

II.A.1 STEMTEC Activities and Impact (organized in accordance with the objectives stated in the Cooperative Agreement)

STEMTEC's cooperative agreement with NSF stipulates five central project objectives and a number of sub-objectives. The following documents how STEMTEC's 2001/early 2002 activities helped fulfill these objectives, and the impact these activities have had within the Collaborative. As STEMTEC developed over time, the formation of a strong Collaborative, faculty development, and the Student Program were STEMTEC's major thrusts. As the project wraps up, the focus has turned to dissemination and evaluation, toward the goal of institutionalization of STEMTEC for continuity beyond the STEMTEC grant. Current activities reflect these changes in focus and maintenance of the achieved goals.

Cooperative Agreement Objective #1: To establish an ongoing collaboration among the Five Colleges, Incorporated consortium (the University of Massachusetts Amherst and Amherst, Hampshire, Mount Holyoke and Smith Colleges) with the three area community colleges (Springfield Technical, Holyoke, and Greenfield Community Colleges) and the neighboring school districts (Springfield, Holyoke, Amherst, Hadley, Northampton, South Hadley, and Franklin County). In order to effect this change, the following activities are planned:

- Establish a Management Team to meet monthly to include a Council composed of the five Principal Investigators, campus coordinators, mentor teachers and a representative of the evaluation team to provide direct administrative supervision.

➤**2001/2002 Activities and Impact:** The five principal investigators and STEMTEC support staff (the "PIE" group) continued to meet bi-weekly (summaries of those meetings are provided in *Appendix A*). The discussions and information exchange at the weekly PIE meetings continue to serve as the primary opportunity for communication and planning. Members of the new external evaluation team, all of whom are at UMass, have been able to attend some of the regular PIE meetings as necessary.

The STEMTEC Coordinating Council also continued to meet monthly (excluding the summer and holiday breaks) to exchange information and plan for the years beyond the grant. (The Minutes from those meetings is also included in *Appendix A*.) STCC STEMTEC participant and mathematician Lauren Brewer joined the group, replacing Georgena Van Strat. The external evaluation team members attend some of the regular Coordinating Council meetings as well; the campus coordinators have expressed much interest in the evaluation, particularly with respect to the Student Program. To this end, the Pre-Education Steering Committee members met with the Campus Coordinators in December. As STEMTEC looks towards institutionalization and continuation of the project beyond 2002 and dissemination, these regular meetings of the Coordinating Council become increasingly important. In addition, STEMTEC HQ and the evaluators provided regular updates. These meetings served as the forum for inter-campus exchange of information and ideas amongst college and K12 participants. Council members regularly updated the Council with news from their own campuses; from this news, other Council members could bring ideas back to their own campuses. The presence of the PIs, evaluators, Collaborating College members, and K12 participants result in a unique and diverse population for providing insight and expertise about the needs of local schools and of students preparing to be teachers, and about the resources the colleges might have for addressing these needs.

- Establish a Board to meet semiannually to include the Council, deans of the eight campuses involved, and the superintendents of the eight school districts involved to act as an advisory, planning and policy body.
- **➤2001/2002 Activities and Impact:** The spring 2002 STEMTEC Advisory Board meeting was held on April 10th at Amherst College's Alumni House. Massachusetts Department of Education Commissioner David Driscoll joined us to speak to the Board on the topic of New Certification Requirements. Now, that the project is no longer in the planning stages, the Advisory Board did not meet during the following fall.
- Establish a Curriculum Council to meet four times a year to include chairs of the curriculum teams involved with reform, the PIs and a member of the evaluation team to act as a coordinating and review body for course development.

➤2001/2002 Activities and Impact: Regular meetings of the Curriculum Council have been discontinued. The Curriculum Councils continue to meet within some STEMTEC institutes.

Cooperative Agreement Objective #2: Redesign the curriculum, field experiences and selected science, mathematics, and education courses so as to reflect current research on teaching and learning and to encourage cross-disciplinary conversation. Courses will be inquiry-based and interactive in format. Science courses will include hands-on laboratory experiences. In order to effect these changes, the following activities are planned:

- Within the first two years, redesign of ten science and mathematics introductory courses currently taken by students preparing to be teachers; two each in biology, chemistry, geosciences, physics and mathematics.

➤2001/2002 Activities and Impact: This objective addresses the first two years of the project; components of Objective #2 have been met and exceeded. STEMTEC continues to support and recognize reform; the latest step toward this goal is getting new faculty involved through the new Faculty Fellows Program, which began in Spring 2002, with workshops, Roundtable discussions and formative assessment opportunities for new faculty from across the Collaborative. Through this program STEMTEC targets the re-design of math and science courses that many first and second-year students take, in order to impact the largest number of students (and many elementary educators as well). STEMTEC continues to showcase "STEMTEC approved courses" through listings on the web.

- Develop two new courses with a strong technology focus: *"Science, Mathematics and Technology,"* and *"Using Technology in the Science Classroom."*

➤2001/2002 Activities and Impact: Although course reform has ceased to be the main focus of STEMTEC, promotion of integrating the use of educational technology (multimedia and presentation software; classroom electronic response systems (Classtalk and infrared systems); online web-based homework (OWL); computer based simulations; electronic student portfolios; spreadsheets and graphing software; video; digital cameras; electronic probes, software design, etc.) into the mainstream content and methods courses continues to be addressed, especially within the Roundtables and by presentations at the "Pathways" conference. This integration of the use of technology into the mainstream of courses has been our main technology focus.

A new course with an online component was piloted in fall 2001: EDUC 706 (see course website at: <http://www-unix.oit.umass.edu/~afeldman/beingnewteacher/newscienceteacher.html>). It's a capstone course that continues initial teacher education into the first years of teaching. The course, which is delivered partially through the Internet, is called Being a New Math and Science Teacher. Topics include: Classroom management, Formative and summative assessment, Web-based instruction, Inclusive pedagogy, Writing in science, Student research, and Teacher research. This course will be offered either fall or spring semester each year.

Many of the STEM Education Institute talks have focused on educational technology. These talks included:

- April 3, 2001 - Pleasures and Difficulties of Non-synchronous Distance Learning on the World Wide Web, Josephine Ryan: Department of Nursing, UMass
- April 17, 2001 - Asking the Right Questions in an Age of Technology: Student Active Learning, Steve Goodwin,: Department of Microbiology, University of Massachusetts
- October 2, 2001 - Engineering – A Marvelous Integrator for All Learners (K-16), Martha N Cyr, Ph.D., Director, Center for Engineering Educational Outreach, Tufts University
- October 16, 2001 – Using Technology to Facilitate the Use of Formative Assessment in Physics Courses, Allan Feldman, UMass School of Education; Aaron Kropf, Val Veneman, Chris Emery, Michael Cunha, Amanda Rappold, and Evie Huguenin.
- November 6, 2001 - Reducing the Distance in Distance Learning, Mark Schlesinger, Associate Professor and Director, Communication Program, University of Massachusetts Boston and John Jessoe: Director, Distance Learning and Video Production Center, UMass Boston.
- November 20, 2001 - Teaching the Nutrition On-Line Course to Traditional and Non-traditional Students : Factors Related to Student Success in Online Learning, Nancy Cohen, UMass Amherst, Nutrition Department, Patsy Beffa-Negrini and Brian Miller
- December 4, 2001 - Learning Science and Engineering Through Teaching Teachers Sarina Ergas, UMass Amherst College of Engineering, Department of Civil and Environmental Engineering
- February 19, 2002 - Victoria Dowling, University Without Walls, University of Massachusetts, Amherst, Learning Online and On Campus: How the Weekends@UWW Program Finds the Right Mix.

The *Pathways to Change 2001* Conference also featured educational-technology-related talks:

- Asking the Right Questions in the Age of Technology: Student Active Learning in the Large Classroom, Randall Phillis, University of Massachusetts Amherst, Biology
- The Nutrition Online Experience: A Comparison of Internet Education for Traditional and Non-Traditional Undergraduates and K-12 Teachers, Nancy Cohen, University of Massachusetts Amherst, Nutrition, Brian Miller, University of Massachusetts Amherst, Hotel, Restaurant & Travel Administration

- O.M.N.I. Listservs: An Effective Application of College Technology in Support of K-12 Teachers and Teacher Preparation, James Ebert, Nancy Elliott and James Reuben, SUNY, College at Oneonta, Earth Science
- Handheld Technology: A Catalyst for Student Active Learning, Ed Connors, University of Massachusetts Amherst, Mathematics, Mary Ann Connors, Westfield State College, Mathematics
- Ultimately effect redesign of at the minimum 74 courses.

➤**2001/2002 Activities and Impact:** Our web site currently lists 122 “approved” STEMTEC courses within the original Collaborative, well above the goal of 74 in the agreement, and definitely understates the number of courses that have been reformed by the original Collaborative. STEMTEC faculty report that once they began to reconceptualize the objectives for their “official” STEMTEC course, they can’t help but teach all their courses in the same manner, as reflected in the current evaluation report. In addition, STEMTEC activities continue to “spread” within Departments as well, in part due to having several faculty members sharing a course or teaching the same course. In addition, some STEMTEC faculty members have not chosen to have their courses listed among the “approved” courses, and those courses undoubtedly also reflect a STEMTEC influence. A new course was added last year, EDUC 706 (see course website at: <http://www-unix.oit.umass.edu/~afeldman/beingnewteacher/newscienceteacher.html>). It’s a capstone course that continues initial teacher education into the first years of teaching. The course, which is delivered partially through the Internet, is called Being a New Math and Science Teacher. Topics include: Classroom management, Formative and summative assessment, Web-based instruction, Inclusive pedagogy, Writing in science, Student research, and Teacher research. This course was piloted in fall 2001 and will be offered either fall or spring semester each year. To this list we will add the courses revised by the new Faculty Fellows.

- Provide field (teaching) experiences as part of the regular science and mathematics curriculum in addition to the prescribed experience in the field.

➤**2001/2002 Activities and Impact:** STEMTEC continues to promote teaching experiences through its redesigned courses as a way to interest students in teaching as a career, as a way to enhance student learning, and as a strategy for providing diverse, high-quality teaching experiences to students already committed to a K-12 teaching career. A detailed student survey will help us to assess whether our goals are being reached; in addition, Teaching Experiences were the focus of the Spring 2001 Coordinating Council meetings. In addition, informal and formal teaching experiences are requirements for the Teaching Scholars and for the Pre-Education program as well.

A sampling of partnerships providing K12 teaching experiences for college students:

- **Amherst College:** In Patricia O’Hara’s Chem 11 (Introductory Chemistry) class first-year students traveled to five different classrooms in Amherst ranging from 1st through 11th grade; Amherst College also hosted visits by Roger Wallace’s 6th grade students from Fort River Elementary School, and Phyllis Eisenberg’s students from Amherst Regional High School.

- **Hampshire College:** Several STEMTEC teaching scholars and faculty facilitated hands on science workshops for the Day In The Lab and the Girls Day in the Lab, run by STEMTEC campus coordinator Sarah Buckley.
- **Holyoke Community College:** Students from L’Heureux/Maiorettesi’s seminar in Science and Math Education worked with K12 students in local schools.
- **UMass:** Students from Phys 100/597T- Electricity and Magnetism (Emery/Murray) and NSM/Educ 197a-Exploring Teaching in Science and Math (Feldman & Yuretich) participated in K12 teaching experiences. Students from Kathy Davis’ EDUC 462 (Teaching Science in Elementary School) worked in local elementary schools. Julian Tyson’s CHM 312 students participated in K12 teaching experiences. In addition, some of the chemistry graduate students in the Preparing Future Faculty program are getting teaching experiences in local colleges.
- **Teaching Scholars:** All of the teaching scholars are required to participate in teaching experiences.

Community service/learning communities are becoming increasingly important on many campuses, in particular (in our Collaborative) at Amherst College, UMass and Holyoke Community College (through Community Partnerships for Social Change). These provide opportunities for students to become involved in community classrooms, and at the same time, provide for possible inroads for institutionalization of teaching experiences. In addition, at Hampshire College, the new Education Studies Program and Center for Innovative Teaching emphasize hands-on involvement in community schools.

In-Class Teaching Experiences

As mentioned in earlier reports, peer tutoring is now the norm in a number of STEMTEC courses, in a variety of ways.

Cooperative Agreement Objective #3: To recruit and retain promising students into the teaching profession, with particular attention to students from underrepresented groups, through the development of an "apprentice teacher" program to be offered to students starting in their freshman year. In order to effect these changes the following activities are planned:

- Offer teaching opportunities to all science and mathematics majors as part of regular courses, volunteer activities and/or special seminar courses.

➤**2001/2002 Activities and Impact:** See discussion above.

- Increase the number of science and mathematics majors electing to teach through identifying and advertising to all students (including students not identifying themselves as teacher preparation candidates) teaching opportunities in existing science, mathematics, technology courses and programs throughout the participating institutions.

➤**2001/2002 Activities and Impact:** The Summer/Fall certification option for secondary math and science, in cooperation with the University of Massachusetts Secondary Teacher Education Program (STEP) in the School of Education, is heading into its third year. It enables students to more quickly fulfill the standard state certification requirements and increases the capacity of the STEP Program at the same time. Details on the Summer/Fall program are included in *Sec. II.A.5* and *Appendix B*.

With the introduction of serious changes in the certification requirements in the state of Massachusetts and UMass' discussion of a science/math education minor, the Pre-Ed program as such was discontinued. Most of the Pre-Ed students were enrolled at the university, and this new program will serve those students. In addition, there is some confusion about participation of elementary educators and community college students in this program, and there is significant overlap/competition with the STEMTEC Teaching Scholars Program.

Hampshire College has introduced a new program in Educational Studies, led by an interdisciplinary group that includes STEMTEC PI Charlene D'Avanzo. While it is not a certification program as such, it starts students on a path towards careers in informal education settings or towards certification. It includes an option for a ninth semester at reduced tuition to facilitate student teaching. Details are on the web at <http://www.hampshire.edu/academics/programs/edstudies/>.

Teaching Scholars Program

Another mechanism for encouraging students to explore their interest in science and math teaching continues to be the Teaching Scholars Program. In the fourth round of NSF/STEMTEC Teaching Scholar awards, the Board selected 57 Teaching Scholars and eight Distinguished Teaching Scholars, again, representing all campuses of the Collaborative and majors across the sciences, mathematics, and education fields, including biology, chemistry, computer science, education, earth science and geology, engineering, environmental science, liberal arts, mathematics, nutrition, physics, and psychology. A list of the recipients is included in *Appendix B*, along with scholarship application materials and other scholarship-related documents. The fifth round of scholarship nominations and applications is occurring during the spring of 2002.

With the aid of the new evaluation team, we have gained some ground in tracking the progress of former Teaching Scholars. We have been able to track some forty-five STEMTEC Teaching Scholars who accepted teaching positions thus far.

Student Services Director Palmer and/or Student Program Coordinator Tyler held STEMTEC information sessions on each campus, along with the campus coordinators and STEMTEC Teaching Scholars. These sessions offer a range of information, from how to achieve teacher certification, to scholarship requirements, to STEMTEC courses students can register for, to teaching opportunities available to all students. In addition to these campus sessions held each semester, STEMTEC sets up information booths at special events, such as the Majors Fair and Job Fairs at UMass, ALANA (Asian, Latino/a, African-American and Native American Honor Society) orientation and Career Fairs. Advertisements are placed in student newspapers and newsletters and

- Establish a set of K-12 teachers and science and mathematics faculty to act as mentors (ten in year one, fifty in subsequent years) to help students in their teaching experiences, write reflective papers on these experiences and help these students appreciate the value of a teaching career.

►**2001/2002 Activities and Impact:** As described in earlier Annual Reports, 48 K-12 faculty have been participants in STEMTEC workshops. They continue to serve as mentors or potential mentors for undergraduates interested in pre-practicum and practicum teaching experiences and serve as unofficial mentors to the Teaching Scholars. STEMTEC teachers participate regularly in

seminars on math and science teaching on the various campuses in the Collaborative. Additionally, a number of college faculty are supporting teaching experiences in K-12 classrooms and are bringing K-12 teachers in as speakers to college courses. Former Teaching Scholars who are now teaching are also mentoring new teachers and Teaching Scholars in a variety of ways.

- Monitor the progress of students who have such teaching experiences to determine the effectiveness of such experiences as a recruiting aid for new teacher candidates.

➤**2001/2002 Activities and Impact:** Our evaluation team continues working to develop ways of determining the effectiveness of teaching experiences, as discussed above under Cooperative Agreement Objective #2, through questionnaires, interviews, and focus groups and through interactions with the campus coordinators.

- Establish a tracking system to identify, early in their academic career, all students preparing to be teachers and to monitor those who do elect to teach.

➤**2001/2002 Activities and Impact:** New state certification/licensure requirements have caused the educator preparation programs on the various campuses to re-vamp their programs. The end result is that for the time being, it is not a priority to identify entering students who might be on an education track; the campuses are looking to see first how these students might be serviced. New licensure requirements have certainly made licensure an elusive target, and this has a serious impact on education programs on campuses where that is not a priority. The courses taught by the new Faculty Fellows target introductory students, and it is hoped that some of these students will become interested in teaching. The NSF/STEMTEC Teaching Scholars are a group of students whose careers can be tracked; tracking the STEMTEC/NSF scholars is a task that has begun by going back to the first round of recipients and is in progress. In addition, the education departments at Amherst College, UMass and Mount Holyoke College are attempting to help STEMTEC evaluators to identify students with an interest in K-12 education.

- Recruit heavily from local high schools and among current science, mathematics, engineering and technology majors.

➤**2001/2002 Activities and Impact:** STEMTEC established 10 scholarships of \$1,000 per year to be given to high school students around the region. These scholarships unfortunately have been underutilized; only two 2001-2002 awards went to high school seniors. For the 2002-2003 awards, STEMTEC has targeted mailings to regional guidance counselors, principals and superintendents, and PALMS teacher-leaders with information about STEMTEC and the scholarships.

Additionally, information on teaching and the STEMTEC scholarships was given to the 600 incoming students of the Commonwealth (Honors) College at UMass; Tyler spoke with them en masse as part of their orientation. The same information was made available at the Science Days held at UMass for 1000 regional high school students (October 2001).

- Increase the number of women and minorities preparing to be science and mathematics teachers, especially those living in inner cities and poor rural areas. Targets are 20% minority representation in students preparing to be science and mathematics teachers by year 3.

➤**2001/2002 Activities and Impact:** While we met the 20% minority representation targeted in year 3, the number of NSF/STEMTEC scholarship awards granted to students from

underrepresented minorities fell to about 11% with the 2001-2002 group, again somewhat less than the overall demographics of the Collaborative institutions as well as of the state (see *Section A.II.9* below). Generally minorities have been underrepresented in teacher education programs relative to the campus demographics. STEMTEC continues to target information towards minority student groups and advisors at the various campuses, and we will closely monitor the demographics of the Pre-Education Program students as well. We will continue our targeted mailings and visits with on-campus minority student groups, but will try to be more pro-active in soliciting applications. This is a difficult issue.

We are clearly more on-track with regards to gender; three-quarters of the Teaching Scholars are female. The majority of our teaching scholars are interested in secondary math and science teaching, where women are currently sparsely represented.

In addition, we have a large number of participants (some 42%) in the Teaching Scholars group from another under-represented group: returning students.

A number of papers have been written and a number of talks have been presented by Collaborative members who are studying the problem of female and minority involvement in classrooms (see *Section II.A.9*). However, all these studies have not resulted in our ability to attract large numbers of underrepresented minorities to the Teaching Scholars program. Faculty members have noted, anecdotally, increased participation in the classroom.

- Support novice teachers through a system of mentor teachers, PALMS teacher leaders, email and internet access, semiannual meetings of program graduates, and offering a graduate seminar in education for new science and mathematics teachers.

➤**2001/2002 Activities and Impact:** STEMTEC's "New Teacher Support" program continues to be very successful. For the past two years, STEMTEC has sponsored a New Teachers Support Group that meets approximately every three weeks at the Five College Consortium. The group started small, composed of graduates from the Five Colleges and former Teaching Scholars. During the past year, it has doubled in size, but still remains small enough to function as a support group; generally a dozen teachers attend each session. The first part of the each session is devoted to informal talk time, allowing each member of the group an opportunity to bring particular problems or questions, or share a moment of triumph. The second part of the evening is planned by more formally by the two facilitators (the "veteran" teachers are STEMTEC K12 middle school teacher Emily Case and former Teaching Scholar and elementary school teacher Maury Bohan), and focuses primarily on curricular and content issues, but also addresses concerns such as managing the classroom and working with veteran teachers and administrators. We feel that that this kind of support group is really critical for new teachers because it provides them with a place to talk openly about their doubts, their vulnerabilities, and small victories. (It's a "safe" place to share.) It is, however, clearly only one of the many support mechanisms that new teachers need in order to remain in the field. Other programs such as peer mentoring and ongoing professional development in their discipline are generally offered through their school district. The current New Teacher Support program also includes mini grants to implement hands-on curriculum (e.g. many teachers need to buy materials with their own money). In addition, new teachers are taking advantage of the workshops and STEM Talks and the Science and Engineering Saturday Seminars offered through the STEM institute.

Cooperative Agreement Objective #4: Establish mechanisms to enable the science, mathematics and engineering faculty and mentor teachers to continually learn about and

implement new techniques in pedagogy. In order to effect these changes, the following activities are planned:

- Establish two cycles of faculty, K-12 workshops in years one and two. Cycle I will have a three-week summer workshop in year 1, academic year follow-up sessions, and one week follow-up workshops in summers 2 and 3. Cycle 2 will follow a similar sequence one year later. The focus of the workshops is course redesign.
- Recruiting at a minimum eighty mathematics, science, engineering or technology faculty.
- Conduct campus-wide and multi-campus seminars, and workshops to encourage faculty to implement STEMTEC findings and successes.

➤**2001/2002 Activities and Impact:** Sixteen new faculty members from the STEMTEC campuses are New Faculty Fellows (see *Appendix H*).

The Roundtable met regularly (three times per semester) at Five Colleges, Inc. The past several Roundtables have had decreasing attendance, however, and the Roundtable concept is now under discussion.

Also continuing are the STEM Talks jointly sponsored with the STEM Education Institute at UMass. These talks are held on alternating Tuesdays and bring a range of speakers to campus to address issues of math and science education reform and teacher preparation. Both college and K-12 faculty as well as STEMTEC Teaching Scholars attend the talks. Attendance ranges from 10-25 per talk. A list of 2001/2002 STEMTalks is included in *Appendix G*.

Cooperative Agreement Objective #5: Establish dissemination mechanisms.

- In collaboration with Continental Cable Corporation, produce a video highlighting good teaching practices in science and mathematics.

➤**2001/2002 Activities and Impact:** The 25-minute video, entitled *How Change Happens* was completed in October 1999; a teacher's guide to accompany this video was also produced; they are being distributed through commercial channels, with the distributor "Films for the Humanities & Sciences". A new recruiting video is just being completed, entitled: *Turning on to Teaching Science and Math*.

- Host an international conference to highlight best practices developed through STEMTEC.

➤**2001/2002 Activities and Impact:** The international conference *Pathways to Change 2002* is scheduled for April 18-21 2002. See *Appendix C* for further information, including speakers and talk/panel/workshop titles.

- Publish in discipline-centered periodicals such as *Science* and *The American Scientist* and present at the annual meeting of discipline centered professional societies as well as publish in more education oriented publications.

➤**2001/2002 Activities and Impact:** This topic is addressed in much more detail in *Section II.A.6* below. Abstracts from selected talks from *Pathways 2000* were published as a special

volume of *The Journal of Mathematics and Science: Collaborative Explorations* (Vol. 4., No. 1, spring 2001). STEMTEC continues to encourage faculty to disseminate their work by helping identify potential publication outlets and conference sessions on pedagogy, and by providing financial support for travel to conferences. We in the early stages of planning a retreat for next fall to encourage faculty, many of whom are more familiar with mathematics and/or science research, writing, and journals, to write up their pedagogical findings and to help them find the appropriate journals for publication.

II.A.2. Accomplishments Compared to Strategic Plan Milestones

STEMTEC reached most of the milestones it set for itself in its updated 2001 strategic plan. Below, we list the milestones the project reached during 2001 or early 2002, and then list and discuss those milestones yet to be reached or changed.

For clarity, program areas organize the strategic plan. The overlapping connections of these areas to the project goals will be noted. For convenience, we list these goals again:

Goal 1: Establish a functional educational collaborative

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 3: Improve the preparation of future K-12 teachers of mathematics and science

Goal 4: Recruit and retain promising students into the teaching profession, with special attention to underrepresented groups

Goal 5: Develop a program to support new science and math teachers in their first year in the classroom

Goal 6: Establish dissemination mechanisms

Goal 7: Conduct strong programs of evaluation and assessment

Supporting the Collaborative (Goal 1): As discussed before, the core STEMTEC Collaborative includes eight colleges and the neighboring school districts; over 160 college and K12 faculty have participated in the STEMTEC workshops. The Statewide expansion efforts brought the number of Collaborative campuses to 21. The new Faculty Fellows Program expands this list further. Activities designed to continue to support and enhance the collaboration for the next year include:

- *Monthly meetings with the STEMTEC Coordinating Council.* Meetings turned toward a focus on mechanisms for maintaining STEMTEC reform past the grant. To this end, campuses are planning on-campus events for the Teaching Scholars groups, since the post-grant period will not have the same sort of infrastructure the grant affords. The first was held in February at Hampshire College, hosted by Hampshire Teaching Scholars.

- *Semi-annual meetings of the STEMTEC Advisory Board (spring, fall).* The spring 2001 STEMTEC Advisory Board meeting was held on April 10th at Amherst College's Alumni House. Department of Education Commissioner David Driscoll joined us to speak to the Board on the topic of New Certification Requirements. Now that the project is no longer in the planning stages, the Advisory Board did not meet during the fall.

Curriculum and Faculty Development (Goals 2-3): While the major thrust of faculty development within the Collaborative was in the first years of the project, faculty development efforts continue. We continue to work with faculty from within the original Collaborative in the following ways:

- *Faculty from all three cycles continue to attend the STEMTEC "Pathways to Change" Institutes/workshops, modeled after a research conference; Pathways 2001 was in June. Pathways 2002 is the international conference, to be held in Washington, D.C. in April 2002.*
- *STEMTEC's list of "STEMTEC-approved courses is currently posted on the STEMTEC web site and is used to produce special flyers during registration periods on each campus.* The new Faculty Fellows courses will be added to this listing.
- *STEMTEC is also developing a larger list of introductory courses that have not yet been "reformed" but typically may serve pre-teacher candidates. These are the courses targeted by the Faculty Fellows program.*
- *Continue to co-sponsor with the STEM Education Institute a bimonthly lecture series and half- and full-day workshops on math and science education for STEMTEC and non-STEMTEC faculty (January-May, September-December)* See the listing of talks in *Appendix F*.
- *Keep participants informed via e-mail, web site, newsletter (year round).* The website is updated constantly; in addition, funds have been set aside for the development of websites at each member institution, as we look beyond the STEMTEK grant. The most recent STEMTEK newsletter was published in spring 2001. Participants are notified of STEM talks and other opportunities via e-mail.
- *Increase participation of math faculty, initially through meeting with Portia Elliot, of the School of Education at UMass.* Despite concern and confusion over changes in the state licensure requirements, there are fifteen students in the STEP Program intending to teach secondary mathematics, double the recent average. In addition, a higher percentage of the Summer/Fall Certification Option applicants to the 2002 program are mathematicians.

Goals not met or changed:

- *Hold monthly STEMTEC Roundtables at the Five Colleges consortium (February-May, September-December).* In 2001, three Roundtables were held in the spring, and three were scheduled for the fall. However, waning enrollment at the first fall events resulted in a cancellation of the third, while STEMTEC PIs try to decide how best to continue conversations with STEMTEC faculty. In the meantime, the Faculty Fellows program has continued in this Roundtable vein.
- *Offer formative evaluation through PI Feldman and his graduate assistant, and train faculty in self-assessment techniques (January-December).* Faculty do not seem to be interested in this opportunity at this time. However, formative assessment will be offered to the faculty in the Faculty Fellows program.

Statewide Initiative (Goals 1-3; 6): STEMTEC's major statewide expansion was concluded with the 2000 Statewide Institute, bringing the total of STEMTEC campuses across the state to 21 and

including schools which now influence half of the teachers prepared in the state. Expansion efforts at this point include inviting Statewide partners to participate in the Pathways Conference (1999 Statewide Institute Partners participated in Pathways 2000, and members of both Statewide Institutes participated in Pathways 2001 and are scheduled to participate in the international conference).

Recruiting and Preparing Future Teachers (Goals 3-4): STEMTEC accelerated its program of teacher recruitment and preparation.

1. New Certification Options: *During spring 2001, flyers were sent to all New England Campuses with identifiable math and/or science departments and to every math or science junior or senior in the five colleges. Inquiries and applications have arrived from New York and New Hampshire in response to these flyers. Acceptances will be sent out in April or May for the summer/fall option. Ten students entered the summer-fall program in 2001; of these ten, nine completed their studies upon certification and one student is continuing with studies. Of the nine that completed the program, five left with full-time teaching positions, and two had positions pending. Applications have begun to come in for the 2002 summer/fall option. (Thus far, eleven completed applications have been received; they continue to come in until the start of the program at the end of May.) In addition, the summer coursework will also serve the students in the new GK12 program on campus.*
2. Scholarships: *The STEMTEC Scholarship Advisory Board continues to advise on scholarship policies and to serve as selection body for scholarship recipients. During 2001 and later years, we will:*
 - *Explore options for continued support to fund the scholarship program past STEMTEC, initially through meetings with the NSM and Education Development Officers (underway in fall 2000). These talks continue, and we are working with Development Officers on individual campuses in an attempt to secure some funding to maintain some aspects of the Teaching Scholars Program, most likely with campus-based support. However, this is a difficult issue, in that in order to secure funding for STEMTEC, the campus development officers must be careful not to place STEMTEC in competition with other campus-based proposals for support, and the involvement of eight campuses makes this it a very complex issue. In addition, STEMTEC PIs work to secure other sources of scholarship funding for future teachers.*
 - *Award the next round of scholarships in June 2001. Sixty-five Teaching Scholar awards were announced for 2001-2002 (see Appendix B). Applications for the 2002 summer/fall options and the 2002-2003 Teaching Scholars program are being accepted at this time.*
 - *Contact STEMTEC participants, high school and college advisers, minority support groups, and other student groups to encourage applications (January - March annually). Recruitment has continued for the 2002-2003 teaching awards. We have made an increased effort to encourage high school students to apply; for example, Student Services Director Palmer has visited a number of local high schools and has spoken directly to teachers and students regarding the scholarships.*
 - *Hold information sessions on all eight campuses (Feb. - March annually). As STEMTEC looks to a more campus-based support system, many campuses are holding their own information sessions rather than relying on STEMTEC Student Services Officers.*

- *Hold award banquet for scholarship recipients (early fall).* The 2001-2002 Teaching Scholars banquet was held on October 2, 2001, and featured keynote talks given by Patricia O'Hara (Professor Chemistry at Amherst College), a K12 teacher with whom she works, Roger Wallace (of Fort River Elementary School in Amherst, MA), and a former student and now collaborator, Juma Crawford (AC '98, now a 9th grade teacher at Codman Academy). Incidentally, the latter two are both African-American gentlemen.
- *Collect applications for the Summer/Fall program 2001 in March, for the 2001-2002 academic year in April.* Six Summer/Fall Teaching Scholar Awards were granted, and sixty-five academic year awards were granted.
- *Hold biweekly events for Scholars (academic year, annually).* In addition to STEM Talks, nineteen Teaching Scholar events were scheduled for the 2001-2002 academic year.

Goals not met or changed:

- The Pre-Education Program: *Now that the Math and Science Pre-Education Program has become an official program, recruitment is of the essence.* Limited enrollment and low rates of completion, perhaps resulting from competition with the very successful Teaching Scholars Program that pre-dated it, caused STEMTEC to reconsider the structure of the Program. Since most of the participants were UMass students, when UMass responded to changes in the state licensure regulations by instituting a formal science/math education minor, STEMTEC withdrew this program.
4. Awareness: STEMTEC has ongoing programs designed to foster an awareness of science and mathematics teaching as a desirable career. Some specifics:
- *STEMTEC faculty talk about teaching in their classes (throughout project)*
 - *STEMTEC faculty use teaching methods demonstrated to support women and underrepresented groups (throughout project)*
 - *STEMTEC courses model good teaching (throughout project)*
 - *STEMTEC courses advertised separately from other science and math courses (April and November annually and on the Web at all times).* As more students turn to on-line catalogs and registration, the course listing is now only maintained on the web-site, which allows constant updates of information.
 - *Professional brochures distributed about science and math teaching and the pre-education program (advising and recruitment periods)*
 - *STEMTEC participates actively in campus majors and career fairs, including those with a minority student focus (each semester) Information sheets and meetings with students in science, mathematics, and engineering to inform them on career options and certification requirements (each semester).*
 - *Information on teaching career options and NSF/STEMTEC scholarships sent to high school guidance counselors (each winter/spring)*
5. Teaching Experiences: STEMTEC encourages math and science majors to do some kind of teaching either in the schools or on the college campus as a way to improve their own understanding as well as a way to test their interest in teaching as a career.

- *Continue to connect STEMTEC college and K-12 faculty interested in incorporating teaching experiences through a system of home page “want ads” and the Student Services Office (January-December)*
 - *Continue to work directly with STEMTEC teacher/mentors to provide and advertise teaching experiences not connected to specific STEMTEC courses (January-December)*
 - *Continue to work to develop connections with local organizations (e.g., science museums, environmental groups, astronomy clubs) that might offer student internships or other “informal” science teaching opportunities (January-December)*
 - *Continue to offer NSM/EDUC 197A “Exploring Math and Science teaching” at UMass (spring semester) and at other campuses as well; “Explorations in Math and Science Teaching” at Holyoke Community College is offered in spring 2001 for the second time.*
 - *Continue to collaborate with the winter term school internship programs at Amherst, Hampshire, and Smith Colleges (each January)*
6. Integration of disciplinary majors with teacher education: STEMTEC is fostering cooperation between the science and math faculty and the teacher education program. Specific examples include:
- *Develop and continue the joint teaching of courses by SMET and Education faculty (e.g. at UMass, NSM/EDUC 197A)*
 - *Develop and continue the joint teaching of courses by SMET and K12 teachers (At UMass, “Theories of Teaching and Learning,” Physics Honors 04; “Electricity and Magnetism for Teachers”, Physics 100/597T) (both, every spring semester)*
 - *Continue to promote the Science Major re-designed in 1998 at UMass for middle school science teachers (January - December), new science and math education transfer options at the community colleges, and the instigation of education tracks within science and math majors and education minors on other campuses*
 - *Continue to promote a revised physics major at UMass intended to better serve potential physics teachers (January - December)*
 - *Continue to promote an earth systems major in the Geosciences Department at UMass designed for prospective earth science teachers. (January - December)*
 - *Continue to offer at UMass, GEO 497A “Geoscience Teaching” (each semester)*
7. Improved teacher training: New options have been or will soon be established on several campuses, and several STEMTEC activities are in place to support the science and math preparation of all teachers. A major addition to teacher preparation within the Collaborative includes Hampshire College’s new Education Studies Program, the result of growing Hampshire faculty and student interest in issues related to teaching and learning in contemporary society. The program provides varied opportunities for study on campus and in the community. Some specific activities for 2001 and beyond include:
- *Continue to promote Liberal arts/science and math teaching transfer programs approved at Greenfield, Holyoke, and Springfield Technical Community Colleges in 1998 and 1999. These programs are particularly important in improving the diversity of the prospective teachers. (January - December)*

- *Continue to promote the science/math teacher education options at Amherst College, Hampshire College, and Mount Holyoke College. Some of these opportunities may be reduced by changes in the state licensure requirements.*
- *Continue to promote the new certification options for math and science teachers established at UMass*
- *Continue to work with elementary and secondary teacher preparation advisors on all campuses to guide students toward STEMTEC courses (every semester)*
- *Prepare and distribute a Five College list of STEMTEC Math and Science and Education and related courses for prospective science and math teachers to facilitate inter-campus registration (every semester). STEMTEC approved courses at all eight campuses are advertised on the website at all times.*
- *Obtain approval for a UMass minor in science and math education*

Goals not met or changed:

- *Continue to promote the Pre-Education program. This program will no longer be promoted; instead, at UMass the science and math education minors will be promoted.*
8. Minority recruitment *(in part through collaboration with the Francis Perkins (Mt. Holyoke) and Ada Comstock (Smith) Scholar programs, and the University's UWW (University Without Walls) program, programs which have a relatively larger representation of non-traditional students) (in progress).*

Supporting New In-Service Teachers (Goal 5): Activities to support new teachers in the Pioneer Valley during 2001 and beyond are extensions of similar activities in earlier years. Specifics:

Workshops for K-12 teachers during the academic year. Recent informal surveys indicated that K12 teachers prefer content-rich workshops, and workshops will be modified along these lines. Offered in cooperation with the STEM Ed Institute, the Saturday Science and Engineering Saturday Seminars at UMass Amherst are designed for teachers in grades 5-9 and offer educational materials and PDPs for teachers completing the program; these were offered in the spring and fall of 2001 and are in progress in spring 2002. In addition, teachers from the New Teacher Support Group are invited to the STEMTEC Teaching Scholar events, offering workshops on content as well as on such topics as classroom management, special education, and such.

- *Compilation of a list of all new math and science K12 teachers hired for the academic year (September each year)*
- *Content mentor support lists (lists of K12 and college faculty willing to serve as content resources) will be updated and distributed each fall.*
- *Continue to provide Internet accounts on UMassK12 for all new teachers who need access (September-October)*
- *Compilation and continued maintenance of a list of science and mathematics courses taught at the eight campuses at times when teachers can take them (April-December)*

Goals not met or changed:

- *Continue to provide a mentor for all new math and science teachers who desire a mentor (September-October).* State requirements have made school and district-based mentors a requirement for new teachers. Our program therefore offers informal mentoring through the New Teacher Support Group, but no assignment of formal mentors.

Dissemination (Goal 6): Dissemination becomes increasingly important as the project continues and looks to wind down; an impressive list of presentations, papers, and products for this report period appears elsewhere. Our efforts in support of this dissemination include the following activities:

- *Continued distribution of the STEMTEC video, “How Change Happens”, and accompanying teacher’s guide.* In addition, a “recruitment” (to the field of teaching) video has been produced, entitled *Turning on to Teaching Science and Math*.
- *The Summer Institute 2001 “Pathways to Change 2001”, will be modeled after a research conference, with innovative math and science education products highlighted, and with participation from all campuses in the Collaborative.* Pathways 2001, held in June, is detailed in Appendix C. Pathways 2002, the international conference, is scheduled for April 18-21, 2002 in Washington, DC.
- *Continued planning for the 2002 International Conference.* Conference details are in Appendix C.
- *Development of a comprehensive Dissemination Plan, in consultation with our evaluation team*
- *Continued distribution of travel funds to regional and national conferences for faculty presenting papers on course redesign and educational reform (January-December)*
- *Continuation of encouraging faculty, and providing support where possible, to submit articles for publication in referred and non-referred outlets (January-December)*
- *Continued development, maintenance, and advertisement of a list of potential outlets for faculty presentations concerning STEMTEC reforms (January-December)*
- *Publication of the STEMTEC newsletter, STEMTREK, and updates in the Five College Partnership Newsletter.*
- *Continued maintenance and development of the STEMTEC home page with its extensive links to project materials and other educational resources (substantial revisions are continuing, the most recent based on meetings with campus coordinators and with an eye towards usefulness post-STEMTEC)*
- *Development of individual campus STEMTEC web sites linked to the main web site at UMass with financial and technical support from STEMTEC.*
- *Continued advertisement of the Teaching Scholars Program and STEMTEC courses in student newspapers, admissions offices, and posters on the various campuses of the Collaborative (January-December)*

Evaluation (Goal 7): In summer 2000, a new evaluation team came on board. This team continues to develop, along with the internal evaluation team, a comprehensive evaluation plan that will eventually deal with many project components, with a current focus on analysis of past data and evaluation of the student programs, evaluations of student learning in STEMTEC classes, and dissemination and sustainability of the project. The present draft evaluation plan appears elsewhere in this report.

1. Other activities:
 - *Continue organizational documentation (January-December)*
 - *Continue collection of NSF Impact Data (January-December)*
 - *Continue collection and analysis of Student Demographic Information and Career Interest data, using revised survey forms (January-December). For details, see the separate Evaluation Report.*
 - *Conduct classroom observations in STETMEC courses (Spring 2001). For details, see the separate Evaluation Report.*
 - *Continue tracking students participating in the Pre-Education Program, the Teaching Scholars program, and STEMTEC K-12 teaching opportunities, documenting the impact of such experiences (January-December)*
 - *Continue distribution to STEMTEC PI's and faculty of summary reports of evaluation team (January-December)*
2. Summative Evaluation: *will be conducted by Evaluation Team Sireci, Berger, Slater, and Zanetti (through end of project and perhaps beyond). In addition, a proposal for a supplement to cover continued evaluation has been submitted.*
- 4 Evaluation of Teaching Experiences Program: *The two-fold purpose of the study is to begin to explore a) the extent to which and b) the ways in which teaching experiences affect students. Interviews will be conducted with students who are currently taking and/or who have taken courses which include a teaching experience or who are participating in teaching experiences throughout the student program. To complement ongoing STEMTEC efforts, students will be selected from the Amherst, Smith, Mount Holyoke and Hampshire College campuses. Interviews will follow two broad lines of inquiry: "How did the experience affect the student's conceptions of teaching and learning?" and "How did the experience affect the student's future plans?" . The evaluation team is interviewing focus groups of students.*

Goals not met or changed:

- Formative evaluation: *Formative evaluation will continue to be conducted by Feldman and a graduate assistant, Brenda Capobianco, hired to assist with the formative evaluation process; they will offer faculty formative course evaluations and workshops on formative evaluation. Faculty members do not seem interested in formative evaluation at this time. These efforts will be renewed within the new Faculty Fellows program.*

II. A. 3. The Nature of Inter-and Intra-Institutional Collaborations Effected

In earlier annual reports, we discussed in some detail the context of teacher education in Massachusetts and the nature of our original collaborative. For convenience, we list some of the salient points, updating the information where appropriate.

- Sixty private and public colleges and universities are approved to prepare students for teaching. More than half the students enrolled in teacher preparation programs attend private institutions.

- UMass, Smith, and Mount Holyoke, have a wide range of certification programs at all levels, and they produce many more science and math teachers than any other institution in Massachusetts except perhaps Harvard.
- Although the Massachusetts Department of Education defines requirements for the various certifications and administers teacher tests, there is little articulation among the programs, and they differ in major ways even within similar institutions such as the state colleges. The state does, however, require an undergraduate arts and sciences major or its equivalent for all teachers, and a major in their discipline for secondary teachers; future teachers do not major in education. This means that for many students with demanding majors, especially future science and math teachers, teacher education courses must be deferred until after completion of the bachelor's degree.
- STEMTEC's design reflects this teacher education environment, and offers a model of national importance for training science and math teachers in research universities and liberal arts colleges. Students graduate from these institutions with very strong academic backgrounds and have the potential to become leaders in K12 education.
- The original STEMTEC collaborative includes the Five Colleges with its long and unique history of cooperation among private liberal arts colleges and a public research university. Amherst is noted for its excellent undergraduate science and math programs. Mount Holyoke and Smith are women's colleges with records of accomplishment in attracting young women to science and mathematics careers. Hampshire is a leader in promoting student-active learning and in making science meaningful for all students. UMass is the largest public university campus in New England, and it has excellent graduate programs in many fields including science, mathematics, engineering, and education; advanced undergraduates have the opportunity to take graduate courses and to be involved in the research programs.

The three community colleges have close ties to the University by virtue of joint admissions and transfer articulation agreements and send significant numbers of transfer students to Smith and Mount Holyoke Colleges. Springfield Technical Community College serves an ethnically diverse urban area, and focuses on preparing students for careers in hi-tech and medical services areas. Holyoke Community College is in a city with a large Hispanic population, and has pioneered programs to attract and support these students. Greenfield Community College serves Franklin County, a largely rural area, and enrolls many poor and older students from old mill towns with high unemployment rates; it is the poorest county in Massachusetts.

The school districts also vary considerably in their characteristics. In Springfield and Holyoke, the majority of the students are African American or Hispanic. In Amherst, home of three of the colleges in the consortium, there are many recent immigrants from Asia and elsewhere, as well as significant numbers of African American and Hispanic students. Also, as noted, Franklin County has many low-income residents.

Inter-Institutional Collaboration

Traditionally, the connections among the eight colleges were most apparent at the student level. Students in the Five Colleges could cross register, and community college students could transfer readily to complete their degrees. With a few exceptions, faculty members at one of the Five Colleges had little or no contact with their counterparts in the other institutions, and even less with the community college faculty. STEMTEC has built connections between science, math, and education faculty in different institutions (and within institutions) that did not exist.

STEMTEC continues to use two bodies to facilitate communication and foster inter-institutional cooperation:

- The Coordinating Council consists of coordinators from each campus (except UMass) and three representative K12 faculty members. The PI's meet monthly with this group to share information and ideas, identify problems, and encourage campus and collaborative efforts. In the past two years, the group has focussed on ways to institutionalize efforts on each campus. For example, each coordinator is arranging for a STEMTEC web site on his/her campus linked to the main STEMTEC web site. Funding is provided to develop the sites. Funds have also been made available for faculty development workshops on the individual campuses.
- The STEMTEC Advisory Board consists of Deans and School Superintendents from the participating colleges and school districts. It meets once or twice a year to keep informed on STEMTEC's progress, and to offer support. The meeting held in April, 2001 featured the Massachusetts Commissioner of Education, David Driscoll, who discussed the latest revisions of the teacher certification requirements. The next meeting is tentatively scheduled for May, 2002, and will focus on continuing the STEMTEC agenda after the funding ends in July, 2002.

Some indicators of success at the inter-institutional level associated with the summer institutes and curriculum teams:

- The original STEMTEC model included two cycles of summer institutes on student-active learning with a total of eighty college faculty. Each of the institutions in the collaborative filled its allocated slots, and in some cases sent additional faculty funded by rearranging other budget lines. With the addition of a shorter winter workshop series, STEMTEC had directly served a total of 108 faculty from these colleges by 1999. One more faculty member from the original eight colleges participated in the Summer 1999 Statewide Institute, and six more participated in the Summer 2000 Statewide Institute, bringing the total to 115.
- The new Faculty Fellows program, described in detail in *Appendix G*, has 16 participants. Fifteen are faculty members in our core collaborative; they represent the three community colleges, Smith, Hampshire, and UMass, and bring the total number of participants to 130. The other is from Framingham State (part of our expanded collaborative).

Intra-Institutional Collaborations

The STEM Education Institute at UMass continues to offer biweekly seminars that bring together a cross section of science, math, and education faculty and students from the area educational community. It also offered a half-day workshop in September 2001 led by UMass science education professor and STEMTEC participant Kathy Davis on ways to encourage women and minority students. A workshop on Teaching Large Courses will be held in September 2002.

STEMTEC has brought together UMass science and education faculty members who have submitted proposals to improve teacher preparation in science and technology. Our third proposal to the NSF GK12 program was successful; informal notice of its approval has been received, and recruiting is underway for fellows and teachers. A proposal for a NSF funded Center for Learning and Teaching is under preparation for submission in May. We also submitted unsuccessful proposals to NSF for an online MEd degree in science education and to NASA for a Broker/Facilitator center.

STEM is involved in a variety of programs for pre-service and in-service science teachers.

- Planet Earth summer workshop and academic year follow-up meetings. Funded through 2000 by NASA, this program continued in 2001 with Massachusetts Space Consortium and internal funds. It is taught by STEMTEC school and college faculty.
- Science and Engineering Saturday Seminars. Offered with the help of Raytheon Corporation funds and the cooperation of the Engineering School, this program served over 30 in-service teachers in the spring 2001 semester and again in the fall. Participants were able to earn graduate credits or “professional development points.” STEMTEC faculty will offer many of these seminars.
- Springfield based MS in science education. Started in 1997 in cooperation with the School of Education and the Springfield school department, this program will graduate its second cohort in May 2001. A new cohort start in 2001. This program will serve at least half the middle school science teachers in Springfield by the end of the third cycle. It is staffed largely by STEMTEC faculty.
- Online MS in science education. A web-based version of the Springfield program is under development. This will serve teachers in Massachusetts and elsewhere who cannot participate in traditional professional development programs because of their location or schedules. STEMTEC faculty are the core of the staff. NSF funding was unsuccessfully requested (see above), but local funds are being used to build the program. By this summer four courses will be developed and offered.

The Five Colleges Public School Partnership continues to offer a variety of professional development opportunities for area K12 Teachers. For the past two years, participating STEMTEC faculty members have offered two day workshops in Physics, Chemistry, and Mathematics as part of the Partnership’s Teachers as Scholars. In addition, the Partnership has worked closely with Amherst College Science Faculty to facilitate summer research fellowships for area K12

II.A.4. Changes in the Vision for Mathematics and Science Education on the Campuses Inspired by STEMTEC

Changes Within the Initial Collaborative

At the University of Massachusetts, which has the largest share of both STEMTEC faculty and pre-service teachers, the General Education Program is heavily influenced by STEMTEC. This program includes introductory-level science and mathematics courses with heavy enrollment by pre-service teachers. The methods being used by STEMTEC faculty in these courses are now being implemented by colleagues, who were not part of the program. Case in point is BIO 100, a large introductory course encompassing several class sections. Active learning and the Classtalk® communication system have become a feature of the instructional methods. Three STEMTEC alumni (Edward Chang, Steven Schneider and Co-PI Richard Yuretich) were active participants in the Hewlett Teaching Fellows program during 2001. This program, run by the UMass Center for Teaching and Learning, is designed to improve the learning environment in large general education courses. These are the typical courses where many pre-service teachers receive their basic science education. The other participants in the Hewlett program are spreading the STEMTEC experience to colleagues in other Departments, and will be further updating and revising courses in ways that promote the teaching profession. In addition, the experience of co-PI Yuretich in this program led directly to the development of the STEMTEC Faculty Fellows program (see below).

The idea of the summer institute as a professional conference, which was initiated with *Pathways to Change* during the summer of 2000, was recapitulated last year. On June 28, 2001 approximately 50 people gathered at the Lederle Graduate Research Center on the UMass campus to participate. Attendees and presenters were more diverse than in recent year, with a sizeable fraction from other colleges in New England and New York. In addition, we had several new and prospective teachers participating in the enterprise. We retained the successful two-way format that we had adopted for *Pathways 2000* and modified it for a one-day conference. Three sessions had three 20-minute oral presentations followed by a 30-minute discussion, and one session had a twenty-minute poster viewing also included. Fourteen reports involving 21 co-authors were given during the day (*Appendix C*). In true STEMTEC fashion, discussions were lively and animated! Evaluation of the conference showed that everyone appreciated the opportunity to see and hear what his or her colleagues were doing, and that our model for idea exchange was successful. We also got some good suggestions for modifying the format for future meetings, such as having a keynote speaker and panel discussions, which we implement for *Pathways International* in 2002. Conference abstracts are available at the STEMTEC web site.

Changes Beyond the Initial Collaborative

The impact of STEMTEC beyond the initial collaborative is now focused on the dissemination of our achievements in publications, workshops and professional conferences. These are detailed in the appropriate sections.

II.A.5 Modifications to Teacher Preparation Programs

Changes in Secondary Teacher Education in Math and Science at the University of Massachusetts

Two major changes are underway in the Secondary Teacher Education Program (STEP) at the University. The first is a development of a minor in secondary education. At this time the only academic program in secondary education available to undergraduates at the University is a certificate program. While this is attractive to some students, most math and science majors opt to enter the certificate program after completing their undergraduate degrees. The secondary education minor will allow undergraduates in math and science to explore teaching as a career and to begin the licensure process without making the commitment to a full semester of student teaching.

The second major change is in response to new licensure regulations in Massachusetts. New teachers in the Commonwealth must fulfill the requirements for Professional Licensure within five years of beginning to teach. One way to do this is with an "Appropriate" Masters Degree. According to the regulations an appropriate masters degree is one in which students take at least half of their credits in the academic discipline of the license. The Appropriate Masters Degree provided by the STEP program would have in-service teachers engaged in research with scientists and mathematicians in a program that contains the following elements:

- Spring ---> 3 credits intro to a research program
- Summer ---> 9 credits research
- Fall ---> 3 credits follow-up research and curriculum development
- Spring ---> 3 credits action research on implementation of action research

In addition to fulfilling the State's licensure requirement, the STEP Appropriate Masters Degree will serve as a research site for investigating the effects that an authentic research experience has on teaching. Possible research questions include:

1. Do middle and high school math and science teachers engaged in research studies gain knowledge and understanding of scientific and mathematical processes and methods that are in-line with those of experts? If so, how can we account for the learning that occurs?
2. If middle and high school math and science teachers do gain new knowledge and understanding of scientific and engineering processes and methods, how does that affect their teaching? Do they provide their students with opportunities to learn about the nature of science and engineering and about scientific methods? Do their students gain knowledge and understanding of scientific and mathematical processes and methods that are in-line with those of experts?

Additional funding for teachers and scientists and mathematicians for the research experiments is being sought through several NSF grants and the Research Experience for Teachers program.

In addition to these major changes, STEP has modified its program to reflect current research in teacher education. Performance assessments have become the norm for determining preservice teacher learning, and STEP students are placed in the field for at least two semesters. In addition, a capstone course has been added that continues initial teacher education into the first years of teaching. The course, which is delivered partially through the Internet, is called Being a New Math and Science Teacher. Topics include:

- Classroom management
- Formative and summative assessment
- Web-based instruction
- Inclusive pedagogy
- Writing in science
- Student research
- Teacher research

This course was piloted in fall 2001 and will be offered either fall or spring semester each year.

The Summer Fall Certification Option

The Summer/Fall Certification Option went through a second cycle in 2001. Ten students entered the program, representing a significant increase over the year before, and nine of those students completed the program and obtained certification at the end of the fall semester. Three of those nine worked as interns during the student-teaching phase. The tenth is still continuing studies. Of the nine that completed the program, five took full-time teaching positions and two had teaching positions pending, when STEMTEC collected the data.

This program serves a number of students from diverse backgrounds who might not otherwise be able to enter into a certification program. Two were mothers, returning to the University after many years, several had graduate degrees in scientific field and were adding teaching credentials; a few others were recently graduated (as in the 2000 class). We had one more 10-year teacher coming to be certified, this time, the teacher was working in one of the area's private schools, Northfield-Mount. Herman.

One of the mothers in this group, a 1977 graduate of UMass in biochemistry, commuted 80 miles to her classes over the summer. She found that she was stretched to the limits between meeting the demands of two teenagers and of the summer course work. She was able to find a student teaching assignment much closer to home, and the fall term passed with a greater sense of normalcy for her and her family.

Another student was attending the University finishing a Masters in Plant biology. She had taken a few education courses during the regular semester, and wanted to speed the certification process along. Single, living apart from her family (in New York State) she was able to avoid the conflicting demands on her time that faced the student described above. She went into the program intending to teach high school biology, but changed her plans after a very positive experience in her summer pre-practicum teaching middle school kids at a summer science camp. She decided to seek a dual certification in both middle and high school, and is now teaching middle school general science in the area.

The program is very intense, and the summer time period makes pre-practicum placements more difficult. A more complete summary of the program is in the separate *Evaluation Report*.

Teaching Scholars Program

In all, nearly 200 Teaching Scholars have been supported thus far (many for multiple years), representing all campuses in the STEMTEC Collaborative, including students who have just graduated from high school up to those in graduate programs seeking teacher certification. Of

those, at least 45 have accepted teaching positions. Of the remainder, at least nine are pursuing graduate/certification programs, intending to teach, and at least one is enrolled in a Ph.D./Educ. Program. At least 30 community college Teaching Scholars have continued on at the Five Colleges, which is a quite impressive rate.

There were 62 2000-2001 Teaching Scholars, including 5 Distinguished Teaching Scholars (and five Summer/Fall 2000 Teaching Scholars). Of those, 29 graduated in 2001, and fourteen of those are now teaching. Five others are seeking teaching positions. (Another six are in graduate programs, including four who are still intending to teach.) Nineteen who are still in school are now 2001-2002 Teaching Scholars.

There are 65 2001-2002 Teaching Scholars, including eight Distinguished Teaching Scholars (and six Summer-Fall 2001 Teaching Scholars). 2001-2002 Teaching Scholar events included: the Teaching Scholar Banquet, Project Learning Tree, The Real Jurassic Park, Certification Information Session, Springfield Science Museum, Classroom Management, Project Wet, Gee Whiz Chemistry, Math Without Tears, and the Massachusetts Environmental Education Society (MEES) Annual Conference. In addition, as we look towards the post-STEMTEC years, some campus-based Teaching Scholar groups are holding their own Teaching Scholars Events, such as one in Hampshire College in Feb. 2002.

Students have really appreciated the student events, stating that there is a "...wide range of events to stimulate interest in teaching and to show diversity of approaches that are possible in teaching." They said they provide an "...endless opportunities for engagement with peers and colleagues..."

All of the Teaching Scholars are involved in teaching experiences of some sort. Of these, they said they were "...a wonderful experience that helped cement my decision to pursue a career in teaching." They also said the teaching experiences were "...one of the most rewarding times of my life. I am confident that I want to teach for the rest of my life."

Last year's end-of year survey reflected these statements. For the question "Did your teaching experience and teaching scholar events increase your interest in teaching Math and/or Science?", the average response was 4.2 (on a scale of "not at all = 1, definitely = 5"). For "How likely is it that you will someday teach a math or science course?" the average response was 4.4.

The students raved about the program: "I think the existence of the program itself...is very important" and "STEMTEC is a wonderful environment to investigate the profession of teaching."

More details on the Teaching Scholars Program are in *Appendix B*.

II.A.6 Dissemination and Public Awareness Strategies and Activities

In the fifth year of the project, dissemination of the accomplishments of STEMTEC continues to be a high priority. The highlight was the special edition of the *Journal of Mathematics and Science: Collaborative Explorations*, which appeared in May, 2001, which contained twelve papers derived from the Pathways to Change Conference of June, 2000. In addition to planning an International Conference for April 2002 focussing on success stories associated with the project, other dissemination activities increased among participants. Dissemination includes a broad

range of activities. They are listed here by type, which helps to show the breadth of participation in the dissemination efforts.

The quality and range of dissemination activities stimulated by STEMTEC are extraordinary. STEMTEC faculty are giving workshops at national meetings, expanding our initial efforts on their campuses, publishing papers, and writing and receiving education grants for programs that amplify their influence.

Journal articles and similar publications

- Special Issue of the Journal of Mathematics and Science: Collaborative Explorations, v. 4, no. 1 (2001) contains the following papers from Pathways to Change 2000 Conference: Yuretich, R.F. and D'Avanzo, C.A., An Introduction to STEMTEC and Pathways to Change. p. 1-7.

- 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.

- Kunkel, J.G., Project- and Group-based Learning in Junior Writing in Biology, p.25-42.
Prattis, S., and Czerwicz, I., Examination of Student-Active Learning Practices in a College-Middle School Educational Collaboration. p. 43-60.

- 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.

- Ganz, A., Phonphoem, A. and Wongtavarawat, K., Integration of Multimedia Interactive Web Tools with In-class Active Learning, p. 85-100.

- Connors, E., The Thayer Method: Student-Active Learning with Positive Results, p. 101-117.
Peelle, H.A., Alternative Modes for Teaching Mathematical Problem Solving: An Overview, p. 119-142.

- Eisenberg, M. Active-Learning in Sophomore Mathematics: A Cautionary Tale, p. 143-164.
Mullin, W.J., Teaching Innovations in an Introductory Physics Course for Non-Science Majors, p. 165-172.

- Rabin, M.S.Z., Experiences and Thoughts on STEMTEC-Inspired Changes in Teaching Physics for Life Science Majors, p.173-183.

- Dufresne, R., Hart, D., Mestre, J. & Rath, K. "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.

- Dufresne, R., Mestre, J., Hart, D.& Rath, K. (in press). The effect of web-based homework on test performance in large enrollment introductory physics courses. Journal of Computers in Mathematics and Science Teaching.

- Attempts to Promote Active Learning Using Technology: A Case Report of Changes Made to an Introductory Biology Laboratory: William Brewer, Instructor, U. of Massachusetts
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- Khan, S. A., Clement, J., Creating a Classroom Community Designed to Improve Confidence in College Women Studying Chemistry (submitted).
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- Mestre, J. & Cocking, R. "Applying the Science of Learning to Science Teaching." 2002 Yearbook of the National Association for Research in Science Teaching.
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Published abstracts of presentations at national conferences and professional meetings

- 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.
- R. Dufresne, B. Gerace, B. Leonard & J. Mestre. "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 Students. 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.

Special Symposia or Colloquia

- Gerry L'Heureux and Brian Hagenbuch 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.

- Gerry L'Heureux, Erica Bergquist, 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.

- Gerry L'Heureux was the principal speaker and presenter at Montgomery College's (Maryland) Critical Literacy Professional Development Workshop, "Creating a Montgomery College Learning Community," January 17th, 2001.

- Gerry L'Heureux and Ileana Vasu will be co-presenting 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, May 29-31, 2002.

- AACU National Learning Communities Conference, Providence, RI. Integrating the Arts and Sciences. Brian Hagenbuch, Kim Hicks, James Dutcher

- 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). The HCC team including Brian Hagenbuch, Kim Hicks, Robert Greeney, and James Knapp. The goal of SENCER is to develop model courses for dissemination that teach science through complex, capacious issues. Through this project HCC has been able to incorporate many of the STEMTEC active learning strategies together with the contextual approaches of SENCER to further develop our science curriculum and model courses. Brian Hagenbuch, an HCC STEMTEC team member, is also serving as the Interdisciplinary Cluster Coordinator for SENCER.

- 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, November 5, 2001.

- STEMTEC "Pathways to Change 2001" Conference, University of Massachusetts, Amherst, MA, June 28, 2001.

- Yuretich, R. F. "Making Active Learning Work in Large Classes", National Association of Geoscience Teachers Distinguished Speaker. Sessions:

Pennsylvania State University, March 13, 2001

Kansas State University, April 4, 2001

Case Western Reserve University, April 21, 2001

- Yuretich, R. F. "Active and Collaborative Learning in Your Classes" workshops given at:

Pennsylvania State University Summer Teaching Academy, July 13, 2001

Pennsylvania State University Winter Teaching Academy, January 4, 2002

MMSTEC (Maine Collaborative) Winter Teaching Academy, January 26, 2002

Presentations:

- Getting Started with Student Active Learning in the Introductory Chemistry Curriculum", Edward J. Brush, STEMTEC Institute Seminar, UMASS Amherst, October 17, 2000.

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

- Capobianco, B. Donna Canuel-Browne (Northampton H.S), 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. Examining the voices and experiences of science teachers as researchers on feminist pedagogy.

- Capobianco, B. Donna Canuel-Browne (Northampton H.S), Susan Lincoln (Northampton H.S.), Ruth Trimarchi (Amherst RHS), Norm Price (Amherst RMS), 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.

- Davis, K. S. Taking it to the field: Integrating science and technology in meaningful ways. Presentation 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. Presentation and workshop to be presented at the University of Massachusetts, Amherst.

- Davis, K. S., Feldman, A., Irwin, C., Pedevillano, E. D., Capobianco, B, Weiss, T., & Bray, P. (under review) 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.

- Dufresne, B. Gerace, B. Leonard & J. Mestre. "Creating an item for in-class formative assessment." The Interactive Classroom [Newsletter for Interactive Classroom Teaching and Learning], pp. 1,3 (Spring 2001).

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

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

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

- McMenamain, 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, February 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, January 6-11, San Diego, CA.

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

- J. Tyson, 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".

- J. Tyson, 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?"

- Whitworth, J. M., Davis, K. S., Doubler, S., Emery, C., & Murray, S. Reaching out to teachers: Is on-line professional development the answer? Panel presentation proposed for the Annual International Meeting of the Association for the Education of Teachers in Science, Charlotte, NC. Presentations at the Annual Meeting of the American Educational Research Association, New Orleans, April 1-5, 2002:

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

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

- The implications of Culture and Identity: A Professor's Engagement with a Reform Collaborative. Tarin H. Weiss, Allan Feldman, Dolly E. Pedevillano, Brenda Capobianco, University of Massachusetts

Presentations at the Annual Meeting of the National Association for Research on Science Teaching

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

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

Workshops

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

- "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," Edward Brush and Greg Nelson, Center for the Advancement of Research and Teaching (CART), Bridgewater State College, December 2, 1999

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

- "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), Brian Hagenbuch.

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

II.A.7. Evaluation Activities and Formative Evaluation Results

See the separate *Evaluation Report* for year 5.

II.A.8 Changes to Evaluation Plan

STEMTEC continues to work with the evaluation team of Sireci, Slater, Berger, and Zanetti, of the Department of Education Policy, Research, and Administration in the School of Education at the University of Massachusetts Amherst. Evaluation is proceeding as planned; see the separate *Evaluation Report* for year 5.

In addition, the major component of STEMTEC II, a three-year follow on grant, is designed to produce a comprehensive summative evaluation (as well as to implement an induction program for new teachers.) The PI's are STEMTEC PI's Sternheim and Feldman. The majority of existing evaluation efforts have focused on evaluating the impact of STEMTEC on faculty, courses and students on the campuses of the eight post-secondary institutions participating in STEMTEC. Evaluation of how STEMTEC, through the preparation and support of new teachers, is impacting science and math education in K-12 settings has only begun to be systematically evaluated during the fifth year of the initiative. Supplemental funding would be used primarily to continue existing assessment activities, but with a particularly strong emphasis on examining the outcomes of STEMTEC efforts in K-12 schools. The evaluators would build upon existing evaluation activities and would work closely with the CETP evaluation core at the University of Minnesota to contribute to the larger national CETP database. (See *Appendix H*.)

II. A. 9. Progress Toward Full Participation of Underrepresented Groups

One of STEMTEC's more elusive goals continues to be diversity amongst teachers. STEMTEC continues to work towards the participation of underrepresented groups in a number of directed ways. These include:

- Targeting minority involvement in the Teaching Scholars

- seminars and roundtables on recruiting and retention of women and minorities
- meetings with the student and faculty directors of on-campus minority programs
- providing information aimed at underrepresented minorities through the web site
- STEMTEC courses continue to serve a number of women and minorities (see Table II.A.9-A)
- STEMTEC faculty continue to make a particular effort to ensure that students from underrepresented groups fully participate in their courses, and that their interest and performance in these science and mathematics courses is maintained.
- Group learning and student-active learning techniques, as espoused by the STEMTEC philosophy, have been shown to be inclusive techniques, particular with regards to women and students of underrepresented groups.

Teaching Scholars Program/Pre-Education Program

Of the 2001-2002 Teaching Scholars, minority participation stayed at about 11% (the year before it was 10%) minority, while another 18% declined to report or reported “other”. There continues to be a large participation rate (74%) participation rate for women. Roughly a fourth of our teaching scholars are interested in elementary education, where there is no shortage of women teachers. However, it is clear that more than half of the teaching scholars interested in secondary math and science are women, and our program is helping to fill a serious need for role models in this respect. (Women are especially underrepresented in teaching chemistry and physics, fields that have strong undergraduate programs on our campuses.) Finally, we noted a 42% participation rate of another under-served population, that is, students of non-traditional age. The participation of underrepresented minorities in the STEMTEC Teaching Scholars Program is somewhat less than the overall demographics of the Collaborative institutions (as is generally true of teacher preparation). Thus we continue to work towards increasing the participation of underrepresented minorities in the Teaching Scholars Program, but we are not sure how to effect the necessary changes. This is a very complication problem with no easy solutions.

The minority enrollment at the community colleges is higher than that at the four-year institutions. We hoped that as the science and math education transfer options at the community colleges became established, this may result in higher minority participation. In addition, we continue to target (and have a significant participation from) the Ada Comstock Scholars program at Smith College and the Francis Perkins Scholars program at Mt. Holyoke; both are programs for non-traditional students and both have relatively high minority participation. However, we still are not observing a large influx of minorities into teacher preparation programs.

We continue to actively recruit from on-campus minority groups. These include the Minority Engineering Program (UMass), Sistahs in Science (Mount Holyoke), the Union of Underrepresented Science Students (Smith College), the Drew Achievers (a support group for African American science students, Amherst College), Jump Start (a program to encourage women to enter science, math and technology, Greenfield Community College), ALANA groups (honor societies for African-, Latino-, Asian- and Native-American students) and METS (a support group for women interested in math, engineering, technology and science fields, Holyoke Community College). Unfortunately, it is widely recognized that this is a difficult issue.

Miscellaneous

The fall Teaching Scholars banquet featured two African-American teachers as keynote speakers, Roger Wallace (Fort River Elementary School) and Juma Crawford (Codman Academy). Both teachers have worked with Patricia O'Hara at Amherst College. While their ethnicity was coincidental, it was nice for the minority Teaching Scholars, in particular, to see some minority teachers. Unfortunately, the lack of minority teachers seems to be at the heart of the problem of recruitment; it is a repeating cycle.

One way to increase the number of minority math and science teachers produced is to maintain high enrollment figures in math and science courses and majors. To this end, at Smith College, Dick Briggs and Laura Katz direct a new program intended to improve the retention of students from under-represented groups. It places first-year students from Introductory Biology into a lab where they participate in a research program with a faculty volunteer. Students acquire an academic home base, a faculty mentor, and contacts with advanced students.

The STEMTEC web site has a link to a site at Mt. Holyoke College's web site (posted by Prof. Sheila Browne), containing some information aimed specifically at underrepresented minorities, with information on mentoring and co-op information for students:
www.mtholyoke.edu/courses/sbrowne/sistahs/final/title.shtml.

Last spring, a STEMTalk focused on the issue of women and mathematics: "*What do women want in a math class?*" was presented by Jim Morrow, STEMTEC participant, Department of Mathematics, Mt. Holyoke College, on May 15, 2001. The description follows: "In this session, I'd like to generate a discussion of the design of mathematics classes and projects for young women in high school. I will provide some background information on a study of women's educational development, ala Women's Ways of Knowing, and on my vision of constructivism, especially as it compares to the Socratic method and "discovery learning." Following the discussion of learning, we will discuss ways of assessing learning. Is there anything but the MCAS?"

In addition, Brenda Capobianco produced the following report:
"Examining the voices and experiences of science teachers as researchers on feminist pedagogy" for a NEERO presentation on April 24-25, 2002, based on her work with local science teachers.

Table II.A.9-A Women and under-served populations: NSF/STEMTEC Teaching Scholars

	Female ^a	Black, Hispanic, or Nat. Amer.	Asian	Total Minority	Students of non-traditional age ^b
1998-1999 STEMTEC Teaching Scholars	84% (42)	12% (6)	4% (2)	16% (8) ^c	28% (14)
1999-2000 STEMTEC Teaching Scholars	85% (63)	14% (10)	5% (4)	19% (14) ^c	32% (24)
2000-2001 STEMTEC	74%	7% (4)	3% (2)	10% (6) ^c	30% (18)

Teaching Scholars	(46)				
2001-2002 STEMTEC Teaching Scholars	74% (52)	6% (4)	4% (3)	11% (8) ^c	42% (30)
STEMTEC Institutions, Teacher Prep ^d	88%	NA	NA	15.4%	
STEMTEC 4-Year Institutions, Total ^e	65%	8%	9.5%	17.5%	
STEMTEC 2-Year Institutions, Total ^e	60%	14.5%	1.1%	15.6%	
CETP Teaching Scholars	73.5%			42.5%	
CETP ^f Institutions, Teacher Prep ^d	74.9%			40.6%	

- a) Note that two institutions, Mt. Holyoke College and Smith College, are all-women institutions
- b) Students of a “non-traditional age” are another under-represented college population from which STEMTEC draws a large number of students. Oftentimes students do not elect to provide this information, so these numbers are low estimates. No comparison data is available.
- c) Twelve 1998-1999 Teaching Scholars (24%) declined to provide race/ethnicity data. Three 1999-2000 Teaching Scholars (4%) declined to provide race/ethnicity data. Five 2000-2001 Teaching Scholars (8%) declined to provide race/ethnicity data while one student self-reported as “other”. Thirteen 2001-2002 Teaching Scholars (18%) declined to provide race/ethnicity information.
- d) Undergraduate students who are preparing to be teachers
- e) Total school populations
- f) Centers for Excellence in Teacher Preparation program, the NSF Program which funds STEMTEC

Faculty/Teacher Participation

Table II.A.9-B Women and minorities: STEMTEC college faculty

	#	Female	Black	Latino	Nat Am	Asian	Total Minority
STEMTEC	108	32 (30%)	5 (5%)	5 (5%)	2 (2%)	1 (1%)	12%
CETP Average		36.5%					12%

Table II.A.9-C Women and minorities: STEMTEC K12 faculty

	#	Female	Black	Latino	Nat Am	Asian	Total Minority
STEMTEC	48	34 (71%)	1 (2%)	5 (10%)	0	0	12.5%
CETP Average		66.9%					15.6%

II.A. 10 – Partnerships and Collaborative Activities

II.H. Interaction and Overlap with Related Math and Science projects

STEMTEC has worked closely with two other NSF-funded systemic projects in Western Massachusetts: Project PALMS, the Statewide systemic initiative in math and science education, and the TEAMS project in Springfield, Massachusetts, an urban initiatives grant. It is also aiding in the preparation of a proposal under NSF's Math and Science Partnerships program.

The NSF systemic initiative project in Massachusetts, PALMS (Partnerships Advancing the Learning of Mathematics and Science) is now in its tenth and final year. Its tenure coincides with a Massachusetts educational reform initiative that led to the development of statewide curriculum frameworks and the Massachusetts Comprehensive Assessment System (MCAS). PALMS has consistently sought to support change at the district level, and toward that end has supported the development of district-wide PALMS teams. These teams include representatives from the schools, parent groups, higher education, museums, and business. There is a great deal of overlap between STEMTEC Participating K12 districts and PALMS districts. For example, STEMTEC K12 faculty at Amherst Public Schools was instrumental in developing a PALMS Project in that district. Other district teams include the urban districts of Springfield and Holyoke as well as Gill-Montague, Greenfield, Mohawk Trail, Frontier Regional, and Mahar in rural Franklin County.

Mary Alice Wilson, formerly the Coordinator the Five College Public School Partnership, was instrumental in developing the PALMS Regional Provider team as well as conceptualizing the STEMTEC Project. When Mary Alice retired in 1997, Sue Thrasher, STEMTEC PI, continued to work with the PALMS team until 1999, when Provider activities were centralized at the Hampshire Educational Collaborative. PI Thrasher continues to work with PALMS in a consultative capacity.

As noted in earlier reports, funding from NSF through the Massachusetts Department of Education enabled PALMS to successfully establish a regional curriculum library of math, science, and technology materials. The bulk of the library's holdings include NSF developed exemplary curriculum units. A full-time Curriculum Implementation Advisor is available to train teachers and district personnel with the various curriculum units. As also noted in the annual report, two satellite libraries of NSF exemplary curriculum materials were established at the School of Education, University of Massachusetts, and the Education Department at Mount Holyoke College. These libraries were established to introduce pre-service math and science teachers to exemplary curriculum units. While primarily for the use of practicum and pre-practicum students, both libraries are available to STEMTEC Teaching Scholars and Pre-Education students.

An electronic list of Math and Science teachers is maintained by The Five Colleges Public School Partnership. This electronic list is used to notify math and science teachers about professional development opportunities, web-based resources, curricular offerings, and grants and awards. Approximately three-four mailings per week go out on this list.

In addition to PALMS, STEMTEC has worked closely with the TEAMS Project (Teachers Emphasizing Achievement in Math and Science). This is an NSF-funded project to promote partnerships for minority achievement. PI Thrasher serves on the Advisory Board of Project

TEAMS. In addition, Dr. Linda Abbott, the Coordinator for Mathematics education for the Springfield Public Schools has been an active member of the STEMTEC Advisory Board since its inception. The former Superintendent of Springfield Public Schools appointed her to this position. Frequent meetings are held with the principals involved in the Springfield Urban Initiative grant. For example, STEMTEC explored the possibility of running a new teachers support group at the Springfield Professional Development Center beginning in the fall of 2001. Ultimately it was decided to include Springfield teachers in the new teachers group that meets regularly at the Five Colleges.

As the TEAMS Project has drawn to a close, Springfield Public Schools has established a Math and Science Task Force, charged with building on the work of the Urban Initiatives program and setting priorities for the future. Principal Investigator Thrasher has served on this Task Force, which has identified a priorities list for improving math and science education. The preparation of teachers in both instructional strategies and content areas, and recruitment and retention of new math and science teachers are high on this list, as well as placing an emphasis on narrowing the achievement gap of minority students

A new initiative currently underway is the writing of a proposal to the NSF Math and Science Partnerships (MSP) program, which has a deadline of April 30, 2002. The consortium is led by the Springfield school district, and will include Holyoke Public Schools, UMass Amherst and the Five College Consortium. This program would focus primarily on the Hispanic bilingual students in the districts. Their scores on the statewide MCAS tests are consistently at very low levels. The program would try to build community and family links that would lead ultimately to improved student performance.

II. A. 11 Activities under the sub-contracts

Five Colleges, Inc. has continued to administer the work of STEMTEC that directly involves the four private institutions of higher education (Amherst College, Hampshire College, Mount Holyoke College, and Smith College), as well as programs involving K-12 faculty. For example, Professional Development Points for re-certification in Massachusetts is handled by the Partnership, a certified state provider. Other specific activities are detailed throughout this Report.

II.B. Additional Demographic Data

STEMTEC's on-line entry of demographic data about the Collaborative continues to show significant numbers of students enrolled in STEMTEC-reformed courses, ongoing collaboration with other reform efforts, a growing body of dissemination work, and the meritorious character of the NSF/STEMTEC Teaching Scholars. In addition, STEMTEC's evaluation team is collecting data, by polling large numbers of students in STEMTEC and "unreformed" math and science courses, in order to show the influence of STEMTEC-style reform in students' thinking about careers in teaching.

II.C. Project Analysis

In February 2002, STEMTEC met with the NVC for the last time. Noted strengths of the project included course reform in some disciplines that affected some 120 courses, the new Faculty Fellows program, new teacher support efforts, and the introduction of distance-learning components in a variety of ways. And, building on the existing collaboration between the Five Colleges, STEMTEC has built new and strong collaborations with three local community colleges and amongst K-16 collaborations. In addition, the science-math-education-administration communications on most campuses were minimal or nonexistent before STEMTEC; now these groups are talking and working together. And while STEMTEC's evaluation efforts got off to a slow start, at this time both STEMTEC and the NVC are pleased with the current evaluation team. At this time, STEMTEC and the NVC are impressed with the current evaluation team as well. As the project winds down, STEMTEC needs to focus on continued evaluation, in order to show that faculty practices have changed in a way that results in increased learning for students, further dissemination efforts, new teacher support, and continued support of students interested in careers in math and science teaching.

One area that STEMTEC fell somewhat short on is minority outreach. Despite our efforts to reach students in underserved communities, it is a complex and difficult task and we have had only minor successes

Course Reform/Faculty Development

Some 120 courses have been formally reformed with STEMTEC-espoused pedagogies, including little lecturing, group activities, critical thinking, alternative assessment, and teaching experiences. STEMTEC faculty talk about the state Curriculum Frameworks, Project-Based learning, and pyramid exams. In addition, students are exposed to connections between teaching and learning and are urged to consider K-12 math or science teaching as a career. In addition, there are now seminars for students considering such careers.

STEMTEC also endorses technology in the classroom and has supported faculty in their efforts to incorporate technology through workshops, seminars, and presentations. At this time, a number of courses incorporate ClassTalk, an interactive response method used in lectures, and more courses are incorporating distance learning components as well.

New faculty are being brought into the project through a new Faculty Fellows program, which encourages newer faculty to explore innovative teaching and learning strategies in the STEMTEC style. This program was recently launched with sixteen junior faculty from the eight colleges and beyond.

New Certification Options/Student Programs

As mentioned earlier, as a result of STEMTEC, all three community colleges have developed math/science education transfer options and all Five Colleges offered certification routes, either through the home institution or through a formal cooperation with another campus. New state licensure requirements are making certification more difficult, and the campuses are now working (and working together) to adapt their programs to these new requirements.

STEMTEC's Summer/Fall certification option is now heading into its third year. Each year this program helps students who would be unable to complete longer-term certification program to gain certification, and most of the Summer/Fall graduates enter into teaching positions immediately.

The NSF/Teaching Scholars program has supported some 200 Teaching Scholars over the years, many for multiple years. While our tracking efforts have not been entirely successful, we've counted some 45 former Teaching Scholars who have accepted teaching positions; many others are working in science/math/education programs, such as at museums. Most of the community college Teaching Scholars continue their studies at the Five Colleges. The Pre-Ed program was not completely successful at all campuses, but is evolving into a new Science Education Minor at UMass.

The state certification requirements present a moving target to which the campuses must continually adapt. The NVC cites STEMTEC's "flexibility to respond to the changing landscape of Massachusetts education policy" as "a particular strength of this project."

New Teacher Support

STEMTEC has a small but very successful new Teacher Support Group. Every three weeks, roughly a dozen new teachers from the surrounding area meet over dinner to discuss challenges, share strategies, and talk with more experienced teachers. They find it a safe place to share. A new teacher support program is built into the STEMTEC II follow-on grant (*Appendix H*).

Evaluation

Last year, a new team of evaluators from the Center for Educational Assessment at UMass began working with STEMTEC. This team is in the process of collecting data through faculty and student surveys (including STEMTEC courses and courses not affected by STEMTEC reform) and course observations. They are also working with the core evaluation project. One of their primary goals is to determine to what extent faculty are adopting STEMTEC-espoused pedagogies, and how effectively. They are trying to determine what role STEMTEC courses may have had, if any, in students' thinking about K12 teaching careers. They are attempting to learn what effects the innovative, student-active teaching methods have on student learning. In a bold move, the evaluators will try to see how K-12 students of former STEMTEC students, now teachers, are impacted by their teachers' STEMTEC learning.

Dissemination

Dissemination has moved to the forefront of STEMTEC activities. STEMTEC has just completed a second video "***Turning on to Teaching Science and Math***", a "recruitment" video aimed at high school teachers, students, and guidance counselors. Our K-16 faculty and teachers continue to "spread the word" through presentations, papers, and workshops (see *Section II.A.6 and II.E*). The proceedings of *Pathways to Change 2000* were published as a special issue of *The Journal of Mathematics and Science: Collaborative Explorations*. *Pathways 2001* was held in June at UMass (see *Appendix C* for listing of contributors) and *Pathways 2002*, the international conference, is scheduled for April 18-21 in Washington, D.C. (see *Appendix C*).

Beyond 2002

At this time, the scholarship program has another full year (summer-fall 2002 and the 2002-2003 academic year program). STEMTEC's efforts to secure future funding for this program have fallen short, due to a number of complications. It is difficult to secure funding for the administration of a scholarship program, and it is strongly felt that the scholarship funds are only one small piece of the Student Program and that the supporting activities are just as important. In addition, it is difficult for on campus development offices to prioritize a multi-campus effort, and in supporting this effort they must also be secure in not setting up any competition for funds within the campus. In the meantime, campuses are gearing up to provide more campus-based support for their students interested in K-12 teaching, as evidenced by the on-campus spring 2002 Teaching Scholar events organized by the Teaching Scholars, campus coordinators, and some on-campus mentors.

In the meantime, a no-cost extension will allow STEMTEC to continue its activities on many other fronts as well. In addition, STEMTEC II (*Appendix H*), the follow-on grant, provides funding for continued support of evaluation and the New Teacher Support program.

As a footnote, we are heartened that we are now beginning to see another generation of reform, now that the first STEMTEC Teaching Scholars are entering the schools. Maury Bohan was an NSF/STEMTEC Teaching Scholar in the first year of the program. Now she is a sixth grade teacher at Wildwood Elementary School in Amherst, where she puts her STEMTEC training into practice, and a leader in STEMTEC's New Teacher Support group, where she helps a newer generation of teachers do the same. (In addition, she is a frequent participant in the Saturday Science and Engineering Seminars.) Joan Prival visited Ms. Bohan's elementary school classroom during the most recent NVC meeting, and she noted that "[h]er students were engaged in an inquiry-based activity on evolution that was based on a curriculum that she had adapted from a teacher whose class she had student taught in. She was an excellent model for the student teacher in her classroom. She explained that she made time for teaching science by compressing the American History curriculum and it was clear from the displays of student work in her room that science and mathematics were emphasized." In addition, Prival noted that also met with the Wildwood's principal and the Amherst-Pelham regional science coordinator, and that they "both extolled the impact of STEMTEC".

II.D. Updated Strategic Plan:

Future Plans

Future plans for the STEMTEC collaborative and the STEM Education Institute include a no cost extension of the present contract, a follow on grant, a variety of local workshops and seminars, a new GK12 award, and possible additional grants from NSF under the Math and Science Partnerships or the Centers for Learning and Teaching.

1. No cost extension:

Present budget estimates indicate that, in addition to the last year of scholarship money, substantial funds will remain on July 31, 2002, the end date for the five-year contractual

agreement. We intend to apply for a no cost extension and will have an active year six program. Key elements of the student program include support for the scholarship and pre-ed programs, Teaching and Learning Seminars on at least two campuses, and the summer/fall program. Faculty support will include the Roundtables, the Faculty Fellows program, a Pathways 2003 conference, and campus based workshops. An active dissemination program will be pursued.

2. STEMTEC II Follow on grant (see *Appendix H*):

STEMTEC II is a request for a three-year follow on grant designed to produce a comprehensive summative evaluation and to implement an induction program for new teachers. The PI's are STEMTEC PI's Sternheim and Feldman. Here we touch on the highlights of that proposal

The majority of existing evaluation efforts have focused on evaluating the impact of STEMTEC on faculty, courses and students on the campuses of the eight postsecondary institutions participating in STEMTEC. Evaluation of how STEMTEC, through the preparation and support of new teachers, is impacting science and math education in K-12 settings has only begun to be systematically evaluated during the fifth year of the initiative. Supplemental funding would be used primarily to continue existing assessment activities, but with a particularly strong emphasis on examining the outcomes of STEMTEC efforts in K-12 schools. The evaluators would build upon existing evaluation activities and would work closely with the CETP evaluation core at the University of Minnesota to contribute to the larger national CETP database.

The new teacher support will serve two groups of new teachers. The first consists of STEMTEC-Educated Teachers; most are teaching in Massachusetts, many are beyond the commuting radius of the campuses, and a few are spread across the country. The second overlapping group is the new math and science teachers in our area. The program has three main components:

- a. A teacher collaborative group. Dinner meetings held every 3 weeks for new teachers; two teachers with a few years of service lead the sessions. This has been in operation for since September 2000 and is very successful.
- b. STEM Ed Institute programs including Science and Engineering Saturday Seminars. Talks with school professional development officers indicated a need for content-based offerings for the new teachers and their peer coaches. Started in February 2001 with support from the Raytheon Corporation, it will be a key part of the support program. The Institute also offers one day workshops and summer institutes blending content and pedagogy.
- c. A re-designed UMass Teacher Education Program, which includes an online seminar, plus an "appropriate" master's program with a strong content research component for the teachers. The netcourse *Being a New Math and Science Teacher* will be part of the new M.Ed. program designed to meet new state regulations. These call for half the credits to be in the subject area. This will be satisfied in large part by having the teachers participate in scientific research in the summer and connect this to academic year activities.

3. Local seminars and workshops

The STEM Ed Institute sponsors a variety of seminars and workshops for various audiences. It offers twice monthly seminars on varied topics that are open to the area educational community. It also holds an annual daylong workshop on a STEM pedagogy area, such as strategies for including women and minorities, assessment, student-active teaching, etc. It seeks funding for

summer workshops for teachers from Eisenhower funds, NASA, the PALMS SSI project, the Space Grant Consortium, internal UMass grant programs, etc.

4. STEM Connections

This is a newly funded NSF/GK12 program that is expected to start in June, 2002, and to last for three years. Each year 10 STEM graduate students at UMass will work with teachers in the UMass/STEM Ed Institute M.Ed. program offered in Springfield, the state's third largest city. The PI's are STEMTEC participants Julian Tyson (Chemistry), and Kathleen Davis (Science Education), along with STEMTEC PI Morton Sternheim (Physics). Six project teams, including 1-2 Fellows, a professor, and two to four teachers will conduct classroom research on environmental issues. The Fellows will receive preliminary training in science teaching and will attend a week long summer workshop with the teachers to introduce the content areas. The teachers will enroll in an academic year course on inquiry based teaching and will earn six graduate credits.

5. New Initiatives

At the time of this writing, the STEMTEC leadership is exploring, with the help of STEMTEC participants and others, a number of possible major grant applications. There is a conscious attempt to broaden the leadership base in these efforts.

UMass system Vice President Jack Wilson, STEMTEC participant Jose Mestre, STEMTEC PI Morton Sternheim, and several others are considering the Centers for Learning and Teaching RFP. A higher education proposal is likely to be submitted in April. Two possibilities are under study for the Math and Science Partnerships (MSP). The cities of Springfield, Holyoke, and Lawrence are discussing a Comprehensive proposal targeting Hispanic students; the School of Education and the STEM Education Institute would be partners. Sternheim and Davis are also exploring a targeted grant that would deliver an online master's in science education for underprepared middle school teachers in cooperation with a rural and an urban district.

II.E. Major Products

STEMTEC participants continue to produce a wide range of materials for their courses. These include lab manuals, assessment rubrics, software, and special course websites. These are listed below; copies of all tangible products are available:

Software

Jennifer Normanly, UMass
Biochem412, 565, 623,694A
Development of OWL database for Biochem 523, 421

Websites

Peter Shaughnessy (Cycle 1, K12 Faculty, Northampton High School) has established a website which also helps his students link with a dozen chemistry websites that augment the material he is teaching. His website address is <http://users.mass.edu/~petersh/peter1.htm>

Aura Ganz created a website for her STEMTEC computer engineering course:
<http://dvd1.ecs.umass.edu/miu/>

Norman Beebe had a website for his MAT 105 course:
www.gcc.mass.edu/folderacad/faculty/math/mat105sylvsp2000beebe.html

Jennifer Normanly, UMass
Development of web site for Biochem 421, 565, 623
<http://www.-unix.oit.umass.edu/~bioc565/>

Esteban Monserrate, Smith College
Web page design: www.science.smith.edu/Env_Sci/tropical

Steve Roof spent his Spring 2000 sabbatical in Death Valley National Park, working on an informational web site about the geology and natural history of the park. Steve added interactive activities for students and teachers who use the web site as a resource. He also added lessons for educators to download and use in their classrooms.

Curriculum/Instructional Modules

Esteban Monserrate, Smith College
Power Point Presentation for teaching the Tropical Ecology Course at Smith

Charlene D'Avanzo, Hampshire College
A Teaching Guide for the video "How Change Happens" was printed by Commonwealth Printers, Hadley, MA in December, 2000. The thirteen page guide describes the courses and faculty featured in the video, gives ideas of how the video can be used in workshops, lists references such as websites and books, and includes a glossary of educational terms used in the guide.

Publications

Bruno, M.S. and Jarvis, C.D., It's Fun but is it Science? Goals and Learning in a Problem-Based Learning Course. *Journal of Mathematics and Science: Collaborative Explorations* (to be published May, 2001).

Connors, E., The Thayer Method: Student-Active Learning with Positive Results. *Journal of Mathematics and Science: Collaborative Explorations* (to be published May, 2001).

D'Avanzo, C., "A Primer on Formative Evaluation: What It Is and Why You Should Do It", *Bulletin of the Ecological Society of America* (p. 23-30) July 2000.

D'Avanzo, C., and Fabel, J., "Teaching Sustainability: How You Teach May Be More Important than What You Teach." *Second Nature website* (www.secondnature.org).

D'Avanzo, C., and Yuretich, R. F., "An Introduction to STEMTEC and Pathways to Change". *Journal of Mathematics and Science: Collaborative Explorations* (to be published May, 2001).

Eisenberg, M. Active-Learning in Sophomore Mathematics: A Cautionary Tale. *Journal of Mathematics and Science: Collaborative Explorations* (published May, 2001).

Ganz, A., Phonphoem, A. W., and Wongtavarawat, K., Integration of Multimedia Interactive Web Tools with In-class Active Learning. *Journal of Mathematics and Science: Collaborative Explorations* (to be published May, 2001).

Khan, S. A., Clement, J.J., Leckie, R.M. and Yuretich, R.F., Increasing student interest in science via active-learning methods in a large oceanography course (submitted for publication)

Kunkel, J.G., Project- and Group-based Learning in Junior Writing in Biology. *Journal of Mathematics and Science: Collaborative Explorations* (published May, 2001).

Mullin, W.J., Teaching Innovations in an Introductory Physics Course for Non-Science Majors. *Journal of Mathematics and Science: Collaborative Explorations* (to be published May, 2001).

Peelle, H.A., Alternative Modes for Teaching Mathematical Problem Solving: An Overview. *Journal of Mathematics and Science: Collaborative Explorations* (to be published May, 2001).

Prattis, S., and Czerwec, I., Examination of Student-Active Learning Practices in a College-Middle School Educational Collaboration. *Journal of Mathematics and Science: Collaborative Explorations* (to be published May, 2001).

Rabin, M.S.Z., Experiences and Thoughts on STEMTEC-Inspired Changes in Teaching Physics for Life Science Majors. *Journal of Mathematics and Science: Collaborative Explorations* (to be published May, 2001).

Rapoport, N., The STCC Science Teaching Intern Project. *Journal of Mathematics and Science: Collaborative Explorations* (to be published May, 2001).

Tyson, J. A., The Impact of a National Science Foundation CETP on an Undergraduate Chemistry Course for Non-Chemistry Science Majors. *Journal of Mathematics and Science: Collaborative Explorations* (to be published May, 2001).

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

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

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, (in press).

Leckie, R.M., 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.

Sternheim, M., “STEMTEC: More and better-prepared science and math teachers”, UMass Physics Department Newsletter, Spring, 2001

II.F. Revised Budget

No budget is needed for the year 5 annual report.

II.G. Meeting Summaries

Reports from the site visits of the National Visiting Committee during 2001 are included in *Appendix A*, along with reports from NSF representatives and responses to reports by the STEMTEC leadership team.

The STEMTEC PIs usually meet weekly during the academic year, and at other times when the need arises. Summaries of the meetings are also included in *Appendix A*. Meeting minutes are also included for the Coordinating Council and various task forces.

II.H. Interaction and Overlap with Related Math and Science Projects

For discussion of the interaction and overlap with related math and science projects, see *Section II.A.10*, Partnerships and Collaborative Activities.

II.I. Newsletters, Newsclippings, Published Articles, Etc.

See *Appendix I* for several disseminable items of general interest.

III. Collaborative

The current management plan and composition of STEMTEC’s Collaborative and subcommittees are listed in *Tables* below.

STEMTEC Scholarship Advisory Board ~ *Table III-A*

Name, Position	Department	Affiliation
Jane Abbott, Dir. of Financial Aid		Greenfield Community College
Linda Abbott, Dir. of Math/Tech		Springfield Public Schools
Sheila Browne, Professor	Chemistry	Mount Holyoke College
Karen Derouin, Dir. of Financial Aid	Financial Aid	Holyoke Community College
Allen Forsythe, Dean of Sci, Engr & Math	Science, Engr & Math	Holyoke Community College
Ana Gaillat, Professor	Chemistry	Greenfield Community College
Bailey Jackson, Dean of Education	Education	Univ. of Massachusetts
Erika Laquer, Director	Ada Comstock Scholars Program	Smith College
Kathleen Methot, Dir. of Financial Aid	Financial Aid	Hampshire College

Patricia O'Hara, Professor Anne Peramba, Associate Director Nancy Rapoport, Professor Vanessa Rivera, Dir., Minority Ed. Mary Santiago, Teacher Anthony Serio, Superintendent Linda Slakey, Dean of NSM Sue Thrasher, Coordinator	Chemistry Financial Aid Biology Engineering Grade 4 Natural Sciences & Math	Amherst College Univ. of Massachusetts STCC Univ. of Massachusetts Sullivan Elem. School Gill-Montague Reg. Schl. Dist. Univ. of Massachusetts Five Colleges, Inc.
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STEMTEC Advisory Board ~ Table III-B

Name	I. Position	II. Affiliation	III. Advisory Board IV. Task Force
Linda Abbott	Dir. of Math/Tech	Springfield Public Schools	New Teacher Support
Jack Barocas	Div. Dean	STCC	New Teacher Support
David Bartley	President	Holyoke Community College	
Donald Baumer	Dean for Acad. Dev.	Smith College	
Aaron Berman	Dean of Faculty	Hampshire College	
David Driscoll	Commissioner	Mass. Dept. of Ed.	
John Dunn	Exec. VP/Dean of Fac.	STCC	
David Entin	VP for Academic Affairs	Holyoke Community College	Faculty Development
Anne Finck	Superintendent	Hadley School Department	
Allen Forsythe	Dean, Science, Eng. & Math	Holyoke Community College	Act. Chair Faculty Development
Laura Cavanaugh	Dean, Academic Affairs	Greenfield Community College	
Tom Gerety	President	Amherst College	
Bob Hanna	Tech. Coord.	Northampton Public Schools	
Bailey Jackson	Dean, School of Education	Univ. of Massachusetts	
Thomas Litwin	Dir, Clark Science Center	Smith College	
Cora Marrett	Provost, Provost's Office	Univ. of Massachusetts	Beyond 2002
James McDonnell	Superintendent	Holyoke Public Schools	
Jim McKeever	Manager	Media One	
Peter Negroni	Superintendent	Springfield Public Schools	
Thomas Noonan	PALMS Higher Ed. Coord.	Mass. Dept. of Ed.	New Teacher Support
Penny Noyce	PALMS Higher Ed. Coord.	Mass. Dept. of Ed.	
Donal O'Shea	Dean of Faculty	Mount Holyoke College	
Lorna Peterson	Coordinator	Five Colleges Inc.	Beyond 2002
Gregory Prince	President	Hampshire College	Chair Beyond 2002
Nancy Rapoport	Professor	STCC	
Lisa Raskin	Acting President	Amherst College	
Melinda Gougeon	Assoc. Dean of Math/Sci.	Greenfield Community College	New Teacher Support
Dick Sawyer	Principal	South Hadley Middle School	
Gus Sayer	Superintendent	Amherst School Administration	Beyond 2002
Donna Scanlon	Curric. Supervisor	Holyoke Public Schools	
Brenda Finn	Superintendent	Gill-Montague Reg. Schl. Dist.	Act. Chair New Teacher Support
Ruth Simmons	President	Smith College	
Robert Hallock	Dean, Natural Sci. & Math	Univ. of Massachusetts	Faculty Development
James Tierney	Superintendent	So. Hadley Public Schools	
Robert Traver	PALMS High Ed. Coord	Mass. Dept. of Ed.	
Robert Helgeson	Vice Chancellor for Outreach	UMass	
Bruce Willard	Superintendent	Northampton Public Schools	New Teacher Support

STEMTEC Coordinating Council ~ Table III-C

Name, Position	Affiliation
Sheila Browne, Chemistry Professor	Mount Holyoke College
Graham Kent, Faculty	Smith College
Sheila Zabko, Science Teacher	Great Falls Middle School
Chris Emery, Physics Teacher	Amherst Reg. High School
Ana Gaillat, Chemistry Professor	Greenfield Community College
Sara Buckley, Science Ed. Program Coord.	Hampshire College
Gerard L'Heureux, Chemistry Professor	Holyoke Community College
Patricia O'Hara, Chemistry Professor	Amherst College
Linda Selleck, Science Teacher	South Hadley Middle School
Lauren Brewer, Faculty	STCC

STEMTEC National Visiting Committee ~ Table III-D

Name, Position	Affiliation
Angelo Collins, Professor	Vanderbilt University
Julia Cothron, Director	Mathematics & Science Center
Leo Hickey, Geology & Geophysics Professor	Yale University
Paul Irish, Teacher	Champlain Valley Union H.S.
John Layman, Physics Professor	Univ. of Maryland
Arnold Ostebee, Mathematics Professor	St. Olaf College
Judith Ramaley, President	Univ. of Vermont
Barbara Tewksbury, Geology Professor	Hamilton College