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PROGRAM EVALUATION
FOURTH YEAR REPORT
SEPTEMBER 2010

A PUBLIC-PRIVATE PARTNERSHIP TO INCREASE ENROLLMENT, RETENTION, AND DIVERSITY IN CHEMISTRY, BIOLOGY, AND BIOCHEMISTRY
NSF/STEP
STONEHILL COLLEGE AND MASSASOIT COMMUNITY COLLEGE

Stonehill College, in partnership with Massasoit Community College, launched a STEP Type I program, in the fall of 2006. The overall goal of the program is to increase the number of students obtaining bachelor's degrees in STEM fields. The program will complete its fourth year of operation on September 30, 2010. This report 1) describes the program implementation with an emphasis on the past year, 2) evaluates the extent to which each of the six program components has contributed to the program objectives, 3) assesses the sustainability of the program once funding ends, and 4) makes recommendations about program implementation and overall management.

Program Objectives

1. Attract 37 more students per year, by year five, to Stonehill's Chemistry, Biochemistry and Biology majors.
2. Reduce average Stonehill attrition rates in the sciences from 47 percent to 23 percent.
3. Increase science transfer track enrollments at Massasoit by 35 students.
4. Increase the number of traditionally underrepresented students in STEM degree programs at Stonehill by 24.

Evaluation Methodology

The evaluator first became acquainted with Stonehill's STEP program in the spring of 2009 when the program was already into its third year. In August 2009 and again in August 2010 the evaluator visited the program, conducting interviews and focus group meetings with students and faculty involved in the six program components and the program director. In addition, data sent to the evaluator electronically were analyzed.

Program Evaluation

1. Revising General Chemistry as a Theme-based Course

Course Description and Implementation

The theme-based chemistry course is a central component of Stonehill's STEP program. It was designed to 1) stem the tide of students who exit science majors after taking the traditional General Chemistry course, 2) attract new science majors, and 3) more fully engage and excite existing science majors.

Stonehill College began offering a theme-based version of General Chemistry in the fall of 2007 while continuing to offer the traditional version of the course. As of the start of the fall of 2009 semester Stonehill offers only the theme-based version of the course. Courses using previously developed themes (in nutrition and forensics) were continued and three new theme-based courses, one in Chemistry in Medicine, one in Chemistry in Art and another in Environmental Chemistry, were introduced. Also, in the fall 2009, due to planned changes concurrent with the opening of a new science building, Stonehill admitted 155 freshmen intending to major in science, all of whom as well as 30 returning students (for a total of 185) had to be accommodated in the first semester of General Chemistry (compared with 123 total students in both 2007 and 2008). Since the theme-based version of the course is designed for a smaller class size, the increased enrollment along with the commitment to change over completely was a challenge. In order to meet the objective of offering the theme-based version of the course to all incoming science majors, two sections of General Chemistry that were intended to be 16-student writing intensive sections were increased to 24 students, the faculty member teaching the forensics themed section taught a second section as an overload, and a part-time faculty member who had previously taught at the college was hired to teach a nutrition themed section of General Chemistry.

The theme-based version of General Chemistry uses the same textbook and covers the same material as did the traditional version of the course. The course's theme is manifested mainly through the examples and problems the students must solve, and through lab experiments. Faculty continue to describe their efforts in this course re-design as "a work in progress," and continue to feel that the theme serves to better engage students.

In previous years, the theme- based course was offered in two 3-hour blocks each week, as opposed to the traditional course, which was offered in three fifty-minute lectures and one three-hour laboratory meeting per week. This change was intended to increase fluidity between the lecture and lab components of the course. This year, however, many of the professors chose to offer the course in three 2-hour blocks because three hours was a challenge to the attention span of many of the students. Some faculty pointed out that they also preferred seeing their students three times, rather than twice weekly. All faculty are in agreement that both formats are an improvement over the old one employed in the traditional course format, in which the lab was discontinuous with any lecture time, and required a pre-lab component to re-contextualize the lab activities. One faculty member

expressed the intention of developing more activities in which lab and lecture could be further integrated.

The evaluator met with two groups of students: One group had taken the theme-based course and the other had taken the traditional course. Students who took the theme-based chemistry course for the most part reported that the increased fluidity between lecture and lab components was an asset. However, some reported that professors didn't adhere to the planned split in lecture and lab times, and many said that the two 3-hour blocks were too long to hold their attention. Students unanimously agreed that the smaller class size and the untraditional format led to their having closer relationships both with other students in the class and with the faculty. Several students provided examples of the intensive mentoring they received and the impact it had in directing them towards career goals in science.

Interestingly, the students who had taken the traditional chemistry course reported that they thought they had the better experience. They felt that for serious science majors the traditional course, with boundaries separating the lab and the lecture—separate notebooks and prescribed times for lab and lecture—led to better organization. They felt that the traditional course better prepared students for organic chemistry, although they thought that the theme-based labs seemed "cool" and were probably more fun. When asked about faculty mentoring, they too reported having close relationships with what they described as a very nurturing science faculty. Students from both groups talked about a wide range of careers in science that they were considering—Ph.D., in chemistry, pharmacy, pharmaceutical science, dental school, high school chemistry teacher, forensic science—all of which they appeared to have discussed with their chemistry professors.

Theme-based sections of General Chemistry, focusing on nutrition, continue to be offered at Massasoit Community College, although changing the time format there is not an option. The professor who offers that course felt that it provided an opportunity for a more "whole student" approach, and that the students were more engaged and more interested in the subject matter. She is considering offering a section of Environmental Chemistry next year.

Student Performance in the Course

In last year's report, student performance in theme-based and traditional sections was compared for all enrolled freshmen in the fall 2007 and 2008 according to three measures: performance on common exam questions, proportion of mid-semester deficiencies, and final course grades. In addition, retention of science majors from the beginning to the end of the course, and student progress in science, as measured by registration in Organic Chemistry, were compared for the two versions of the course. Students in the theme-based course performed better on common exam questions, had fewer mid-semester deficiencies, remained science majors and registered for Organic Chemistry at higher rates than those in the traditional course. In addition, based on scores for common exam questions, the students in the class of 2011 (fall 2007 enrollees) performed better overall than did the students in the class of 2012 (fall 2008 enrollees) whether they were in the theme-based or traditional courses.

This year, with only the theme-based version of the course offered, we have evaluated retention in the science major as of the summer of 2010 for the classes of 2011 (entered in 2007), 2012 (entered in 2008), and 2013 (entered in 2009). We have looked at retention among entering freshmen science majors. Students who transferred out of Stonehill their first year were considered two different ways, either as not being retained or excluded from the data altogether. (The reader is reminded that for the class of 2013 there is no comparable data for the traditional course.) One notable finding is that a higher percentage of students in the class of 2011 remain science majors than in the class of 2012. This is the opposite of what would be expected if the two classes were equivalent. That more students from 2011 remain science majors at a fixed time is consistent with their better performance overall (based on common exam question scores) than the class of 2012. Nonetheless, for both classes, regardless of whether one includes or excludes students who transferred , retention in the sciences is higher among those who took the theme-based course. Most important, the gains in retention rate initially seen for those in the theme-based course appear to remain one and two years later.

Table 1. Rate of retention in the science major in summer 2010 for students exposed to traditional or theme-based chemistry in 2007, 2008, and 2009.

Graduation Date	Entry Status	Traditional	Theme-based
Class of 2011	Freshmen (including transfer)	60.0	69.2
	Freshmen (excluding transfer)	63.5	73.0
Class of 2012	Freshmen (including transfer)	50.0	65.3
	Freshmen (excluding transfer)	56.1	69.6
Class of 2013	Freshmen (including transfer)	N/A	77.7
	Freshmen (excluding transfer)	N/A	77.7

Student Evaluation of the Course

Students completed 15-item course evaluations. A repeated measures t-test comparing mean ratings across all 15 items for traditional vs. theme-based versions of the course was conducted. The means and statistical findings, as seen in Table 2, show significantly higher ratings for the theme-based course in 2008; the difference was in the same direction for 2007, and approached significance. Interestingly, ratings for the theme-based course exhibited a small but significant decline over the course of three years, from 2007 to 2009. Given that this course is still a work in progress (new themes and new time formats are still being explored), the small size of the decline is not viewed by the evaluator to be of concern.

Table 2. Mean ratings across 15 items

	2007	2008	2009	Comparison over time
Traditional	4.12	3.73	N/A	
Theme-based	4.26	4.02	3.96	F(2,28)=23.203, p<.001
Comparison of type of course	t(14)=1.943 *p=.072*	t(14)=4.857 *p<.001*		

2. Offering an Early Research Experience

The Early Research Experience is a 10-week, 40 hours/week program that runs from the last week of May to early August each summer. Offered in conjunction with Stonehill's SURE program, which is a competitive intensive research experience for upperclassman at Stonehill, the Early Research program serves Stonehill students who have completed only one year of college and Massasoit students who have completed one or two years. Unlike the SURE program, the Early Research program seeks not necessarily the top students, but those who are highly motivated and hard-working, and potentially handicapped by a lack of self-confidence and/or strong background in science. There is also a strong effort to recruit minority students. All STEP students are provided with a $3,500 stipend for their participation in the program. The Stonehill students resided on campus during the program, and the Massasoit students commuted to campus.

In addition to working side-by-side with the SURE students in the laboratories, the Early Research students participate in all the extra-laboratory activities offered through SURE. This includes a weekly lunch, often combined with a workshop/advising session, evening activities, barbecues, and two trips over the course of the summer.

For the summer of 2010, 10 students and eight faculty members participated in six labs. Two labs were led collaboratively by a Massasoit faculty member and a member of the Stonehill faculty, each with two Massasoit student participants; three were headed by individual members of the Stonehill faculty, one with two Stonehill student participants and two with one Stonehill student participant; and one was headed by a member of the Massasoit faculty, with two Massasoit student participants. Five of the six labs (those with Stonehill faculty) also had SURE student participants. Table 3 presents the number of student and faculty participants in the Early Research Experience over the four years of the grant.

Table 3. Number of student and faculty participants in Early Summer Research Experience each year

	Students		**Faculty**	
Summer	**Stonehill**	**Massasoit**	**Stonehill**	**Massasoit**
2007	3	5	4	2
2008	1	4	3	2
2009	7	6	7	3
2010	4	6	5	3
Total	***15***	***21***	***18***	***10***
Total unique	***15***	***20***	***10***	***5***

The evaluator conducted separate focus group meetings with the faculty and student participants in the summer 2010 Research Experience and analyzed 10 mid-summer and 7 end-of-summer surveys completed by students.

What emerged from a focus group meeting between the evaluator and the Early Research

faculty was a strong sense that the program was doing an excellent job of serving the students. They also felt that the program enabled them to move their own research forward. When asked about the length of the summer program, the faculty said that it took about five weeks for the students to hit their stride, but that during the second half, an amazing amount of work was accomplished. They felt strongly that providing this intensive research experience for highly motivated, but not necessarily high achieving students was, in many cases, life-changing. The students benefited from an expanded knowledge base, a close mentoring relationship with faculty, and the experience of intensive immersion in a scientific pursuit. Many became more self-confident about their own potential for careers in science.

In general, the faculty felt that the association with the SURE program was an asset. They felt that in some cases the SURE students served as models for the STEP students. (One Massasoit faculty member felt that the community college students were somewhat intimidated by the SURE students, but this was not corroborated by student responses to a survey question probing that point, as discussed below.) Other faculty thought that some of the students might go on to become SURE students at a later point.

Last year, some faculty complained that there was a delay in getting started on the summer research, specifically in getting all their supplies on time. This was due to the move into the new building. This year the faculty were thrilled to be working in the new science building and the start-up was smooth and on time.

In their focus group meeting with the evaluator, students raved about the research experience. They appeared to the evaluator to be more set on their career goals at this early stage in their education than was last year's group. Their comments about the program focused almost exclusively on their excitement about the research they were conducting. In response to my question about it, the Massasoit students reported that they felt very much welcomed and a part of the Stonehill community. Unlike last year, none complained about the difficulty of integrating the research program with their outside commitments.

Following are some comments in response to my question, "What have you taken away or learned from your experience in the Summer Research Program?"

- "This experience affirmed that this is what I want to do."
- "This solidified my original desire to be a classroom science teacher."
- "I'm only a sophomore but I have research for my thesis. This made me realize I want a Ph.D and my own lab."
- "I learned patience. Things don't go right the first time, and you have to learn to deal."

On the mid-summer and end-of-summer questionnaires, students were asked about the strengths and weaknesses of the program. There were virtually no complaints or weaknesses described, and the strengths included learning lab techniques, getting a taste of what research is like in the real world, getting to know professors, and learning to keep

a notebook and work systematically. In response to a pointed question on the subject, the Massaasoit students responded uniformly, that they felt included in the Stonehill community of students and faculty. In response to an objective question, all the students reported that their interest in science and their interest in pursuing a career in science increased as a result of the summer research experience. The tables below show student evaluations of the various non-laboratory components of the summer program. They demonstrate that virtually all students are engaged in the wide range of experiences offered outside the lab, and that overwhelmingly, they found them to be enriching and enjoyable.

Table 4. Number of responses on midsummer evaluations (n=10) of activities outside the laboratory

Activity	Attended?			Enrichment Level				Enjoyment Level		
	Yes	No		Low	Medium	High		Low	Medium	High
Weekly lunchtime workshops	10	0		0	4	6		0	4	6
Research presentations	10	0		1	1	8		0	6	4
Social activities outside lab hours	6	4		0	3	3		1	1	4
Relationship with your lab mentor(s)	NA	NA		0	1	9		0	2	8
Relation with students in your lab group	NA	NA		1	1	8		1	2	7

Table 5. Number of responses on end of summer evaluations (n=7) of activities outside the laboratory

Activity	Attended ?			Enrichment Level				Enjoyment Level		
	Yes	No		Low	Medium	High		Low	Medium	High
Weekly lunchtime workshops	7	0		0	2	5		2	2	3
Social activities outside lab hours	6	1		1	3	2		0	0	6
Relationship with your lab mentor(s)	NA	NA		0	2	5		1	1	4
Relation with students in your lab group	NA	NA		0	2	5		0	1	5

Having the Massasoit faculty participate in the Early Research Experience has provided an opportunity for some members of their science faculty to carry on their own research—something that is usually difficult if not impossible to do at a community college. As described in last year's report, this has raised the bar for new science faculty at Massasoit, where they continue to require a Ph.D. for all their new science hires, and

they advertise the position as affording research opportunities. The Massasoit dean/chair of liberal arts attributes the change to the participation of her faculty in the Stonehill research program.

3. Enhancing Mentoring, Tutoring and Advising

Enhanced mentoring takes place in the context of most of the other STEP program initiatives. This section describes two independent efforts, one at Stonehill and the other at Massasoit, aimed at systemic changes in academic advising and career mentoring, as well as building a community among students and faculty for science majors early in their college careers.

The STEP program channels its mentoring initiative at Stonehill through teaching assistants who staff the PLTL program in *General Chemistry*. These teaching assistants, 23 in all this past year, are paid by the College. The STEP program pays them an extra $200 for the semester to spend additional time reaching out to and mentoring their PLTL students. The additional mentoring activities include an introductory email, an exchange of contact information, lunch dates, and developing online friendships. Thus the mentoring program capitalizes on the College's already-existing PLTL program.

Stonehill College routinely asks students to evaluate their teaching assistants on a five-point scale (-2 to +2). The STEP program has added an additional set of questions focused on mentoring. This year, 131 students completed evaluation forms (compared to 99 last year). Overall, the ratings were high for both the TA-related activities and extremely high for mentoring-related activities. Tables 6 and 7 show the mean ratings in 2007, 2008, and 2009. A repeated measures ANOVA revealed a significant increase in ratings of TA items [$F(2,26)=12.009$, $p<.001$] and mentoring items [$F(2,10)=22.011$, $p<.001$]. The change for the TA ratings are attributable to an increase in the past year, and the change in the mentoring ratings was due to an increase last year. The students' responses to open-ended questions reveal that they found the TAs/mentors to be supportive, available on short notice, and willing to hold review sessions before exams.

Table 6. Mean ratings on TA questions for 2007, 2008 and 2009

Item	2007	2008	2009
I usually go to this TA after trying the material on my own first	0.75	0.53	0.82
I usually go to this TA to reinforce class material and/or concepts	1.31	1.09	1.21
I usually go to this TA in preparation for an exam/test	1.21	0.90	1.12
My TA was friendly and encouraging	1.62	1.56	1.74
My TA was prompt and dependable	1.33	1.61	1.65
My TA was concerned about my ability to do well in the course	1.20	1.17	1.37
My TA understood my difficulties with the material.	1.25	1.14	1.32
My TA was knowledgeable about the subject.	1.33	1.53	1.55
My TA reviewed my test/paper scores with me.	-0.02	0.05	0.40
I was made aware of study strategies I could use to improve my learning.	0.71	0.63	0.95
As a result of working with this TA, I feel that I understand the content better.	1.25	1.19	1.35
My TA explained the material to me in a meaningful way.	1.12	1.23	1.41
My grades improved with the help of my TA.	0.96	0.82	0.90
I would recommend my TA to other students.	1.27	1.35	1.50
Mean rating across all questions	***1.09***	***1.06***	***1.23***

Table 7. Mean ratings on mentoring questions for 2007, 2008 and 2009

Item	2007	2008	2009
My mentor was friendly and easy to talk to.	1.60	1.64	1.66
My mentor was supportive and listened to my concerns.	1.38	1.49	1.57
My mentor was accessible outside the weekly PSGs.	1.16	1.32	1.28
My mentor gave me good advice about how to be successful in the sciences.	1.10	1.14	1.19
My mentor had a positive attitude about the science program at Stonehill.	1.41	1.56	1.56
I would recommend this mentor to other science students.	1.39	1.55	1.52
Overall mean across all questions	***1.34***	***1.45***	***1.46***

Prior to their participation in the STEP program, faculty at Massasoit had few opportunities to provide academic advising and career mentoring for science students. In part because the students are commuters, but also because of the absence of a systematic effort, there have been few opportunities to meet with students, with the exception of registration day, where they are assisted in selecting classes. Nor were there any forums for introducing students to career opportunities in science. At their last re-accreditation evaluation, Massasoit was cited for poor advising.

There is currently a dean of advising and an organized advising team of five faculty members, who utilize technology to reach students (there's an advising website and a *Facebook* page), hold group and individual advising sessions, support the development of

articulation agreements with 4-year colleges, and hold a Science Transfer Day event and a Careers in Science event.

One Massasoit faculty member has undertaken a systematic effort to change the culture for liberal arts transfer-bound students. She has identified the many challenges, designed and mounted activities that can succeed in the face these challenges, and tracked her progress. Her efforts in publicizing a series of events by creating and distributing attractive handouts for faculty and students, asking faculty (via email) to make announcements in their classes, and collecting personal (as opposed to school-based) email addresses of science students, over the course of the 2008-09, and 2009-10 academic years led to her reaching increasing numbers of students.. She also created a database of the attendees and to the extent possible, of all Liberal Arts Transfer in Science (LATS) students. She recently received a grant from the Balfour Foundation to support advising events and pay mini-stipends to faculty involved in specific advising initiatives, and this funding will provide her release time from teaching to further promote advising events.

During the 2009-10 academic year 15 advising events were mounted. Most of the speakers were from four-year colleges, and all the activities were aimed at providing students with the knowledge, skills, and confidence they need to successfully transfer to a four-year institution. Student and faculty attendees were asked to complete evaluations of all events. In general, the evaluations were strong, but more important is that the practice of using feedback to "close the loop" in meeting students' needs is impressive. Tables 8 and 9 attached to this report describe her work in detail.

4. Launching a Science Summer Bridge Program

The Summer Bridge is a three-week program for incoming freshmen who have selected a science major. Students live on campus in rooms on a common hallway and attend three classes each weekday from 9:00 AM to 4:00 PM (including a 1.5 hour lunch break). The courses are in writing and literature, science, and mathematics. The program employs teaching assistants who organize activities and trips during evening hours and on weekends. When the program ends and the fall semester begins, the students remain in the same housing. The 2010 Bridge Program was just starting as this report was being compiled and so will not be evaluated until next year.

Last year, the previous year's Bridge students came on the first day to help the new students move in. According to the professor who ran the program, they were a "tight" group and remained close over the course of the school year. The students in the summer of 2009 went on trips to two science industry corporations (Organogenesis and Genzyme), had presentations by Career Services about internships, summer jobs, and resume writing, were introduced to the pre-med advisor, and had a library workshop.

Twelve students participated in the Summer Bridge program in 2007, 14 participated in 2008 and 18 participated in 2009. In a focus group meeting with several participants in the last two years of the program, the students described the program in extremely

positive terms. They found the professors in their courses to be of high quality, they very much valued the idea of meeting them and getting comfortable with them before the start of the school year, and they were glad that they had an opportunity to start out by doing work that didn't count towards their grades. One student said about his Chemistry course once the semester started, "I was well prepared while everyone else freaked." Another said, "I had never done a chemistry lab before coming here." The students felt that the courses were perfectly pitched to their academic needs. The only negative comment was that they were placed in the least desirable housing facility on campus as a result of their participation in the Bridge program.

To determine whether the summer program was associated with better performance in *General Chemistry* the students' grades were measured against a comparison group of incoming science majors. Based on a comparison of 80 students (43 Bridges and 37 comparison group) over the three years of the program, grades were compared in two ways. The mean final grade for the Summer Bridge students was 2.62, and for the comparison group it was 2.31. The difference was not statistically significant [$t(78)=1.234$, $p > .10$]. We then looked at whether there was a relationship between student success in the course (defined by having achieved a grade of C or better), and whether the student was in the Bridge program. Of the summer Bridge students 20.9 percent were not successful, while 27.0 percent of those in the comparison group were not successful. The chi square analysis was not significant ($\chi(1)=0.408$, $p>.10$). Finally, we conducted a chi square analysis to determine whether there was a relationship between participation in the Summer Bridge program and whether a student went on to register for Organic Chemistry after completing General Chemistry. Of the Summer Bridge students, 76.2 percent went on to register for Organic Chemistry, compared to 78.4 percent of the comparison group. The finding was not statistically significant ($\chi(1)=0.054$, $p>.10$), and therefore we conclude that there is no relationship between participation in the Summer Bridge program and registration in Organic Chemistry. Table 10 presents the mean grades in General Chemistry for students in the Bridges and comparison group for each of the three years of the program.

Table 10. Mean grade in General Chemistry for students in Bridge and comparison groups for each year of the program

Year	Summer Bridge	Comparison
2007	2.94	2.47
2008	2.25	2.07
2009	2.69	2.33
Grand Mean	***2.62***	***2.31***

5. Providing Opportunities for Early Career Exploration

Early career exploration has been incorporated into other program components, as described above. At Stonehill's Summer Bridge Program the Career Services staff makes a presentation on internships, summer jobs, and careers in science, and the students take

trips to local scientific corporations. Students in the Early Research Experience have a number of opportunities, in part through individual mentoring by professors in whose labs they work, as well as exposure to the activities provided by the SURE program.

Massasoit has developed an elaborate career exploration program. Students (most of whom originally think only about nursing) are provided with pamphlets on career options that are possible with a four-year degree in the sciences. Invited speakers, all involved in science careers, make presentations to the students. In the 2009-10 academic year there were ten such events, including a Chemistry Postdoctoral Fellow, a dentist, a chemical engineer, a scientist at Walter Reed Army Institute of Research.

6. Enhancing AP Chemistry and Biology with a Laboratory Experience

Participants in this program component are high school students enrolled in AP Biology or Chemistry courses from area high schools. Using a chartered bus, the program transports the students to Stonehill, where they attend 2.5 hour laboratory classes on each of 10 Saturdays in either biology or chemistry. The course instructors are high school teachers who are alumni of Stonehill and hold Master's level degrees in their subject.

In 2007 three high schools participated: Coyle Cassidy, a private Catholic high school, Brockton High School, and Randolph High School. Coyle Cassidy was not cooperative in providing student scores, and their high school teacher, who they required attend the labs, was disengaged to the extent that he was a poor role model. Therefore, in 2008 only Brockton and Randolph were invited to participate. In that year there were problems with attendance among the Brockton students. Some of the teachers, in their evaluations, suggested that Brockton be eliminated from the program in 2009. In 2009 teachers from both Brockton and Randolph were invited to a planning meeting. While Randolph faculty appeared enthusiastic, the science teachers from Brockton did not attend, although one vice principal did. As a result, the offer to participate in the AP Laboratory Experience was offered to Randolph first and when there were empty slots they were offered to Brockton. The Brockton chemistry teacher decided not to participate, but 10 biology students did participate in the program.

The Stonehill faculty member who runs this component of the STEP program said that this was the program's most successful year. The faculty survey corroborated that perspective. Everyone agreed that the students were more engaged than in previous years, and the engagement and enthusiasm of the high school teacher from Randolph had a strong positive impact as well. One teacher held a review session to go over problems like those that would appear on the AP exam. He reported that he received strong positive feedback from the students, who he felt really benefited from the session, and he recommends holding two such sessions next year. The other teacher pointed out that most of the labs were new to the Randolph students and repeats for the Brockton students. This may explain the difference in enthusiasm that has been noted between the two groups.

In the 2009-10 academic year 56 students participated in the program. The demographic data on 52 of the students appears in Table 11 below:

Table11. Demographics of participants in AP lab program

	Male	Female	African Amer.	Amer. Indian/Ala	Asian Amer.	Latino	Native Hawaiian	Caucasian	Other	Total Diversity
#	20	32	10	0	24	2	1	8	7	44
%	38.5	61.5	19.2	0	46.2	3.8	1.9	15.4	13.5	84.6

We received all 56 AP test scores on the program participants for 2009-10, however comparison scores were obtained for only nine students. To conduct a meaningful statistical analysis, students' scores were analyzed for the three years of the program. In all, 134 program participants were compared to 76 non-participating students from the same high schools. Scores were examined in two ways. First, they were divided into two categories: those that achieved a grade of three or higher and those that did not. A chi square analysis revealed a significant relationship between program participation and AP score category [$\chi(1)=11.452$, $p<.005$]. As can be seen in Table 12, 38.1 percent of the program participants, as compared to 15.8 percent of the comparison group, scored a three or better.

Table 12. Relationship of program participation to scoring a three or higher on the AP exam

Group	AP score of 1 or 2		AP score of 3, 4, or 5		Total	
	#	%	#	%	#	%
Program Participant	83	61.9	51	38.1	134	100.0
Comparison Group	64	84.2	12	15.8	76	100.0
Total	***147***	***70.0***	***63***	***30.0***	***210***	***100.0***

Second, we divided the scores into those that achieved a grade of four or higher and those that did not. This might be considered a more meaningful categorization because scores of 4 and 5 usually enable students to earn college credit. Table 13 presents the same data with that grouping. As can be seen, 20.1 percent of program participants scored a 4 or 5, compared to only 4.0 percent in the comparison group. A chi square analysis revealed a significant relationship between program participation and AP score category [$\chi(1)=10.496$, $p<.005$.

Table 13. Relationship of program participation to scoring a four or higher on the AP exam

Group	AP score of 1, 2, or 3		AP score of 4 or 5		Total	
	#	%	#	%	#	%
Program Participant	107	79.9	27	20.1	134	100.0
Comparison Group	73	96.0	3	4.0	76	100.0
Total	***180***	***85.7***	***30***	***14.3***	***210***	***100***

Program Sustainability

The Public-Private Partnership to Increase Enrollment, Retention, and Diversity in Chemistry, Biology and Biochemistry, a collaborative project between Stonehill College and Massasoit Community College, has just begun its fifth and final year of funding. Realizing that this funded program has had a profound impact on science education in both institutions, administrators and faculty have been proactive in finding ways to sustain the program once the funding ends.

At Stonehill, this program has taken place in the context of a broader institutional investment in science education. In the fall of 2009 a new science building opened, and the college admitted 155 freshmen intending to major in science, compared to 104 the previous year. An additional line for a chemistry faculty member, initially funded by the STEP program is now half-funded by the College, and when the program funding ends the College will fund the entire line. In addition, the College has expressed interest in taking over the Summer Bridge program. The College is exploring possible funding sources for the AP laboratory experience.

In May 2009, Stonehill, in partnership with Massasoit received a five-year grant of $600,000 from the National Science Foundation's Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) Program for a project entitled, *"Access to the Science Education of a Four-Year Liberal Arts College for Economically Disadvantaged Students."* Programmatic features funded by S-STEM that will contribute to sustaining the current program include enhanced advising, mentoring/tutoring, undergraduate research, early recruitment efforts, career awareness, and access to financial aid.

In April 2010, Massasoit and Stonehill collaborated in applying for, and received a one-year grant of $100,000 from the Lloyd G. Balfour Foundation for a project entitled, *Stonehill-Massasoit Community College Transfer Initiative.* This grant will be used to sustain the summer research program, funding summer stipends for students and faculty research, advising of and scholarships for Massasoit transfer students (and possibly Stonehill students if transfer admissions are low), career awareness seminars, student field trips, and a science transfer day.

As described earlier in this report, the culture in the science programs at Massasoit Community College has undergone a profound change, such that there is an increased emphasis on scholarly research for faculty and research experiences for students. The lead Massasoit faculty member on this STEP grant, Rachel Hirst, has begun to take steps towards applying for grants to make scientific research a reality at Massasoit. She, along with colleagues, submitted an application to attend a series of workshops on how to prepare proposals for NSF's Course, Curriculum and Laboratory Improvement (CCLI) grant program which has recently been extended to community colleges. In her application for the workshops, she articulated the following objectives: Continuing the Massasoit-Stonehill summer research program, incorporating research-like experiences in classroom settings, and creating a research culture on Massasoit's campus.

These efforts demonstrate institutional and faculty commitments to sustaining the collaborative partnership that has led to rich educational opportunities for science students at both institutions.

Findings

Stonehill College has successfully implemented *A Public-Private Partnership to Increase Enrollment, Retention, and Diversity in Chemistry, Biology, and Biochemistry* through its NSF-STEP grant for four years, and has systematically evaluated its effectiveness and made changes on the basis of those evaluations. At this point every aspect of the program is flourishing, and students at both institutions are benefitting from that. The students rave about the program, and the faculty are strongly invested in it and committed to providing a rich science education in the context of a supportive and nurturing environment.

The program is on target or ahead of targets in meeting many of its goals and objectives. Most important has been the increase of 24 percent in the number of science majors at Stonehill, exceeding the 20 percent goal. As can be seen in Table 14, Stonehill has fallen short of its goals in increasing diversity among science students. While the number of transfer students admitted to Stonehill falls short of the original goal, it should be noted that Massasoit science students are successfully transferring to and graduating from four year colleges at high rates.

Table 14. Project Outcomes

Outcome Measures	Year 1		Year 2		Year 3		Year 4	
	Expected	Achieved	Expected	Achieved	Expected	Achieved	Expected	Achieved
Increase in total Stonehill science students	0	31	13	64	41	103	90	174
Annual increase in underrepresented Students in sciences at Stonehill	0	2	3	1	8	2	16	15
Annual increase in science transfers to Stonehill	2	0	3	1	5	2	7	3

Recommendations

1. **Schedule regular meetings among faculty who teach theme-based chemistry.** During the focus group meeting with the faculty who taught the theme-based course it became apparent that many were experimenting with different class formats and other pedagogical techniques, and some found themselves interested in hearing about what their colleagues were doing. Given that this course is a work in progress, and also given the seeming collegiality and receptivity to new ideas that this group exhibits, regular meetings designed to exchange experiences might be useful.
2. **Continue efforts to sustain this program.** Both Stonehill and Massasoit have done an excellent job of identifying ways to sustain this successful program beyond the funding period. In light of the demonstrated success of the AP lab component, the College should continue its efforts to find funding to sustain that initiative.