workshop on student-active teaching in introductory level courses at Mount Saint Mary College, NY. May 18, 2000.

Year 3 – 1999/2000

D’Avanzo, C., Grant, B. W., and Musante, S. 2000. TIEE (Teaching Issues and Experiments in Ecology): Evaluation workshop. Ecological Society of America Annual Meeting, August 6-10, Snowbird, Utah (Invited participant workshop).

D’Avanzo, C., in October, 2000 gave a workshop at the Second Nature Conference, MA, called "Teaching Sustainability: How You Teach May Be More Important than What You Teach".

D'Avanzo, C. Workshops on Student Active Teaching in Introductory Marine Courses. Biannual meeting of the Estuarine Research Federation (ERF), New Orleans. September 25-28, 1999.

D'Avanzo, C. Annual Ecological Society of America Meeting, Workshop on Student-active Teaching in Introductory Undergraduate Courses, August, 1999.

D'Avanzo, C. August 5, 1999. Workshop on student-active teaching in the ecology curriculum, Unity College, Unity ME.

D’Avanzo, C., co-organizer, New England Science Faculty Enhancement Collaborative workshop, Hampshire College, June 20, 2000.

D'Avanzo, C. Faculty development workshop on student-active teaching in introductory level courses at Mount Saint Mary College, NY. May 18, 2000.

O’Hara, P., Professor of Chemistry at Amherst College, working with Phyllis Eisenberg of the Amherst Regional High School and Richard Blatchly of Keene State College, led a two-day seminar with chemistry teachers on March 13 and 14, 2000 on “Seeing is Believing: Introduction to Molecular Modeling”.

Wenk L. and D’Avanzo C. December 10-13, 1999. “Comparison of scientific reasoning skills in first year students at Hampshire and Mt Holyoke Colleges, MA, USA.” International Conference on Science Education, University of Camaguey, Cuba.

Year 2 – 1998/1999

Bruno, Merle. (6/8/99) workshop on Student Active learning for faculty from the Colleges of the Fenway and Emerson College at Simmons College

D'Avanzo, C. June 9, 1999. Project-based Teaching. Faculty Development Workshop, The Fenway Consortium, Boston, MA.

D'Avanzo, C. Ecological Society of America workshops on student-active teaching in ecology courses, Spokane WA, August 7-9, 1999

Feldman, Allan. Workshop leader for Three Communities Connected by a River, a secondary school teacher professional development workshop funded by the Eisenhower professional development program. Marshfield, MA. February 23 and June 22, 1999.

Year 1 - 1997/1998

Bruno, M & C. Jarvis. Workshop on Problem-Based Learning (New England Science Faculty Enhancement Collaborative, Hampshire College, June 1998) (Cycle I and Cycle II college faculty)

D'Avanzo, C. Workshop on inquiry-based teaching in introductory ecology courses at the national meeting of the Ecological Society of America (August) and two teaching workshops on student-active teaching in introductory college courses and using the Internet for student investigations at the national meeting of the Estuarine Research Society (October). D’Avanzo also has agreed to co-lead a workshop on student-active teaching in ecology courses for the 1998 annual meeting of the Ecological Society of America. Bayer, West Haven, CT, March 3-4, 1999.

Symposia

Year 5 – 2001/2002

D'Avanzo, Charlene – Symposium: Charlene D'Avanzo, Hampshire College, Diane Ebert-May, Michigan State University, Laura Wenk, Hampshire College, Neil Stillings, Hampshire College, Richard Yuretich, University of Massachusetts, "Evaluating Critical Thinking" or "Why College Science Faculty Should Learn About Research and Evaluation of Higher Order Thinking". Pathways to Change Conference 2002.

Hagenbuch, Brian, Hicks, Kim, and Dutcher, James. AACU National Learning Communities Conference, Providence, RI. Integrating the Arts and Sciences.

Hagenbuch, Brian, Hicks, Kim, Greeney, Robert, and James Knapp. The goal of SENCER is to develop model courses for dissemination that teach science through complex, capacious issues. SENCER Summer Institute HCC's STEMTEC participation was leveraged in our application to participate in a new NSF project called SENCER (Science Education for New Civic Engagements and Responsibilities).

L'Heureux, Gerry and Hagenbuch, Brian. Co-presented a 3-day National Science Foundation Short Course, "Cross-Disciplinary and Interdisciplinary Approaches in Teaching College Science" at Christian Brothers University in Memphis, TN, 5/30/01-6/9/01.

L'Heureux, Gerry, Bergquist, Erica, Marsha White, and Brian Hagenbuch were active participants in the Learning Communities "Open House 2001" Conference at Holyoke Community College under the auspices of the New England/Mid-Atlantic Learning Communities Network sponsored by the Washington Center for Improving the Quality of Undergraduate Education on 10/17/01.

L'Heureux, Gerry, principal speaker and presenter at Montgomery College's (Maryland) Critical Literacy Professional Development Workshop, "Creating a Montgomery College Learning Community," January 17, 2001.

L'Heureux, Gerry and Vasu, Ileana, co-presented a 3-day National Science Foundation Short Course, " Creating a Learning Community: An Interdisciplinary Approach to Teaching College Science and Mathematics to Liberal Arts Students" at Christian Brothers University in Memphis, TN, 5/29/02 – 5/31/02

Macdonald, R.H. and Yuretich, R.F., convenors, "Strategies for Promoting Active Learning in Large Entry-Level Courses" Geological Society of America Annual Meeting, Boston, MA, 11/5/01.

Sternheim, M., Hamos, J. (UMass President's Office), J. Russell (UMass Dartmouth), and others, "UMass Faculty Commitment to Standards-based K-12 Mathematics & Science Education," a proposed AAAS symposium, February 2002.

Yuretich, R.F. “Making Active Learing Work in Large Classes”, National Association of Geoscience Teachers Distinguished Speaker. Sessions: Pennsylvania State University, 3/13/01; Kansas State University, 4/4/01; Case Western Reserve University, 4/21/01.

Yuretich, R.F. “Active and Collaborative Learning in Your Classes” workshops given at: Pennsylvania State University Summer Teaching Academy, 7/13/01; Pennsylvania State University Winter Teaching Academy, 1/4/02; MMSTEC (Maine Collaborative) Winter Teaching Academy, 1/26/02.

Year 4 – 2001/2000

Yuretich, R. and Little, R., convenors, “Effectiveness of K16 Collaboration in Geoscience Education.” Geological Society of America, Northeastern Section Annual Meeting, New Brunswick, NJ, March 14, 2000.

Year 3 – 1999/2000

A Special Symposium: PI Richard Yuretich and Richard Little (Greenfield Community College) conveners, "Effectiveness of K16 Collaboration in Geoscience Education." Geological Society of America, Northeastern Section Annual Meeting, New Brunswick, NJ, March 14, 2000.

- Jamros, S., (Athol Middle School) "College and Middle School Field Trip Collaboration"
- Leckie, R.M. and Yuretich, R., "STEMTEC Develops Successful Strategies for Student-Active Teaching and Learning in Very Large Geoscience Classes"
- Little, R., "Go 'Hollywood': Create High Quality Videos for your Classroom and Beyond"
- Reid, J., "Exploring the Tuplomne River: an Interactive CD ROM on Fluvial Processes"
- Yuretich, R., "The STEMTEC Experience: K-16 Collaboration Improves the Quality of Geoscience Education”

L’Heureux, Gerry, Hagenbuch Brian, and Dutcher, Jim (Humanities, HCC) attended the SENSER symposium at the AAC&U Annual Con. in Washington D.C. 1/2000.

Year 2 – 1998/1999

Browne, S. "Affective measures and peer mentoring in science classes and labs" (symposium talk), Conference on Mentoring in Science, Mathematics, and Engineering for Underrepresented Populations, First Meeting of Presidential Award Winners, Duke University, Nov 16-17, 1998.

Poster Presentations

Year 5 – 2001-2002

Galton, Ayala – Poster: Ayala Galton, Hampshire College, Tom Murray, Hampshire College, Larry Winship, Hampshire College, Neil Stillings, Hampshire College, Esther Shartar, Hampshire graduate, "Supporting Teachers in Adopting Innovative Software-Based Inquiry Curriculum for Forest Ecology". Pathways to Change Conference 2002.

Year 4 – 2000/2001

Musante, S., D'Avanzo, C., & Grant, B. W., 2000. A digital site of pedagogical and interactive information to teach ecology developed through the ESA. Ecological Society of America Annual Meeting, August 6-10, Snowbird, Utah

Year 3 - 1999/2000

Roof, Steve, presented a poster, Oct. 23-29, 1999, to the Geological Society of America Annual Meeting, Denver, CO: "Teaching Science by Example: Real Problems, Real Data, All Classes, Every day." The poster focused on the STEMTEC-supported student-active projects added to the Hampshire class "Local and Global Climate Change". Over forty people visited the poster and exchanged ideas on student-active teaching and inquiry learning.

Journal Articles

Year 5 – 2001/2002

Special Issue of the Journal of Mathematics and Science: Collaborative Explorations, v. 4, contains the following papers from Pathways to Change Conference 2001:

Bruno, M.S and Jarvis, C.D., It's Fun but is it Science? Goals and Learning in a Problem-Based Learning Course. P. 9-24

Connors, E., The Thayer Method: Student-Active Learning with Positive Results, p. 101-117.

Dufresne, R., Hart, D., Mestre, J. & Rath, K. (in press) "The effect of Web-Based Homework on Test Performance in Large Enrollment Introductory Physics Courses." To be submitted to Journal of Computers in Mathematics and Science Teaching.

Eisenberg, M. Active-Learning in Sophomore Mathematics: A Cautionary Tale, p. 143-164.

Ganz, A., Phonphoem, A. and Wongtavarawat, K., Integration of Multimedia Interactive Web Tools with In-class Active Learning, p. 85-100.

Khan, S. and Clement, J., A Case Report of the Impact of Community Based Projects, Current Issues, and Analogies in an Introductory Biology Course at a Community College: Erica Berquist, Instructor, Holyoke Community College.

Khan, S.A., Clement, J., Developing Inquiry Skills in Chemistry Students Using Multiple Compact Simulations: William Vining, Instructor, U. of Massachusetts.

Khan, S.A., Clement, J., Strategies to Revitalize Student Interest in Chemistry and Recruit Future Science Teachers (submitted).

Khan, S.A., Clement, J., Listservs In The College Science Classroom: Evaluating Participation and "Richness" in Computer-Mediated Discourse (submitted).

Khan, S.A., Clement, J., Creating a Classroom Community Designed to Improve Confidence in College Women Studying Chemistry (submitted).

Khan, S.A, Clement, J., Teaching Strategies Designed To Change The Undergraduate Experience for College Women Learning Chemistry (submitted).

Khan, S.A., Clement, J., Leckie, R.M. and Yuretich, R.F., Increasing student interest in science via active-learning methods in a large oceanography course (submitted to Journal of College Science Teaching).

Kunkel, J.G., Project- and Group-based Learning in Junior Writing in Biology, p. 25-42

Mestre, J., “Implications of Research on Learning for the Education of Prospective Science and Physics Teachers” Physics Education, 36 #1, 2001, 44-51.

Mestre, J.P. & Cocking, R.R. (2002, in press). Applying the science of learning to the education of prospective science teachers. In R.W. Bybee (Ed.), Learning science and the Science of Learning: 2002 Yearbook of the National Science Teachers Association. Arlington, VA: National Science Teachers Association.

Mestre, J. & Cocking, R. “Applying the Science of Learning to Science Teaching.” 2002 Yearbook of the National Association for Research in Science Teaching.

Mullin, W.J., Teaching Innovations in an Introductory Physics Course for Non-Science Majors, p. 165-172.

Prattis, S., and Czerwiecz, I., Examination of Student-Active Learning Practices in a College-Middle School Educational Collaboration, p. 43-60.

Rabin, M.S.Z., Experiences and Thoughts on STEMTEC-Inspired Changes in Teaching Physics for Life Science Majors, p. 173-183.

Rapoport, N., The STCC Science Teaching Intern Project, p. 61-70.

Tyson, J.A., The Impact of a National Science Foundation CETP on an Undergraduate Chemistry Course for Non-Chemistry Science Majors, p. 71-83.

Yuretich, R. F., Khan, S.A., Leckie, R.M. and Clement, J.J., 2001 Active-learning methods improve student performance and scientific interest in a large introductory oceanography course. Journal of Geoscience Education, v. 49, p. 111-119.

Yuretich, R.F. and D’Avanzo, C.A., An Introduction to STEMTEC and Pathways to Change. P. 1-7.

Year 4 – 2000/2001

Special Issue of the Journal of Mathematics and Science: Collaborative Explorations, v. 4, contains the following papers from Pathways to Change Conference 2001:

Ganz, A., Wongthavarawat, K., and Phonphoem, A. W., "An Internet Technology Course for IT Curriculum: Integration of Multimedia Interactive Web Tools, In-class Active Learning, and Community Participation," Fifth World Multi-Conference on Systems, Cybernetic, and Information (SCI 2001).

Peele, H.A., Alternative Modes for Teaching Mathematical Problem Solving: An Overview.

Year 3 – 1999/2000

Hart, D., Slakey, L., Woolf, B. (2000). Using OWL to Improve Instruction and Reduce Costs in Large-Enrollment Classes. Syllabus 2000 Educational Technology Conference, Santa Clara, CA. July 2000.

Leckie, R.M., and Yuretich, R.F., 2000. STEMTEC Develops Successful Strategies for Student-Active Teaching and Learning in Very Large Geoscience Classes. Geological Society of America, Abstracts with Programs, v. 32, No. 1, p. A-29.

O'Hara, Patricia, Sanborn, John, and Meredith Howard, "Pesticides in Drinking Water: Project Based Learning Within the Introductory Chemistry Curriculum, Journal of Chemical Education (76) p1673-1677, December 1999.

Woolf, B., Hart, D., Day, R., Botch, B., & Vining, W. (2000). Improving Instruction and Reducing Costs with a Web-based Learning Environment. Proceedings of the International Conference on Mathematics/Science Education & Technology. Pp. 410-415.

Yuretich, R., 2000. The STEMTEC Experience: K-16 Collaboration Improves the Quality of Geoscience Education. Geological Society of America, Abstracts with Programs, v. 32, No. 1, p. A-83.

Yuretich, R., 1999, "Student-Active Teaching Incorporates Research into Geoscience Classes: an Outcome of the STEMTEC Project". American Geophysical Union, Transactions, v. 80. No. 17, p. S3.

Year 2 – 1998/1999

Cohen, N.L., Laus, M.J., Beffa-Negrini, P., Cluff, C., Volpe, S.L. and Dun, T. FASEB Journal 12(5): A823 (1998)." Nutrition education for teachers via the World Wide Web."

Cohen, N.L., Laus, M.J., Beffa-Negrini, P., Cluff, C., Sternheim, H. and Dun, T. FASEB Journal 13(5): A867 (1999). "Outcomes of Internet-based nutrition education of teachers" (

Cohen, N.L., Beffa-Negrini, P., Cluff, C., Laus, M.J., Volpe, S.L., Dun, T., and Sternheim, M. Nutrition Science Online: Professional development for secondary school teachers using the World Wide Web. J. Family and Consumer Sciences Education (accepted).

Year 1 - 1997-1998

D'Avanzo has had accepted for publication in the *Journal of College Science Teaching* a paper titled "The K-16 Continuum: What College Science Faculty Can Learn About Change From School Teachers".

Published Abstracts of Presentations at National Conferences and Professional Meetings

Year 5 – 2001/2002

Condit, C.D., 2001, Using Dynamic Digital Maps Interactively in Large Geology Courses. Geological Society of America, Abstracts with Programs, v. 33, No. 6, p. A-125.

Dufresne, R., Gerace, B., Leonard, B. & Mestre, J. "Creating an item for in-class formative assessment." The Interactive Classroom [Newsletter for Interactive Classroom Teaching and Learning], pp. 1,3 (Spring 2001).

Rhodes, A.L., 2001, Using a Mock Trial to Develop Scientific Literacy and Communication Skills in an Introductory Environmental Geology Course. Geological Society of America, Abstracts with Programs, v. 33, No. 6, p. A-64.

Sammons, J.I., Murray, D.P., and Reid, J.B., 2001, The National Aeolian Detritus Project: A Student-Controlled, A Standards-Based Research Opportunity for Middle and High School Student. Geological Society of America, Abstracts with Programs, v. 33, No. 6, p. A-352.

Yuretich, R.F., 2001, Cooperative Examinations in Large Classes: An Example from Oceanography at the University of Massachusetts. Geological Society of America, Abstracts with Programs, v. 33, No. 6, p. A-63.

Year 4 – 2000-2001

Jamros, S.M., and McMenamin, M.A. 2000, College & Middle School Field Trip Collaboration. Geological Society of America, Abstracts with Programs, v. 32, No. 1, p. A-26.

Leckie, R.M., & Yuretich, R.F., 2000, STEMTEC Develops Successful Strategies for Student-Active Teaching and Learning in Very Large Geoscience Classes. Geological Society of America, Abstracts with Programs, v. 32, No. 1, p. A-29.

Little, R.D. 2000, Go "Hollywood": Create High Quality Videos for Your Classroom and Beyond. Geological Society of America, Abstracts with Programs, v. 32, No. 1, p. A-31.

Reid, J.B., Jr., Kidder, J.D., Ramirez, M.A., & Woolf, B., 2000, Exploring the Tuolomne River: an Interactive CD ROM on Fluvial Processes. Geological Society of America, Abstracts with Programs, v. 32, No. 1, p. A-68.

Yuretich, R., 2000, The STEMTEC Experience: K-16 Collaboration Improves the Quality of Geoscience Education. Geological Society of America, Abstracts with Programs, v. 32, No. 1, p. A-83.

Year 3 – 1999/2000

Jamros, S.M., and McMenamin, M.A., 2000. College & Middle School Field Trip Collaboration. Geological Society of America, Abstracts with Programs, v. 32, No. 1, p. A-26.

Grants

Year 4 - 2000/2001

Goodwin, S., (Cycle1,UMass) received a Pew Foundation grant to further revise his STEMTEC courses in Biology to incorporate a Web-based class preparation element to his class.

Year 3 – 1999/2000

Grant received: "UMEB: Preparing Students for Careers in Environmental Biology – A Massachusetts Partnership." 255,000 for four years. (July, 1999). NSF. Mentoring and internships for biology undergraduates from UMass and 3 community colleges; career information, including teaching. Elizabeth Brainerd (Biology), Susan Prattis (Biology, Hampshire) and others.

Grant received: "Identifying and Understanding the Effects of SMET Education Undergraduate Reform on K16 Teachers." Allan Feldman and Kathy Davis, Education. Approved for one year at $59,972; an expanded version will be proposed.

Grant received: Noyes Foundation, $10,000, to support PALMS participants in statewide workshop.

Grant received: $12,000 President's Office Professional Development in Instructional Technology grant. Morton Sternheim (Physics), Nancy Cohen (Nutrition) and David Hart (Computer Science) to develop web based "CyberSeminars".

Grant received: Julian Tyson, American Chemical Society, $10,000 per year for two years, "Preparing Future Faculty." Includes STEMTEC participants at other colleges.

Grant received: Julian Tyson, NSF/ILI award of $60,000 with institutional match of $60,000. "Making valid measurements in analytical laboratories" Sept 98 - Aug 00

Grant received: Richard Yuretich, NSF CCILI grant, $87,045, "Improving instruction in geochemistry using project-based learning and modern analytical techniques".

Grant received: Allan Feldman and Kathleen Davis (Education), "Orchestrating Engagement in Science and Mathematics for All Through the Inclusion of Frameworks-Based Curricula in Preservice Teacher Education." One-year (1998-99), $14,000. Funded by PALMS, the MA SSI

Grant received: Allan Feldman, co-PI, Eisenhower grant, "Three Communities Connected By A River: Building Sustainable Communities Through the Science & Technology, Math, History & Social Studies." Marshfield, MA. (Academic year 1999-2000).

Salem State College, part of the extended Statewide Collaborative, received PALMS (SSI) funding in 1998-99 and 1999-2000 allowing a regional collaborative in the northeastern part of the state to hold college faculty development workshops.

Other grants received and discussed above: renewal for year 3, NASA Planet Earth project; NSF/Operation Primary Physical Science for *Moving Objects*; Massachusetts Department of Education for *Bridging the Gap.*