



PROGRAM REVIEW

A PROCESS FOR
SELF-EVALUATION
AND
CONTINUOUS IMPROVEMENT

PHYSICAL SCIENCES DEPARTMENT

Bergen Community College

PROGRAM: Physical Sciences Department

PROGRAM REVIEW TEAM: Gary Porter, Fred Marton, Joan Tscherne, Lynda Box and the BCC Physical Sciences faculty

DATE OF THIS REPORT: June 2015

PERIOD OF YEARS BEING REVIEWED: from 2009/10 to 2014/15

OVERVIEW

State the mission of the program, describe program goals and objectives, describe the relationship to overall college mission and goals, ...

In keeping with the mission of Bergen Community College, the Physical Sciences Department prepares students to transfer into baccalaureate programs in chemistry, physics, earth science and engineering science. Within each of these disciplines students are trained in scientific reasoning and to demonstrate problems solving skills. They are expected to demonstrate mastery of the discipline-specific terminology. The courses also aim to train them in discipline specific software and instrumentation. Graduates of baccalaureate programs in chemistry and physics programs contribute to the community by entering traditional STEM occupations in research, quality control, laboratory technology, engineering, environmental science and academia.

SUMMARY OF SIGNIFICANT DEVELOPMENTS SINCE LAST PROGRAM REVIEW

Provide a brief summary of significant developments since the last program review, with particular emphasis on challenges identified by the previous team, accomplishments relating to the action plans, any work yet to be done, ...

Since the last program review a new chemistry laboratory wing with five labs and two preparation rooms have been completed and the physics laboratories have been renovated on the Paramus campus. Both are now equipped with projection systems. There are also 74 laptops available for student use during laboratory sessions as well as Quest 2 data collection devices and probes for automated data collection. A laboratory for chemistry and physics classes was built on the Meadowlands campus two years ago.

The STEM-GPS grant now in its fifth and final year has allowed us to undertake programs and activities that enrich the experience of our students and support student success. Thanks to the STEM grant a Math-Science Walk-in Center has been established which provides tutoring for students in STEM courses. In the STEM Center, faculty provide one-on-one tutoring to support students in their course work. Through the STEM Student Union students participate in engineering related projects involving building and programming electronic circuits and developing machining/manufacturing skills. Students at BCC are entering four year colleges with experience few students at the transfer college have.

The Bridges to the Baccalaureate (B2B) grant funded by NSF provides stipends for community college students from underrepresented populations for books and other supplies to support them as they work toward transfer to a four year institution and a baccalaureate degree.

Several new Honors courses have been established in the past five years, CHM-140, CHM-240, CHM-260 and CHM-262, PHY 114 and PHY-185. Through these courses our students are challenged to understand the underlying reasons for natural phenomena.

The retirement of two tenured faculty members (one in chemistry and one in physics) and the loss of a chemistry instructor who decided to take a position at another institution has put a strain on the department as it attempts to find qualified instructors for all of the classes necessary to meet the students' needs.

FOCUS ON STUDENTS

Reflect on the degree to which the program is meeting student needs. Comment on each of the following categories. Some considerations are given after each category—**please comment on only those which are applicable to this program.**

Demographics

[Analysis or examination of the demographics of the students enrolled, special populations being served or not being served, trends and patterns of enrollment, comparisons to other colleges in New Jersey and national trends,

AS.NSM.GEN. For this major, for Fall 2014, there were 341 fulltime and 173 part time students with the following demographic composition: 28.7% white females; 21.5% white males; 26.5% female Hispanics; 24.8% male Hispanics; 10.7% male Asians; 10.7% female Asians; 4.8% Black females; 3.7% Black males. The biggest group of students was Hispanic closely followed by white students with female students outnumbering male students in each case.

AS.NSM.CHEM: For Fall 2014, there were 46 full time and 26 part time students enrolled; 20% white females; 21.9% white males; 25.0% female Hispanic; 28.1% male Hispanic; 25.0% female Asian; 9.4% male Asian; 5.0% female Black 3.1% male Black. The biggest group in this cohort was Hispanic followed by white students, with male students outnumbering female students in each case.

For the period Fall 2010 to Fall 2014 decreases were seen in the number of Asian, White, male and students in the biggest population group of 18 - 21 years. Increases were seen in the female, Black and Hispanic populations.

AS.NSM.PHYSC: For Fall 2014, 18 fulltime and 8 part time students enrolled: 44% white male; 16% Hispanic male; 12% Asian male; 8% Black male; 16% Unknown male. From the data, only male students enrolled in this major.

For the period Fall 2010 to Fall 2014, increases were seen in the White, Black and male and age 22-24 populations while decreases were seen in the Asian, Hispanic, female and 18-21 year old populations.

AS.ENGIN.SC. For Fall 2014, 223 fulltime and 131 part time students enrolled with the following demographic composition; 32.6% white female; 28.0% white male; 27.9% female Hispanic; 23.2% male Hispanic; 7.0% female Asian; 10.0% male Asian; 2.3% female Black; 3.2% male Black with the remainder being Unknown. The majority of the students was white followed by Hispanics.

For the period Fall 2010-Fall 2014 the Hispanic, White, male and 18-21 year old populations increased, while the Asian and Black decreased. The ratio of male versus female remained the same.

A diverse body of students is enrolled at the College: full time, part time, male, female, White, Hispanic, Asian, Black. and students of varying ages and from over one hundred different countries. The College also serves a large proportion of Special Needs students as well as Veterans.

Student Satisfaction

[Student surveys of enrollees, transfer students and/or graduates (program-specific or institution-level), qualitative measures for example focus groups or interviews, ...]

AS.NSM.GEN:In 2012, 6 graduates from this major responded to the *Graduate Follow Up Survey*. All were enrolled full time at another college in a degree granting institution. For 50% of these students 64+ credits earned at BCC transferred, for the other 50%, 33-63 BCC credits transferred.

Three students were employed part time, 1 was not available for employment, and 2 were seeking employment. Three students stated that their program of study at BCC helped their performance on the job. In response to the question *how well did the training at BCC prepare you for your current job*, the rating was 2.5 out of a 5.

Sixty one NSM graduates responded to the *Graduate Transfer Experience Survey*. The universities with the largest number of BCC transfers were Montclair State University, Rutgers University, William Paterson University and Ramapo College. Eighty two percent of students transferred to institutions within New Jersey, while 16.4% transferred to out of state institutions and 85.2% were currently enrolled in their program.

For 27% of the students, 50-60 credits were accepted; for 23% of the students 61-70 credits were accepted. Some students, 24.6% had to retake some General Education courses and 32.8% stated that some of their BCC courses (including chemistry) were not accepted.

AS.NSM.CHEM: There were no responses to the *Main Graduate Follow-Up Survey* for 2012. For 2011 two students responded. One was a full time student, the other was not enrolled. One student had 64+ BCC credits transferred, the other had 33-63 credits transferred. In response to the question *how well did the courses at BCC prepare you for further education* the score was 4.5 out of 5.0. The same score was obtained for the question *how well did the training at BCC prepare you for your current job*.

One student transferred to NJIT, the other to Mount Holyoke College.

Both were employed in jobs that were somewhat related to their BCC program of study.

One stated that the BCC program helped in obtaining a job, the other stated that the BCC program helped job performance.

No data was available for the *Graduate Transfer Experience Survey*.

AS.NSM.PHYSC: No data was available for the *Main Graduate Follow-up Survey* or for the *Graduate Transfer Survey* for 2011 or 2012.

AS.ENGIN.SCI: No data was available for the *Main Graduate Follow-up Survey* or the *Graduate transfer Survey* of 2012.

One student responded to the *Graduate Follow-up Survey* of 2011. This student was enrolled part time at NJIT and gave a score of 4.0 out of five in response to the question *how well did the courses you completed at BCC prepare you for further education*. The student's job was directly related to his/her program of study and stated that his BCC program helped his performance on the job.

Learning Outcomes Assessments

[Documented outcomes, degree of faculty participation in regular assessment activities, results of assessments, what has been learned from assessments, what has changed as a result of assessments, what plans are there for changes in the future, are there appropriate feedback loops to improve student learning, ...] Attach copies of recent assessment reports.

The Center for Institutional Effectiveness oversees student and institutional assessment. The assessment of student learning determines whether students are achieving the stated course outcomes. The results are used to improve student learning.

Academic departments have been developing assessment plans since 2005 to address student learning at the program, course and department levels. AS programs are assessed on even year cycles and are two years long.

Each department has an assessment liaison who works with a CIE fellow who assists with the development of the plan.

CIE, through Faculty development offers assessment workshops and the Faculty Senate has established a Learning Assessment Committee to oversee the assessment process.

The CIE website provides valuable information in the form of Handbooks, Analysis of Assessment Activities, General Education Assessment Reports, Framework for Assessment, Assessment Definitions, Curriculum Maps, and Program Learning Outcomes.

Student Success

[Retention and completion rates, placement data, comparison to other colleges in New Jersey and national trends, transfer rates and/or transfer success, graduates' perspectives, employers' perspectives, degree to which students succeed at next educational level, degree to which diverse populations succeed, ...]

AS.NSM.GEN: For fall 2014, the one year retention rate was 80.2% compared to the BCC rate of 68.7% while the transfer rate for the major was 12.1% versus 15.0% for BCC. The graduation rate was 24.2% for the major versus 19.0% for BCC. The 2014 graduation rate was 98, up from 91 in 2013 and included 27 white, 10 Hispanic, and 3 Black students.

AS.NSM.CHEM. For Fall 2014 the one year retention rate was 66.7% for the major compared to 68.7% for BCC while the transfer rate was 38.5% versus the 15.0% BCC rate. The graduation rate for the major was 30.8% versus 19.0% for BCC. There were three graduates up from two in 2013 and down from four in 2012.

AS.NSM.PHYSC: For Fall 2014, the one year retention rate was 71.4% for the major versus the 68.7% BCC rate and the transfer rate was 0%. One student graduated down from three in 2013.

AS.ENGIN.SC. The Fall 2014 retention rate was 75.7% for the major versus 68.7% for BCC. The transfer rate was 19.6% versus 15% for BCC. The graduation rate was 19.6% versus the 19.0% BCC rate.

The demographic composition of the 15 graduates was: 5 White; 3 Hispanic; 3 Asian; 1 Unknown; 3 Other.

The universities with the largest number of BCC transfer students were Rutgers University, Montclair State University, Ramapo College and William Paterson University.

Data Needs

What additional data that is currently not available would have been helpful to effectively evaluate this area of the program?

Data on students' graduation/success rates at their transfer institutions would be helpful in maintaining the high quality of our programs.

FOCUS ON FACULTY AND STAFF

Reflect on the faculty and staff in the program and the degree to which their needs are met, in order for them to in turn be successful with students. Comment on each of the following categories. Some considerations are given after each category—**please comment on only those which are applicable to this program.**

Demographics

[Demographics of faculty and staff, full-time and part-time, faculty, technical/professional assistants, support positions, ...]

The Physical Sciences Department includes seven full-time tenured faculty, two lecturers and nineteen adjuncts teaching chemistry and in physics, six full-time tenured faculty, two lecturers and twelve adjuncts teaching physics, engineering science and earth science on both the Paramus and Lyndhurst campuses. Of the chemistry full-time faculty (tenured and lecturers) 78% (7) hold doctorates in chemistry or a related discipline and 22% (2) hold Master's degrees while in physics 50% (4) of the full-time faculty hold doctorates and 50% (4) hold Master's degrees. Adjunct faculty have a minimum of a Master's degree. In chemistry 33% (3) of the full-time faculty and 68% (13) of the adjunct faculty are male while in physics 88% (7) of the full-time faculty and 75% (9) of the adjunct faculty are male. In addition, 78% (7) of the chemistry faculty and 88% (7) of the physics full-time faculty are Caucasian. Adjuncts in both disciplines are drawn from many ethnic groups. (*For more detailed information, please see p. 12 of the ACS Assessment tool for Chemistry in Two-Year College Programs and p. 12 of the ACS Assessment tool for Physics in Two-Year College Programs.*) The Department has one secretary and one full-time laboratory technician for chemistry. It is also supported by two part-time technicians one for chemistry and one for physics as well as two or three student workers depending on the semester. The laboratory technicians (both in chemistry and physics) hold a minimum of a Bachelor's degree although one in chemistry has a Doctorate. The laboratory support is ethnically diverse with approximately 50% (3) drawn from different minority groups depending on the semester.

Professional Activities

[Special projects, reassigned time, professional organizations, grants (e.g. Perkins), partnerships, publications, presentations, other contributions, ...]

In chemistry 67% (6) of the full-time faculty are members of the American Chemical Society and 33% (3) belong to 2YC₃ while one is a member of the AAAS and one of the NYAS. Nearly half of the full-time faculty have attended at least one scientific meeting during 2015. Among the physics full-time faculty, 38% (4) belong are members of the American Association of Physics Teachers/NJAAPT and one belongs to the Geological Society of America and one to the AAAS. In addition 50% attended at least one scientific meeting during 2015. In general, adjuncts are not reimbursed for attendance at professional meetings and so only a few have attended any professional meetings, however, they are invited to the professional development days sponsored by the College. (*For more detailed information, please see p. 13 of the ACS Assessment tool for Chemistry in Two-Year College Programs and p. 13 of the ACS Assessment tool for Physics in Two-Year College Programs.*)

The Department was awarded a grant of over \$3,000,000 (STEM-GPS) which provides funding to encourage students to enter STEM fields by allowing them to explore scientific areas that require the design, construction and use of technology. It also provides funds for release time for faculty involved in implementation of the grant. Dr. Joseph Sivo receives six hours of release time to mentor students of the STEM Student Union in engineering related projects involving building and programming electronic circuits and developing machining/manufacturing skills. Faculty who serve as members of the STEM “cadre” also receive release time. Dr. Joseph Sivo also co-founded the STEM C² Research Summit an annual spring conference, where students present their research projects.

Publications:

Opstbaum, Roger F. et al. Fast Atmosphere-Ocean Model Runs With Large Changes in CO₂, *Geophysical Research Letters*, 40, December, 2013.

Presentations:

Marton, F., Promoting math skills for laboratory exercises: using “The Math You Need, When You Need It” in an introductory geology course. Paper 125-8 presented at the 2013 Annual Meeting, Geological Society of America, Denver, CO, 27-30, Oct.

Marton, F and McCrary, M., Improving the exam experience: Testing test procedures in introductory physical science courses at a two-year college. Abstract ED21A-0707 presented at the 2013 Fall Meeting, American Geophysical Union, San Francisco, CA, 9-13 Dec.

Marton, Fred, Steinheimer, Jessica, McCrary, Marie, Sivo, Joseph, and Griffo, Paul J., Faculty Advising for STEM students at a two-year college. Paper 37-6 presented at the 2014 Annual Meeting, Geological Society of America, Vancouver, BC, 19-22 Oct.

Marton, Fred, Greater than the sum of their parts? Splitting-up and integrating laboratory exercises into an active-learning classroom at a two-year college. Paper 276-2 presented at the 2014 Annual Meeting, Geological Society of America, Vancouver, BC, 19-22 Oct.

Adjunct Faculty

[Hiring, coordination, support, communication, ...]

There are 31 adjunct faculty in the Physical Sciences Department – 19 teaching chemistry and 12 teaching physics and earth science. The hiring of adjunct faculty is mainly the responsibility of the Academic Department Chair. Resumes are collected centrally by the Human Resources Department and released to the Dean periodically. The Chair interviews the candidates or in the cases where the candidate teaches in a different discipline, the chair may call on another member of the department for assistance.

Staff

[Secretarial/clerical support, other staff support, ...]

The department is supported by one secretary who handles all the secretarial and clerical duties for both the Physical Sciences Department and the Biology and Horticulture Department. There is one full-time laboratory technician and one evening part-time tech who handle the preparation of the reagents and equipment to support the chemistry classes. The full-time lab tech also handles all the ordering for the chemistry lab classes. There are also two or three (depending on the semester) student workers who help with setting up the materials for the chemistry labs. In physics there is a part-time laboratory technician (14 hours/week) who prepares the equipment and any other necessary materials for the physics labs. There are no student workers to support the physics program.

Data Needs

What additional data that is currently not available would have been helpful to effectively evaluate this area of the program?

Better information about the transferability of courses and the success of students after leaving Bergen would help us in designing new curriculum and in general better meet the needs of our students.

FOCUS ON CURRICULUM

Reflect on the curriculum for the program—the courses, the scope and sequence, articulation with other institutions, teaching innovations, and other relevant issues—**please comment on only those which are applicable to this program.**

Summary of Program Curriculum

[Degrees, certificates, sequences of courses] Attach copies of Program Learning Outcomes, Curriculum Maps and Master Course Syllabi, Program Degree Course Requirements, where applicable.

AS.NSM.GEN: This transfer program consists of 30 General Education credits, 9 program support credits and 22-24 program requirements taken from the fields of Biology, Chemistry, Computer Science, Mathematics and Physics.

AS.NSM.CHEM: This transfer program consists of 30 General Education credits, 9 program support credits, 3 free elective credits and 24 program specific credits, namely General Chemistry 2, Organic Chemistry 1 and 2, Calculus 1 and 2 and calculus based Physics 1 and 2.

AS.NSM.PHYSC: This transfer program includes 30 credits in General Education, and 24 program specific credits in calculus based Physics 2 and 3, Engineering Mechanics, Calculus 3 and 8 Natural Sciences credits with General Chemistry 1 and 2 being recommended.

AS.ENGIN.SC: This transfer program consists of 30 General Education credits and 33 program specific credits namely calculus based Physics 2 and 3, General Chemistry 1 and 2, Programming for Scientific Applications, Drafting 1, Calculus 3 and Differential Equations.

All program requirement courses, course descriptions, prerequisite, corequisite courses and sequencing of courses can be found on the College's Online catalog and on the student's program evaluation. Advising Center, Cohort and STEM advisors are available to explain these requirements.

Curricular Issues

[Articulation, program development, course development, changes to curriculum since last approval]

Reflect on the curriculum for the program—the courses, the scope and sequence, articulation with other institutions, teaching innovations, and other relevant issues—please comment on only those which are applicable to this program.

All programs were revised in 2008 to meet the revised state of NJ guidelines for General Education courses. The *Chemistry in Context* and *Energy and Society* courses which are not required courses in the General Science or Chemistry programs, were developed and have been running regularly. The Basic Biochemistry and Introduction to Instrumental Methods of Chemical Analysis courses which are not courses in the General Science or Chemistry programs are no longer being offered.

Prerequisite, co-requisite courses and minimum grade requirements for sequential courses have been established or revised.

There has been an increase in the number of online, hybrid, Honors courses and web enhanced courses.

Lead-in Courses

[Developmental preparation, prior courses and their impact, dual enrollment or articulation agreements with high schools, ...]

Based on the results of the Accuplacer Admissions test, students are placed into remedial or non remedial Mathematics course. The MAT 011, Arithmetic course is required as a prerequisite for the Introduction to Chemistry course.

Students are required to take the Introduction to Chemistry course or to pass the CHM 100 proficiency examination to enroll in General Chemistry 1. The Testing Center directs students to online resources that offer reviews for this test. Students may also take the CHM 100 boot camp, sponsored by a STEM grant, in August or January.

Many courses have established mathematical prerequisites or corequisites.

Follow-up Courses

[Sequential courses, connecting activities, ...]

Because of the high demand for science classes, the department has been offering sequential courses every semester, including the summer semester, for example General Chemistry 1 and 2, General Physics 1 and 2, Calculus based Physics 1 and 2.

Scheduling

[Enrollment patterns and trends; time and date issues such as day, afternoon, evening, or weekend, format issues such as self-paced, online, hybrid, or short-term; ...]

Courses are offered during the day, morning and afternoon, evening, and Saturdays in the traditional, online, hybrid and Honors formats over two Fall semesters, two spring semesters, and three summer semesters. General Chemistry 1, lecture is offered during the winter session. A sufficient number of courses are offered each semester to allow students to graduate in a timely manner.

Fall 1 and Spring 1 courses are fifteen week courses; Fall 2 and Spring 2 are 12 week courses; summer 1 and summer 2 courses are 5.5 week courses; and some courses are offered in an 11 week semester during the summer.

Assessment

[Ways in which the program addresses the college's commitment to assessment and assesses its program learning outcomes, ...]

- a) The syllabus of every course clearly outlines its outcome. Each instructor distributes a copy of the syllabus to each student in the course on the first day of classes.
- b) Each program periodically undergoes a program review in which all program faculty participate. An evaluation by an external reviewer may lead to recommendations which are communicated to the Academic Vice President for possible action.
- c) Also each program is involved in student assessment of learning which takes place over a two year cycle.

In Fall 2012 the Physical Sciences Department developed an assessment plan for Physics and Chemistry.

For **Physics**, data was collected for the Physics 2 and Physics 3 courses during Fall 2013. In Physics 2, data was collected for the Ohm's Law experiment, and for Physics 3, data was collected from the Reflection and Refraction experiment. These experiments were chosen since the preparation, set-up, data collection and report elements are similar and both experiments are done at approximately the same time in the semester. The intended outcome was to measure students' understanding of the scientific method by analyzing laboratory reports.

The students' reports were divided into six parts namely objective theory, data collection, analysis of data and conclusion and was graded using a rubric.

Results: The total scores for Physics 2 and Physics 3 were 88.9% and 92.4% which exceeded the 80% goal. The largest increase was 10% for the Theory section with smaller increases in the Objective section, a 2.3% increase in the Analysis section and a 3.2% increase in the conclusion section. There was a decrease of 1.2% in the Attendance section.

Action: Students must read the experiment before coming to class.

For **Chemistry** data was collected from two experiments in General Chemistry 1: the Relationship Between Mass and Volume and the Heat of Neutralization lab. These reports were chosen to determine whether there was an increase in the number of students who reach competency in understanding the scientific method by comparing the reports from the start of the semester (density lab) to the end of the semester (Heat of Neutralization lab).

The students' reports were divided into three parts, namely objective, data collecting and processing, and analysis and conclusion and were graded using the same rubric that was used for Physics.

Two sections of the General Chemistry 1 lab course were used in this assessment process. For the first section, CHM 141-001, the 80% goal was met. There was a 14% improvement in the objective section, a 2% decrease in the Data Collection and Processing section, and a 19% decrease in the Analysis and Conclusion section.

For the second section, CHM 141-003, students exceeded the 80% overall expectation. There was a 4% decrease in the Objective section. A 14% decrease in the Data Collection and Processing section and a 7% decrease in the Analysis and Conclusion section.

Reasons for the decreases were analyzed and this led to the following action.

Action: Stress concepts relating to lab along with the experimental procedure.

Innovations or Changes in Last Five Years

[New issues, significant changes, improved methodologies, ...]

There has been an marked increase in the offerings of courses including online, hybrid and Honors classes. Many faculty use online resources provided by the publishers, for example Power Point presentations, and online homework and other tools.

Computer molecular modeling using the software Spartan, data acquisition hardware and software by Vernier and other computer programs have been introduced and are routinely used.

Data Needs

What additional data that is currently not available would have been helpful to effectively evaluate this area of the program?

Additional data on how well students are prepared by BCC for their program at the transfer institution.

FOCUS ON SUPPORT

Reflect on the support issues related to this program — **please comment on only those which are applicable to this program.** To what degree are they met, where are there kudos to be given, changes that have taken place, improvements to be made, ...?

Technology

[Hardware and software, technical issues and/or support, instructional issues and/or support, training for faculty]

Over the past five years the Physical Sciences Department has been able to update all the classroom and laboratory presentation equipment, all the rooms used by the department have new teacher stations, projection equipment and presenters as well as Wi-Fi for the teachers and students to access. Both Chemistry and Physics have a set of twenty four new laptop computers on a cart for the instructors to use when a particular experiment calls for it. When all is working as it should, these laptops can print wirelessly to an in lab printer so that the students have access to their experimental results before they leave the laboratory. Students can also send their digital results to themselves via e-mail so they can work up an experiment at home. The PC's or laptops that each faculty member is assigned are also relatively new and in good working order.

Most of these upgrades were funded by the Buehler grant (2009 to 2011) and the Department of Education STEM GPS grant (2011-present). We are also very lucky to have a faculty member in the department who has voluntarily taken on the role of liaison to the colleges IT department. This dedicated faculty member makes sure all of new and existing software is and remains compatible with the college's hardware and systems. Refer to the infrastructure section of our ACS program review in Chemistry and Physics for more detailed information on this subject.

Facilities and Equipment

The recently completed SA (Science Addition) wing and the complementary upgrades and additions to all the Physics and Earth Science laboratories have given the department modern laboratories and classrooms at our Paramus Campus. With this addition, chemistry now has much greater capacity to offer courses but we quickly have once again reached the point where the laboratories are all in use. Physics and Earth Science on the other hand received a wonderful upgrade but didn't gain any new lab space so our ability to offer course is still limited by laboratory space. Hopefully we can retrofit a former Dental Hygiene laboratory into a physics laboratory when the new Health Professions building open up this year.

We also now have two brand new wet laboratories on the 5th floor of our Meadowlands campus building. One of these labs is shared between Chemistry and Physics and is also starting to reach capacity. These Meadowlands labs are state of the art and have smart classroom presentation capabilities.

As was mentioned above most of the equipment, instrumentation and furniture that was purchased over the last year was funded by the Buehler grant (2009 to 2011) and the Department

of Education STEM GPS grant (2011-present). We were also able to purchase and implement new Pasco® data acquisitions equipment, Oscilloscopes and signal generators for the Physics labs as well as analytical instrumentation that is used in both the General the and Organic Chemistry laboratories. New *Vernier*® data acquisitions equipment that interfaces with our updated laptops was recently purchased with departmental funds.

For more information on this topic refer to the Infrastructure section of our ACS program review in Chemistry and Physics.

Learning Resources

[Collection of books, databases, journals, videos, ...; learning assistance or tutoring, ...]

The Sidney Silverman Library and the Meadowlands campus Library are state of the art Library facilities with more than one hundred and twenty thousand volumes in print and over sixty Academic and Technical databases for the students, faculty, staff and the community to access. The Silverman library has group study rooms as well as study carrels for private study. Both Libraries are open six days a week for extended hours. The Henry and Edith Cerullo Learning Assistance Center was awarded the number one rated Tutoring Center among two year colleges in the country last year. The Center includes a newly created Math and Science Walk in Tutoring Center that is funded by the college's STEM GPS grant and is especially utilized by students in Chemistry and Physics courses. The Meadowlands campus also offers similar tutoring services at that location. Traditional one on one tutoring is also complemented by faculty lead workshops hosted by the center. Supplemental Instruction is led by certified SI leaders and peer led study groups. The STEM GPS grant and the Student led "STEM Student Union" also operate the STEM research center in S315. This space serves as a more informal lab where students can work on their research projects and or hold group meetings and seminars where they present their work. The faculty / student research teams also utilize the Manufacturing Technology laboratory (TEC 101), SA119 and the Block house to design, build and test their projects. The Block house is a student led refurbishment project that took an abandoned concrete shell and retrofit it into an off the grid building design and energy conservation laboratory that is available to instructors and college community members to use.

For more information see the Infrastructure section of our ACS program.

Marketing and Public Relations

[Brochures, print materials, website, special events, recruitment efforts, ...]

The Physical Sciences Department doesn't currently print professional quality brochures for and of its degree programs, it does however maintain and / or support the following webpages for students to access information about its programs, courses and extracurricular activities and organizations

- ✓ Physical Sciences homepage
<http://www.bergen.edu/academics/academic-divisions-departments/physical-science>

- ✓ Physical Sciences Course Syllabi
<http://www.bergen.edu/academics/academic-divisions-departments/physical-science/course-syllabi>
- ✓ Physical Sciences Faculty contact information
<http://www.bergen.edu/academics/academic-divisions-departments/physical-science/our-faculty>
- ✓ Academic Degree Programs in the Physical Sciences Department
<http://www.bergen.edu/Portals/0/Docs/Academics/Acad-Catlg2015-16.pdf>
- ✓ STEM GPS grant website
<http://www.bergen.edu/stemgps>
- ✓ Bergen STEM Student Union home page
<http://bergenstem.org/>

Support Services

[Advisement, assessment, testing, job placement, ...]

Each of the Departments thirteen full time faculty member are responsible to contribute fourteen hours of advisement, this can be completed by working in the College's walk in advisement center or by providing academic advising to a particular student group, club or POD. The STEM GPS grant currently provides funding for a full time dedicated counselor for students majoring in one of twelve STEM disciplines which includes all the degrees within the Physical Sciences department. Some faculty member have volunteered to advise a group of students by majors as assigned by the STEM counselor.

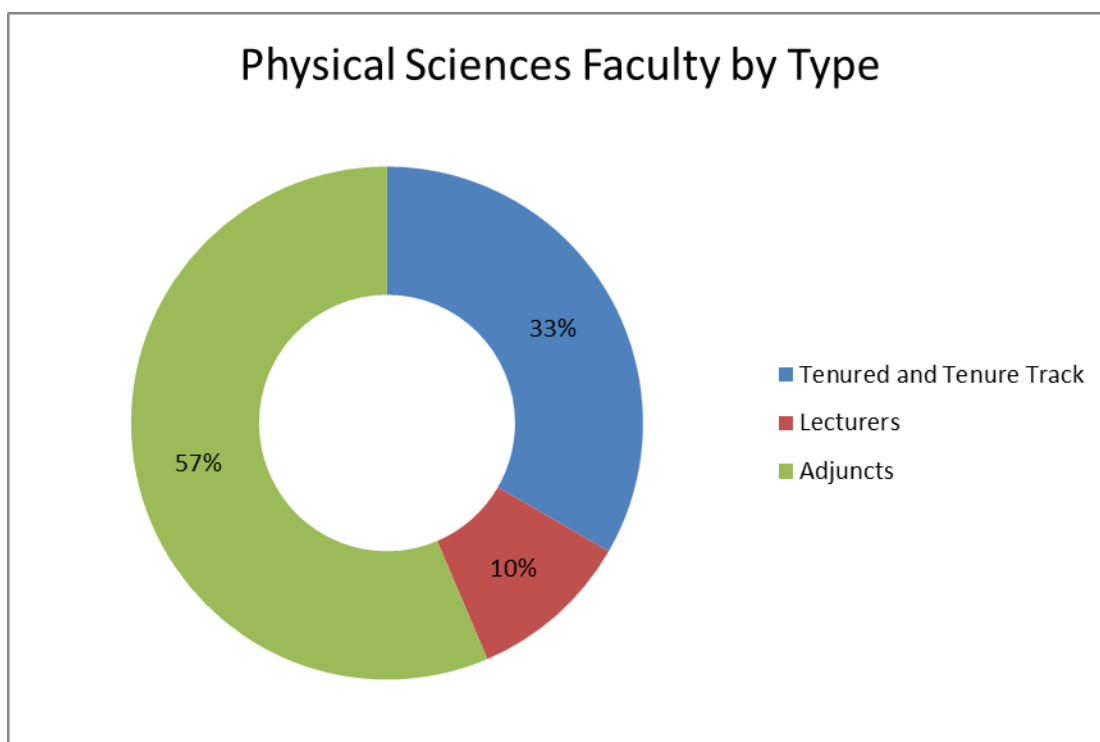
The college maintains Testing Centers at both the Paramus and Meadowlands campuses, these facilities are open six days a week for extended hours. Faculty member typically use the facilities to administer make up exams and also to students in certain online courses. The college also maintains a robust Career and Workforce Development Center which is open to students in the physical sciences department at no charge.

Resources, Budget

[Staffing, operating and capital budgets, grants, including Perkins funding, ...]

The Chemistry Discipline has seven full time tenure and tenure track faculty, two lecturer lines and typically has twenty adjuncts teaching each semester. The Physics department has six full time tenure and tenure track faculty, two lecturer lines and typically has twelve adjuncts currently teaching each semester. Three of our Division's fifteen lecturers are currently funded by the STEM GPS grant which is currently in its last year. The demand for Chemistry and Physics courses continues to grow at the college and qualified and effective adjuncts are very hard to come by. If we had more full time faculty we could offer and fill several more sections of

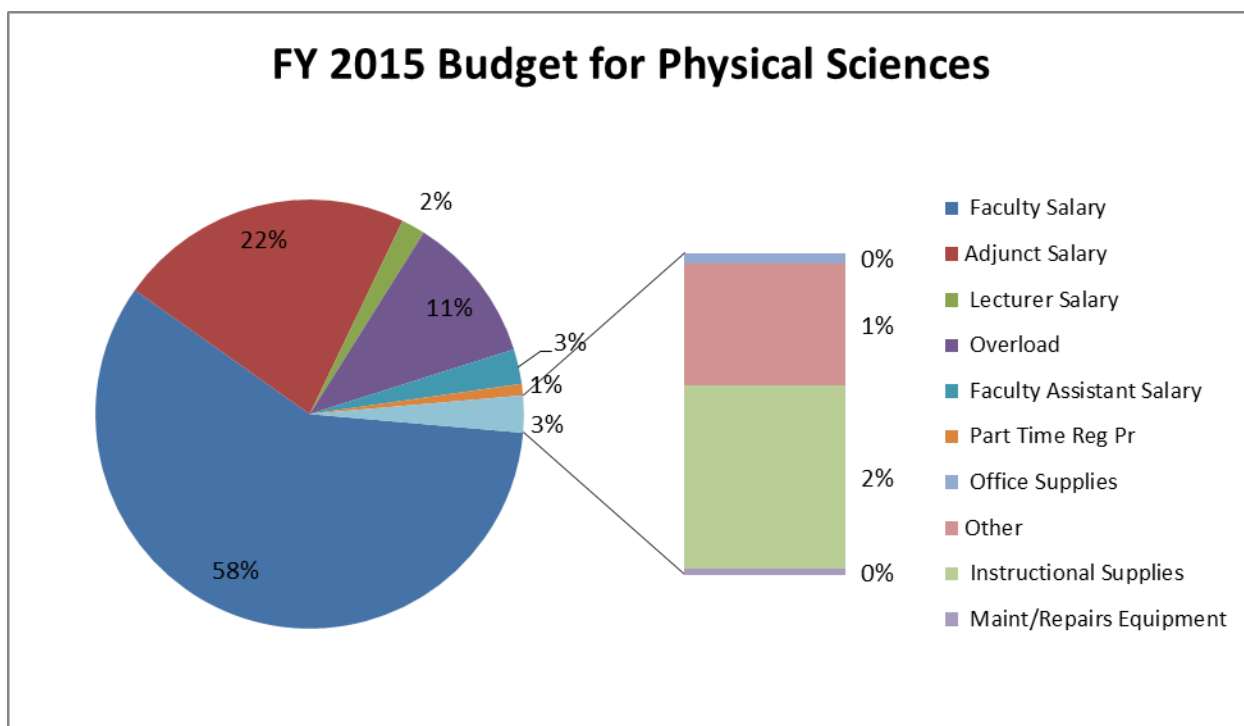
high demand courses. In the fall of 2015 our division grew by 6% while the overall enrollment of the college decreased by 2.5%. We also had two Full time faculty retirements this past spring, one in Chemistry and one in Physics. At the very minimum these lines should be replaced. A summary chart of the faculty break down by type for the entire department is presented below. The department shares an administrative assistant with the Biology department which works out well. But it had lost one of its two Chemistry Lab technicians a few years back and this position has never been filled, so we are forced to use part time lab techs to simply cover the hours that the lab is in operation. This situation has caused quality issues in the labs that affect the students' outcomes and may ever prove to be a safety issue going forward.



For a more detailed look at the faculty, technical and support staffing in the department refer to pages 12 and 13 in both the Chemistry and Physics ACS program review documents.

Bergen Community College operates with a fiscal year from July 1 till June 30th each year; the total departmental budget for the year was just over 2.1 million dollars and the % break down of that that allocation is show below. As you can the vast majority of the budget is spent on the three classes of instructional salaries which are outside of the department's control. The most important item on the discretionary side of the budget is the instructional supplies line which was just over \$32,000. This amount has been relatively stable over the five years and seems to be an adequate amount to cover consumables but is not typically enough to cover lifecycle upgrades to equipment and instrumentation. The Laboratory fees generated by each student who takes a chemistry and / or physics class currently does not come directly back to the Instructional Supplies budget as you might expert but the administration does factor in the generated revenue

in a fiscal year when determining the Instructional Supplies budget for a subsequent year. Over the past five years we also have been able to utilize significant STEM GPS and Buehler grant funds for new equipment and life cycle upgrades in both Chemistry and Physics. Both of these grants are now coming to an end so we anticipate having much larger budget constraints going forward. None of the degree programs in the department qualify for Perkins funding and the department does not have its own capital budget; it must reserve funds out of the operational budget for one or two small capital projects each year.



For a more detailed look at the Physical Sciences Departmental budget and resources, refer to pages 9 and 10 of both the Chemistry and Physics ACS program review documents.

Data Needs

What additional data that is currently not available would have been helpful to effectively evaluate this area of the program?

No additional data is required at this time.

FOCUS ON COMMUNITY

Reflect on the degree to which you seek regular input from outside of the college—the community—for this program— **please comment on only those which are applicable to this program.**

Community Groups

[High school connections, community agency connections, other forms of community involvement, ...]

The Physical Sciences Department has formal connections and / or partnerships with the following entities;

- ✓ Applied Technology High School (*located @ BCC's Paramus campus and shares laboratory space in our SA wing*)
- ✓ Paramus Rotary Club (*Professor Box is a member of the chapter*)
- ✓ RAHP (*Ridgewood Academy of Health Professions, Professor Ricatto is a long serving Board member for the program*)
- ✓ Buehler Challenger and Science Center (*Dr Ricatto is a member of the Board of Trustees*)
- ✓ Whitehouse labs (*BCC has placed Chemistry students into summer internships over the past two summers*)

For a more detailed look at community partnerships that currently exist or are under development with the department, refer to page 39 of both the Chemistry and Physics ACS program review documents.

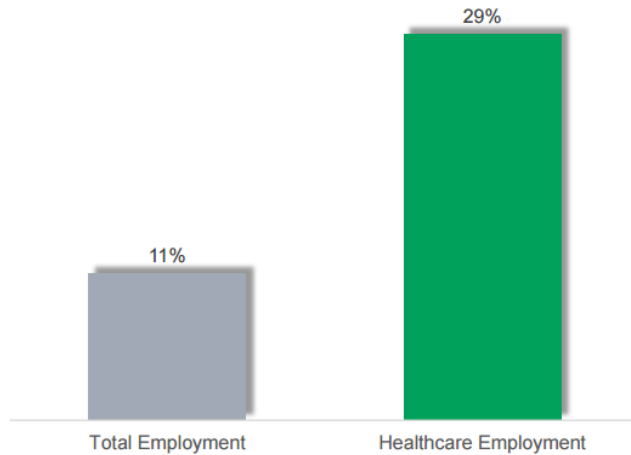
Community Issues Related to Program

[Trends, employment trends or projections, transportation, funding]

With the completion of the College's new Health Professions Building we expect the already high demand for prerequisite chemistry and physics courses by students interested in careers in the health professions both at BCC and at BS and MS programs elsewhere will to continue to grow. This expected trend in demand for chemistry and physics courses by students in the health professions is driven by the unprecedented expected growth in Healthcare Employment (*see below* [<http://www.nasrecruitment.com/uploads/files/healthcare-workforce-outlook-to-2022-72.pdf>]).

Employment Growth

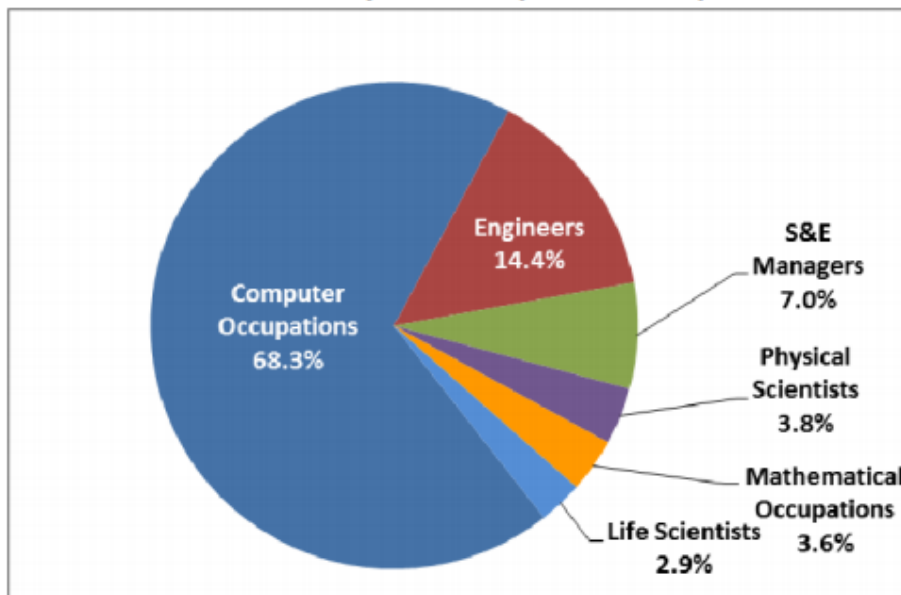
Projected 2012-2022



Employment in the healthcare and social assistance industry is projected to grow by 29% from 2012 to 2022, according to the Bureau of Labor Statistics. This is more than twice as fast as the projected total employment growth overall.

Bases on the national trends (below) for employment growth in Physical Sciences and Engineering, we also expect a corresponding growth in our Chemistry, Physics and Engineering Science Degrees over the next twenty years.

Figure 6. Share of Total Projected S&E Occupational Job Growth, 2012-2022, by S&E Occupational Group



Source: CRS analysis of Employment Projections, 2012-2022, Bureau of Labor Statistics, U.S. Department of Labor.

Notes: Numbers are rounded and may not add to 100%.

External Requirements or Considerations

[Certifications, accreditations, licensures, professional organization status or involvement, ...]

The Physical Sciences department is currently not involved in any external certifications, accreditations or licensure.

Advisory Boards

[Advisory Boards' composition and input, number of Advisory Board meetings during the last two years, degree to which the Advisory Council reviews the competencies of the degree or certificates and program courses, timeframes for last reviews, other functions or activities of the Advisory Board, ...]

The Physical Science department does not have a separate advisory board for the department or any of its degree programs, instead it chooses to use the very successful umbrella STEM GPS advisory board to accomplish its mission. The current membership of this body is given in the table below.

STEM GPS Advisory Board 2015-2016

- Mr. Peter Abitante Stryker Orthopedics
Vice President
Global Hip Research & Development
- Dr. John Bechtold NJIT
Department Chair & Professor of Mathematics
- Dr. Karin Block City University of New York
Professor
Department of Earth & Atmospheric
Sciences
- Dr. Lee Carpe President
Carpe Consulting, LLC
- Mr. Jonathan Goldman Mankind, Inc.
Director of Business Development
- Ms. Yamini Mandalia BASF Corporation
Research Chemist

- JoAnne Mitchell Sandvick Coromant USA
Senior Project Leader

- Richard J. Moitoza POWER Burns and Roe
Principal Engineer

- Manfred Morales UPS
Corporation Operations Project Manager

- Ms. Jane Mullooly Triangle Manufacturing Company, Inc.
Manufacturing Training Specialist

- Dr. Marion McClary Fairleigh Dickinson University
Associate Professor of Biological Sciences
Co-Director, School of Natural Sciences
Biology and Marine Biology

- Mr. Nick Paolazzi Lubrizol Advanced Materials, Inc.
Plan Manager

- Mr. Daniel Prince Gibraltar Laboratories Incorporated
President and CEO

- Dr.. Edward Saiff Ramapo College
Dean, School of Theoretical
& Applied Sciences

- Jeffery Schlecht RSC Architects
Senior Project Leader

- Dr. Lynn Schneemeyer Montclair State University
Associate Dean for Academic Affairs
Professor of Chemistry
College of Science and Mathematics

Mr. Kenneth E. Wolf William Paterson University
Dean, College of Science and Health

Data Needs

What additional data that is currently not available would have been helpful to effectively evaluate this area of the program?

No additional data is needed at this time.

Summary

- Achievements and Progress Since Last Review

In the intervening years, the Physical Sciences Department was created as one of three off shoot departments of the Science Department. The laboratory facilities for the Physics & Earth Science classes were renovated in the mega complex. However, no additional classroom laboratory space was allocated. The laboratory facilities for Chemistry were new construction and the total facilities have increased by nearly 50%

In addition staff has vacillated through this time frame. Initially, staffing had increased by 1 in Chemistry and 2 Physics (Earth Science) to meet the external demand for more Chemistry, Physics and Earth Science Courses. And as can be validated by college data, the enrollments (revenues) in these areas continued to rise. Since that initial hiring, the department has not received approval to replace faculty lines due to retirement and resignation factors. Recently one faculty member in Physics/Earth sciences and two faculty in Chemistry have left the college. Unfortunately, due to purported financial issues at the college, no decisions regarding the replacement of these lines has been forthcoming.

In spite of the lack of college support for suitable & sufficient staffing, the department continues to increase offerings to meet demand. It should be recognized that in spite of the continued increase in offerings, the demand for science, physics, and earth science courses continues to outstrip the department's ability to meet the demand.

Finally, sciences laboratory instruction requires resources that non laboratory courses have. In addition, to budgetary resources to cover the costs of supplies and equipment, staff is required to prepare and maintain the equipment and supplies. Since the last review, the number of hours of staffing time has been decreased concurrent with an increase in the number of courses offered.

- Mission, Goals, and Objectives

At this time the department has no regularly published mission and goals. A quick review of the colleges Mission Statement below suggests that the department serves a central function of the college by offering “a comprehensive set of accessible, affordable, high-quality credit degree programs.”

Mission

Bergen Community College educates a diverse student population in a supportive and challenging academic environment that fosters civility and respect. The college offers a comprehensive set of accessible, affordable, high-quality credit and non-credit courses as well as degree and non-degree programs. Bergen provides life-long learning opportunities for all members of the community. The college responds to community needs through work force training and continuing education, and by developing programs for employers.

- Strengths

The following major strengths have been identified.

- All laboratory facilities have been recently renovated at the college. The newest facilities on the first floor of a new wing at the college were assigned to chemistry classes.
- Currently, sufficient institutional resources have been made available to fund virtually all instructional supplies and equipment needs.
- Currently, sufficient grant resources have been made available to fund a multitude of instructional projects in support of teaching and learning.
- Currently sufficient foundation resources have been made available to support the public use of astronomy resources at the college.
- Currently sufficient resources from a diversity of sources have been made available to fund major equipment acquisitions.

- Challenges

The following challenges have been identified.

- This program review is being initiated at a time when the college questions the validity of having degree options in Chemistry and Physics separate from the parent program in Natural Sciences and Mathematics. Contributing to this consideration is the paucity of graduates in these options as compared to the parent program.
- The Physics Faculty have concerns regarding the lack of technical support in the laboratory and the failure to expand classroom availability for Physical Science (Physics & Earth Science) Courses.
- The Chemistry & Physics Faculty have concerns regarding the college's recent failure to replace lines held by retirees up until the Spring of 2015.

Celebration and Recognition

The following celebrations and recognitions have been identified.

- Marton, F., Promoting math skills for laboratory exercises: using “The Math You Need, When You Need It” in an introductory geology course. Paper 125-8 presented at the 2013 Annual Meeting, Geological Society of America, Denver ,CO, 27-30 Oct.
- Marton, F. and McCrary, M. Improving the exam experience: Testing test procedures in introductory physical science courses at a two-year college. Abstract ED21A-0707 presented at 2013 Fall Meeting, American Geophysical Union, San Francisco, CA, 9-13 Dec.
- Marton, Fred, Steinheimer, Jessica, McCrary, Marie, Sivo, Joseph, and Griffo, Paul J., Faculty advising for STEM students at a two-year college. Paper 37-6 presented at 2014 Annual Meeting, Geological Society of America, Vancouver, BC, 19-22 Oct.
- Marton, Fred, Greater than the sum of their parts? Splitting-up and integrating laboratory exercises into an active-learning classroom at a two-year college. Paper 276-2 presented at 2014 Annual Meeting, Geological Society of America, Vancouver, BC, 19-22 Oct.
- Opstbaum, Roger F., co-author: Fast Atmosphere-Ocean Model Runs With Large Changes in CO₂, *Geophysical Research Letters*, 40, December 2013.

Recommendations for Changes

Externally, the demand for Physics, Earth Science, and Chemistry has continued to rise in the intervening years from the last program review. Without exception, most offered sections that start the semester, closed with unmet demand on waiting lists for these classes. The department continues to attempt to meet this demand by increasing the part time faculty resources. Therefore offered courses continue to rise.

Internally, the number of laboratory facilities for Chemistry has increased to meet this demand. However, the number of laboratory facilities for Physics and Earth Sciences have not increased. So the need for additional offerings in Physics and Earth Science will continue to hinder the department’s ability to meet this demand.

Internally, on the chemistry side of the offerings, the department has experienced a decline in the number of full time chemistry faculty. While on the surface some collegiate leaders might argue to simply hire more adjuncts, some minimal full time cadre of full time faculty is required to maintain quality. For example, chemistry faculty volunteer for (uncompensated) responsibility to be Course Coordinators for the various offered courses in the department. At present the

department has eight different classes which are offered. With six full time faculty current on staff, many have had to do double and triple duty to maintain the quality of the oversight.

In addition, the faculty staffing issue in chemistry is only projected to get much worse in the next one to three years. The pending alleged retirement of additional chemistry colleagues looms menacingly in the near future. This is exacerbated by the fact that not just faculty but experienced full time faculty is needed to ensuring “quality” oversight of departmental chemistry offerings.

Finally, the hours for staff, whose responsibility to prepare and maintain the laboratory offerings and facilities, continues to decrease in the face of increasing the offerings in physics, chemistry, and earth science. Remaining resources will be hyper focused on preparing experiments leaving little time left for maintenance. Therefore inevitably decline in the maintenance of the laboratory facilities is anticipated. Unfortunately, history has taught us that a decline in maintenance will lead to an increase in hazards which students, staff, and faculty, may become exposed to.

ACTION PLAN

Program review is a means to an end in itself. Your final task is to develop a plan to improve the program.

[Identify 2-3 program goals and objectives for the future, improvements planned, changes taking place, responsible parties, timeframes, resource implications, etc...]

- 1) **Goal:** Offer more upper level courses in Physical Sciences (Chemistry, Physics and Earth Sciences) at the Paramus and Lyndhurst campuses to meet increasing student demand.
 - a) **Objective:** To schedule many more classes in additional classrooms.
 - i) **Timeframe:** Fall 2016
 - ii) **Responsible Party(ies)** : Dean Ricatto and the department head of the Physical Sciences department.
 - iii) **Resource Implications:** S-319 has been identified as a suitable room for a Physics laboratory at the Paramus campus. This room will become available by summer 2016 when the Dental Hygiene relocates to the new Health Sciences building. Lab space is available at the Lyndhurst campus.
Equipment and supplies for both laboratories will be needed.
 - b) **Objective:** Staff a greater number of upper level classes with effective tenure track faculty in Chemistry and Physics
 - i) **Timeframe:** Fall 2016
 - ii) **Responsible Party(ies):** Dean Ricatto and the department head of the Physical Sciences Department.
 - iii) **Resource Implications:** Hire additional tenure track faculty to replace two retirees and one who resigned.
 - c) **Objective:** Provide additional laboratory support for the increasing number of course offerings.
 - i) **Timeframe:** Summer 2016
 - ii) **Responsible party(ies):** Dean Ricatto and the department head of the Physical Sciences department.
 - iii) **Resource Implications:** Hire another full time chemistry lab technician and a part time physics lab technician with increased hours.

In 2008, when fewer Chemistry and Physics classes were offered and when these classes were offered at only the Paramus campus, two full time and one part time laboratory technicians prepared and deconstructed the labs, maintained the labs, were involved in purchasing, overseeing the disposal of chemical waste and ensuring that safety requirements were met. Presently, there is only one full time chemistry lab technician, one part time chemistry lab technician and one part time physics lab technician to handle the multitude of preparations needed for a marked increase in the number of course offerings at **two** campuses. The magnitude of the job is beyond what one full time and two part time technicians could effectively manage.

GUIDELINES FOR WRITING THE REPORT

Your report should be a well-organized narrative describing and evaluating your program. Please use a traditional font and point size (such as Times New Roman 12) and number your pages.

Please be sure to check grammar, spelling, and dates. Your report will be viewed by others as representing the quality and integrity of your program.

Consider adding a glossary of terms if the report uses a number of acronyms or abbreviations that a general audience would be unlikely to understand.

Consider using appendices for survey results, audit reports, organization charts, forms, assessment instruments, samples of promotional materials, inventories, etc. Appendices should be numbered or lettered so you can direct readers to them in the body of the report.

PRESENTATIONS AT PUBLIC FORUMS

Program reviews are presented to the college community in a public forum in the fall semester following the submission of the final report in May. The venue for the public forum will be decided upon by the Team Chair in consultation with the Divisional Dean and the Vice President of Academic Affairs. Possibilities include but are not limited to the following: Faculty Senate meetings, Board of Trustees meetings, College Council meetings, etc.

Each presentation should last 20 minutes: 10-15 minutes for the presentation and 5 minutes for questions and answers. Academic program review team presentations are to include a brief introduction and the Summary and Action Plan from the academic program review report. A sufficient number of copies of the Summary and Action Plan needs to be reproduced (2-4 pages) for distribution at the public forum. You should not duplicate your entire report for distribution at the public forum but you can refer participants to the BCC website where it will be posted.

Team chairs are invited to use PowerPoint or another presentation software system to present program review highlights. You are also invited to produce videos, take photos, etc., for your team's presentation. Each team must rely on its own expertise and resources to produce a presentation.

For those team chairs using PowerPoint, Media Technologies will need to receive the presentation on a CD or a USB Thumb or Flash drive prior to the presentation date. Due to schedule constraints, Media Technologies may not be able to accommodate media brought by presenters the day of the forum.

ADDITIONAL ACTIVITIES

External Review

The external review is done by an outside consultant who is an expert in the field, preferably experienced community college colleagues with expertise in academic program review and/or accreditation. The external reviewer is selected by the Divisional Dean based on recommendations from the Team Chair. Once the external reviewer is identified, the Team Chair provides him or her with the preliminary data and information for review. The external reviewer then works closely with the faculty/staff and the Team Chair. The reviewer examines a program's information, relevant data and survey results, course outlines, program requirements, etc., and then participates in an on-site visit which must include a classroom observation (to be determined by the program review team in consultation with the Divisional Dean), and meetings with faculty/staff and students. In an exit interview, the external reviewer meets with the VPAA to offer preliminary recommendations. A final report is generated by the reviewer and submitted as part of the final program review report.

Archiving Program Review Forms and Supporting Documentation

Paper copies of the completed program review including supporting data and other accompanying documentation should be filed with the:

- Department Chair
- Division Chair
- Vice President Institutional Effectiveness
- Vice President of Academic Affairs

Select completed program review forms and accompanying documentation will soon be available for viewing on the BCC Web site: So this information can be made available on an ongoing basis, please send an electronic copy of the completed program review form and other accompanying documentation that is in an electronic format as e-mail attachments or on disk to the VPIE and the VPAA office. PowerPoint files will be welcomed.

GLOSSARY

Goal	A long-term organizational target or direction of development.*
Mission	A statement of organizational purpose.* For program review purposes, a statement of program purpose.
Objective	A measurable target that must be met on the way to attaining a goal.*
Vision	A description of what an organization will look like if it succeeds in implementing its strategies and achieves its full potential.*

* These definitions were taken from
Creating and Implementing Your Strategic Plan
by John M Bryson and Farnum K. Alston.

BCC VISION, MISSION AND VALUES

Vision

As a college of choice, Bergen Community College provides a comfort level that enables students of all abilities to mature as learners and engaged citizens. A leading community college in the nation, the College creates a stimulating, rigorous, and inclusive learning environment. Use of innovative technology enhances learning experiences and widens access to learning media. Community and business leaders value the College as a reliable partner and principal provider of workforce development. Bergen County residents of all ages and cultural backgrounds appreciate the College as the hub of their educational and cultural activities.

Mission

Bergen Community College educates a diverse student population in a supportive and challenging academic environment that fosters civility and respect. The College offers a comprehensive set of accessible, affordable, high-quality credit and non-credit courses as well as degree and non-degree programs. Bergen provides lifelong learning opportunities for all members of the community. The College responds to community needs through workforce training and continuing education, and by developing programs for employers.

Values

To fulfill the vision and mission of Bergen Community College, we are committed to:

- integrity
- student success
- academic and institutional excellence
- lifelong learning
- respect
- accountability
- innovation

These core values will guide our daily endeavors.

HELPFUL TIPS

- * Identify special data needs early to allow time to generate the data and provide it when it's needed by the team.
- * * Prepare for the first team meeting by meeting in advance with those who provide support (examples: Institutional Research, tutoring, curriculum).
- * Adjunct faculty, if selected carefully, can make excellent contributions.
- * Don't hesitate to ask questions and get clarifications.
- * If some members of the team need to attend team meetings sporadically, or are occasionally unable to attend, e-mail can be used to keep them updated and is also useful as a means of getting a good cross-section of input.
- * Some have found it helpful to keep the committee to a manageable size.
- * Once you have started entering information on the program review form, always make a back-up copy!
- * Be prepared for occasional miscommunications and "bumps in the road."
- * Start early and do little pieces along the way.
- * It works well to have team members who are willing to work as a team and figure things out together.



A.S. Degree Program: Natural Sciences or Mathematics: General Curriculum

A.S. Degree Program: Natural Science or Mathematics: Chemistry Option

External Review Report

Submitted by

Fred J. Safarowic, Ph.D.

Associate Professor of Chemistry

Passaic County Community College

Paterson, NJ

November 2015

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Executive Summary

As a result of the research and writing of this report, the external reviewer has had the opportunity consider various issues associated with the A.S. Degree Program: Natural Science or Mathematics: General Curriculum and the A.S. Degree Program: Natural Science or Mathematics: Chemistry Option. At the present time, it is the opinion of this reviewer to recommend APPROVAL of both of these degree programs. The main issues and challenges facing this department are financial and under the mostly external control of Bergen Community College (BCC). Suggestions for changes under the control of the department are also made. Below is a list of key strengths and recommendations for areas of the department that could be addressed in terms of the two degrees listed above.

Department Strengths:

1. Modern, well-equipped laboratories with sufficient equipment, instructional and storage space.
2. Sufficient funding, at the present time, to maintain instructional materials without having to alter curricula or policies.
3. Excellent student support through campus tutoring etc.
4. Highly energetic and excited STEM students who can form the foundation of an expanded program.

Areas to Be Addressed:

1. Uncertainty of faculty staffing. A decrease in faculty, assignment to administrative positions without replacement and retirements will leave the department in a perilous situation going forward. Priority must be given to maximizing the number of full-time faculty in the department.
2. Insufficient laboratory support. One full-time and one half-time laboratory technician is not sufficient to support the number of sections being offered on multiple campuses while maintaining educational effectiveness. Also, major instrument maintenance is dependent on faculty which is unrealistic due to the time requirements already placed on faculty.
3. Lack of assessment data. Data included in the report is dated, incomplete or missing entirely. A standardized method for data collection and results format should be agreed on. There is no evidence of course assessment.
4. No application of assessment results back into the curriculum or programs. There is no evidence that any assessment data has been applied to make any changes or support not making any changes in either curricula or programs. If this is a campus-wide problem, then there will be significant difficulty in meeting the Middle States Standard on Assessment and showing evidence of instructional effectiveness.

Findings and Recommendations

A. College and Department Mission and Goals

The Department programs align well with the College Mission statement. Outside activities support the views and objectives of BCC.

The ACS survey states that a department mission statement does not exist. However, when researching the department on the BCC website, a paragraph which could be identified as a department mission exists. Although this is more of a description than a mission, it would be easy to edit and align this statement with the college mission.

Recommendations: Create a brief department mission statement that can be used in department literature and in advertising the department.

B. Need for the Program

According to the Bureau of Labor Statistics, the demand for chemists is expected to rise 2% in the period 2014-2016 and 6% over the next 10 years. Pharmaceutical companies continue to lead in employment with 5.31% of the industry.

Despite a number of high profile companies (such as Roche Pharmaceuticals) leaving the state, New Jersey continues to be in the top five in chemical employment by state and by location quotient. In addition, the area encompassed by Wilmington, DE, Philadelphia, PA, New Brunswick NJ and White Plains/NYC, NY are five of the top ten areas with the highest employment in the chemical occupation. A brief search of the American Chemical Society website and Google showed 600 job openings in New Jersey of which about 160 were in the analytical chemistry field. Unfortunately, this outlook is only positive for graduates with the AS or bachelor's degree. Students who go on to complete the terminal degree are facing a poor job market in both academia and industry. This market is not expected to improve.

Student demand for both programs is proportionately comparable to institutions of similar size and mission. In the most recent data available, 2013, there were 78 students enrolled in the chemistry degree; however, in the same year there were only 2 graduates. This is a glaringly small number compared with the number of degrees awarded at BCC (2,222) during the same time period. Since the State of NJ is increasingly counting graduation rate as a measure of success, and BCC awards more degrees than any other NJCC, this number must improve. The numbers are more optimistic for the General Curriculum with 91 graduates during the same time period. It is also true that many students transfer to other institutions, such as NJIT, after the completion of only a single year of study. According to IPEDS, this accounts for a loss of almost 33% of available graduates.

The department retention rate of 68.7% for both the Chemistry degree and the General Curriculum is slightly higher than the college retention rate as recorded by the Office of Higher Education of 67.1%. This is also 3% higher than the average for community colleges as a whole.

The department shows articulation agreements with only Montclair State University while agreements with William Paterson University and Rutgers University are listed as “under review”. Articulation agreements with transfer institutions are a major selling point for community college degrees especially when the cost for the first two years can be as much as 80% less. This is particularly true in light of the Lampitt Law regarding transfer. There is no plan for increasing enrollment discussed in the department report. No mention is made of department involvement in the B2B Alliance, for instance.

Recommendations: Increase the visibility of the chemistry degree emphasizing its superiority to the more general curriculum. Work with other college departments and high schools to bring in more students and then adjust the advisement system to direct them into the more effective degree.

C. Educational Programs/Courses

This evaluation covers the degree programs AS: Natural Science or Mathematics: General Curriculum (GC) and AS: Natural Sciences or Mathematics: Chemistry Option (Chem).

Both degrees are consistent with the transfer programs at sister institutions and the courses are shown to be transferable through NJTransfer. The General Curriculum gives the student a large amount of program flexibility but this may not be an advantage. To utilize the General Curriculum properly requires advising by science professionals and specialists in the field. Student comments included in the review do not support receiving this type of advisement. This could maximize problems both in transferability and once a student arrives at the four-year institution. Also, there is a minor point of visibility. A chemistry degree is specific. The knowledge base expected of a junior level student in the chemistry is commonly understood in both industry and academia. A General Curriculum is too much like a general liberal arts degree for science: lots of little pieces/courses but no overarching theme. The degree is trying to be all things to all students and its reason for existing is unclear. There is too much margin for error which is supported by the data in the dashboards showing a significant number of unaccepted course. It would also be possible to further differentiate the two programs by adding Analytical Chemistry as an elective in the Chemistry Degree. This course is increasingly being considered at the 200-level and the department is well equipped to offer it.

The Program Learning Outcomes (PLO's) for both degrees are available on the BCC website but are not included in the college catalog degree listing. To obtain this information, it is necessary to download a large document from the web and then locate the program. There are nine objectives in the Chemistry Option. Some of these objectives would be better listed as course objectives such as: 1). Describe the nature of the atom (General Chemistry I), 2). Explain

the nature of chemical bonding or 3). Recognize energy considerations in chemical reactions (General and Organic Chemistry II). PLO's should be restricted to material that is found throughout the program and not restricted to a particular course such as, "Demonstrate the effective use of chemical instrumentation." Also, it is a significant challenge to assess nine objectives. The General Curriculum has 11 objectives. Some of these objectives are multi-part. Objectives should be limited to one measurable item each. When broken down in this fashion, the General Curriculum would contain 18 goals. This is much too complicated.

It is unclear how the program objectives would be assessed. Examination of the programs do not show a capstone experience, portfolio or evaluation exam which would allow for the evaluation of the program objectives. Also, the program objectives should be listed with the programs, not in a separate, unsearchable document.

Both degree programs are currently 64-66 credits. Many transferring institutions will only accept 60 credits in response to the requirements of the Lampitt Law. This means a probable loss of credits at many public colleges in New Jersey. Additionally, CHM 140 – General Chemistry I has a "hidden prerequisite" of CHM 100. This increases the degree by 4 additional credits by adding a 100-level prerequisite to a 100-level course that is typically the introductory course to the chemistry degree. Since General Chemistry and Organic Chemistry are a four-semester sequence that cannot be hurried, this effectively adds a fifth semester to the degree and would most likely have a negative impact on both retention and graduation.

The ACS Survey evaluates the student's ability to develop a specific set of skills. However, it is not clear how these skills are linked to the course objectives listed in the syllabus. Also, there are no general education goals listed for general education courses on any syllabi. Are these written and assessed by the department or by a separate committee?

Except as noted above, the syllabi for the chemistry courses is comprehensive and contains all the information a student would require for the course.

Recommendations: Simplify the program objectives down to a maximum of three objectives (not including general education objectives) each containing only one action verb. Add General Education Goals to the courses which are considered General Education. Include the program goals in the degree printout. Develop a clear method for assessing the program objectives either by adding an exam early in the degree and a post-exam or a capstone experience. Portfolios are currently not in favor with Middle States. Encourage students to declare a more traditional major as early as possible in their education careers and link them to a faculty advisor. Reduce the degrees to 60 credits and remove any hidden prerequisites.

D. Students

The student profile of the department parallels the BCC population overall within a reasonable margin of error. The only exception is the Asian population which is significantly higher in both degrees. However, when population demographics from the Census Bureau are considered, the County population is more accurately reflected by the department than by the institution. The number of graduates by gender also parallels the college as a whole.

The current financial situation of the college has caused the loss of a number of positions at the Lecturer rank. This has required the cancellation or rescheduling of course sections regardless of student enrollment. This causes difficulties in student planning, advising and graduation. The Dean tracks enrollment through the “Data Boxes for Program Enrollment and Graduates” report prepared by the Center for Institutional effectiveness. This data was easily available to Dean by his office computer. Since this report covers five-year enrollment and graduation, it is an excellent planning document for student offerings.

The students the reviewer met were working on interesting projects and were very enthusiastic. A method to recognize these students through either a graduation award or some other certificate could be implemented at low cost to the college. Both the CRC Handbook Freshman Chemistry Award and the American Institute of Chemists award are suitable for this purpose. Superior students have the opportunity to take Honors sections of chemistry courses but other than the course listing, there is almost no information available about this option either in the department or on the web.

STEM Students: The students met by the reviewer were enthusiastic and involved in interesting projects. It seemed, however, that there was a lack of available department mentors as well as very limited recognition for the projects by BCC.

It would have been useful to have some information on how students enroll, are advised and keep track of their academic progress. No information appears in the department report.

Recommendations: Increase the visibility of the programs by emphasizing the Honors program and developing a student recognition program. Examine advisement methods and personnel for effectiveness.

E. Faculty

Currently, there are nine full-time faculty in the chemistry department of which two are temporary hires (Lecturers). Of the seven faculty holding rank, five are Full Professor's and two are Associate Professor's. All are currently tenured. All of the permanent faculty hold doctoral degrees. There is an average of 19 adjunct faculty per semester. This results in between 51 and 75% of all sections being taught by full-time faculty which is consistent with the previous

MSCHE Standards of Excellence. The average teaching load of 9 lecture hours and 9 lab hours is consistent with community college norms. One sabbatical per year has been granted previously or is projected for the next two years.

One area of concern is the number of faculty at the top rank of Full Professor. Although this does provide continuity and leadership to the department, it means that a vacuum will be created when retirements occur. It is expected that at least two faculty will retire in the near future. Under the current staffing, there is no one being primed to step into the gaps.

According to the ACS Assessment faculty are infrequently active outside of the college. Currently, only one faculty member (not listed on the college website) is listed as performing any research and attendance at professional conferences is infrequent. Also, partnerships with other two-year and four-year institutions are weak and only occasional. Professional activities are mostly concentrated internally. Community interactions, part of a Community College's mission, are only occasional. Mentoring of STEM grant students was not consistent.

The significant responsibilities required of full-time faculty shows in activities related to professional development. Only 4 out of 7 faculty attended an externally sponsored meeting in the previous year and only one attended two. Only 6 out of 9 are members of the American Chemical Society. This is a small number considering the significant numbers of opportunities available such as the Eastern Analytical Symposium, the AIC Awards Dinner etc.

Recommendations: Replace any retiring faculty immediately in order to maintain program quality and enrollment. Add at least one more faculty member with responsibilities that include at least half time at campus sites other than Paramus. Increase interactions/collaborations with other institutions generated from the department as opposed to other areas of the institution. Increase available funding and incentives for faculty to attend professional meetings. Maintain the level of sabbaticals to allow faculty to increase professional knowledge.

F. Support Personnel

The department employs laboratory staff for 60 hours over two campuses as well as a 35 hour secretary and 45 hours of student workers. There is no staff dedicated to instrument operation or maintenance. Secretarial services are split between 3 departments but there is no indication that this is a problem.

The college maintains five laboratories on the Paterson campus and one on the Meadowlands campus. Laboratory support is split between the campuses. During Fall 2015, there were 43 laboratory sections of chemistry of which four were on the Meadowlands campus. These had the potential to serve approximately 1000 students. Conversations with the faculty and department administration indicated that it was planned that additional sections would have

been run but were prevented by a lack of available faculty. Projected increased enrollment is supported by the program enrollment report.

It is unrealistic to expect the current level of lab support staffing to maintain current course offerings. Simple math indicates that the full-time lab person has less than one hour per section of time available to perform his/her duties. This covers not only preparing the lab but coordinating with faculty, laboratory maintenance, inventory of chemicals, chemical safety, budgeting, purchasing and reports. Even with student assistance, this cannot continue. It is understood that the financial situation at BCC is difficult but investments in personnel must be made or there will be no way to offer the additional sections needed to reverse the decline in enrollment at the college. Although community college enrollment as a whole is decreasing, STEM enrollment continues to increase. This requires not only physical assets but the personnel to support them. A comparison of staffing with other community colleges supports increasing the number of personnel.

The maintenance of chemical equipment is a specialized skill. Large colleges and universities maintain an instrument center usually headed by at least one PhD. It is understood that this is unrealistic at this level but it is equally unrealistic to expect that faculty have the time available to align spectrometers, calibrate instruments etc. Since service calls by a professional maintenance technician averages between \$800 and \$1000 per trip, it is easy to see that utilizing a non-faculty college employee would, in fact, be a cost savings.

Recommendations: Maintain two full-time lab technicians. Assign one to handle just CHM 100 (22 sections) and the second the other chemistry courses (21 sections). An instrument specialist should be hired to maintain the specialized chemical equipment such as the IR, NMR, AA etc.

G. Finances

According to the Executive Summary, the ACS Assessment tool and the Natural Science and Math Dashboards, sufficient funding is available for instructional supplies and equipment. Instructional projects and major equipment purchases are supported through grant funding. New and renovated facilities have recently been provided for chemical instruction.

The state of finances at BCC makes it an open question as to whether the current level of instruction can be maintained. A faculty level of 9 chemistry faculty (two temporary) is insufficient and does not compare equally with institutions offering similar numbers of course sections. Since two faculty are lost to administrative responsibilities (Dean and Department Chair), and two are temporary there are only five tenure-track faculty with full-time teaching loads. This makes it difficult for faculty to participate in research and other professional activities and increases the reliance on part-time faculty. This can only become worse since there is a question that some retiring faculty may not be replaced.

Recommendations: It is hard to make any recommendations beyond the obvious. Staffing levels must be maintained at the highest level consistent with academic quality. At no time should a point be reached where curriculum decisions become driven by available funding.

H. Physical Facilities

The department utilizes five lecture rooms on the Paramus campus for chemistry instruction as well as the 5th floor classrooms on the Meadowlands campus. Section size is typical for the square footage listed for each room. Unfortunately, all rooms listed are shared with other disciplines. This makes it difficult to enrich lectures with discipline specific activities or demonstrations since all materials must be removed at the conclusion of each lecture and classroom construction must be generalized.

The department lists five laboratories on the Paramus campus and one on the Meadowlands campus. All labs have been recently renovated and seem to be well maintained. Storage facilities for chemicals and instrumentation appear to be sufficient. Additionally, all labs are equipped with media equipment as well as standard safety supplies/equipment. A central location for sensitive chemical instrumentation is maintained. Stock rooms are easily accessible to each lab and comply with all relevant state and federal regulations. MSDS sheets are readily available if needed as well as appropriate protective equipment.

The department also maintains two astronomy facilities. Although this is part of the second reviewer's report, it is worth noting here since the facility is well maintained and staffed and could support some chemical concepts such as the behavior of light.

Recommendations: Designate a specific classroom for chemistry lectures, especially General Chemistry. In addition to a Periodic Table, media, etc. provide this room with a demonstration table with gas, water and storage space for materials.

I. Library/Tutoring Services

The college is well supplied with library and tutoring services. The Tutoring Center (L-125) is easily located and has received recognition for excellence. Tutoring appears to be well-coordinated and discipline specific. In addition, a STEM Learning Center is available (S-315).

Access to the chemical literature both live and online is excellent; however, assignments using the literature appear to be limited to only organic chemistry. Despite this, the Journal of Organic Chemistry is not available. Are the CRC Handbook and the Merck Index available and updated regularly?

Recommendations: Continue to ensure availability of current literature to both faculty and students. Due to financial considerations, it is possible that these expensive items could be cut. This would be both unfortunate and unwise. Consider adding JOC to the journal holdings.

J. Computer Facilities/Website

Findings: The IT and computer facilities available to the faculty and for instructional purposes are adequate to meet current needs. There are five PC equipped computer labs as well as one Mac lab. Five labs are located on the Paramus Campus and one is located on the Lyndhurst campus. Only two are open on Saturday and all are closed on Sunday. A BCC ID is required for all labs although computers for public use are available in the library and at other locations on campus.

The IT Department website maintains a substantial list of forms for data retrieval as well as for requesting IT actions. A help desk is maintained by the IT department with help available for most BCC services by walk-in, by phone or by e-mail. A Master Plan for the IT Department is available online.

The department website contains most of the information of interest to students. A comprehensive listing of course syllabi is easily available as are course descriptions. It is not clear, however, how often this information is updated and who is responsible for ensuring the accuracy of the information. Dr. Box is listed as the Department Chair on the main Academic Affairs page but Dr. Tscherne is listed as the Department Chair on the department homepage. Also, the listing of faculty on the web is inaccurate.

Recommendations: Consider creating a computer lab specifically for STEM students with specialized programs available as needed. Designate a liaison in the department with whoever maintains the college website and has the responsibility of updating and verifying information.

K. Administration

The department reports to a Department Chair who reports to the Dean of Mathematics, Science and Technology (a chemist) and then to the Vice-President of Academic Affairs. Results of the ACS survey indicate faculty satisfaction with the current structure. Faculty are consulted on teaching loads, promotions, tenure, sabbaticals, and hiring. There is strong agreement that faculty are consulted on the selection of the Department Chair as well as teaching assignments and hiring. Faculty are also consulted on the hiring of adjunct faculty.

Recommendations: Continue to maintain the maximum amount of faculty input into decision making at both the college and department level.

External Review

This external review for the Department of Physical Sciences at Bergen County Community College is based on a visit to the Department on September 25, 2015 and a review of program data and course syllabi. The visit included meetings with Dr. Lynda Box, Chair of the Physical Sciences Department, Dr. P.J. Ricatto, Dean of Mathematics, Science & Technology, Vice President of Academic Affairs Robert Mullaney, and with Professors Gary Porter (chemistry), Joseph Sivo (astronomy), and physics professors Paul Griffo, Joshua Guttman, Marie McCrary, and Fred Marton.

This review will focus primarily on the physics offerings at Bergen County Community College, both within the AS Degree Program: Natural Sciences or Mathematics: Physics Option, and as a service for students in a variety of other programs.

Recommendations:

Personnel

The Department of Physical Sciences is currently strained by a shortage of both faculty and staff. An additional tenure track position could easily be justified with current student demand, but the college recently chose not to replace the department's most recent retiree. Physics course offerings generally fill quickly, to the point where an additional tenure track line would be warranted from an institutional perspective, and certainly welcomed by the current physics faculty.

Budget cuts have also led to staffing shortages at the nurses' station and the replacement of full-time laboratory technicians with student employees, which has resulted in problems with purchasing and maintaining lab equipment. The physics labs currently have only three hours per week of lab technician time. This is barely enough to set up the experiments, but not enough to maintain and replace aging equipment. The chemistry labs also needs a dedicated equipment manager.

The small number of graduates completing the physics option (5 in the last 5 years) has raised the possibility of dropping the physics option altogether. It is expected that dropping the physics option for the AS Degree would have a deleterious effect on the program as a whole. Whereas new sections are currently filling to capacity, this trend might not continue if the physics option for the AS Degree were removed.

Facilities

Bergen Community College has an impressive math/science tutorial center. The Math Hub has a beautiful layout, and appears to be an important resource for math students at the college. The College also has an outstanding astronomical observatory, with two telescopes and impressive homemade spectroscopic analyzers.

The Physics Department needs one lecture room large enough for B-mode classes and one additional lab. Aside from these specific needs, the feeling is that classroom availability has not kept pace with demand.

Programs

The observatory currently hosts weekly community viewing sessions which significantly enhance the visibility of the College's science departments. However, the current Code of Conduct places the responsibility for visitors' conduct with the professors who are hosting events, such as the community observation sessions at the observatory. In its current form, this Code of Conduct inhibits professors from initiating these effective outreach events.

Extensive data has been collected on each of the departments. But how that data is used in making decisions about the administration of the departments is unclear. Of particular concern among the physics faculty is that the small number of physics major graduates not be mistaken for a good metric of the department's overall effectiveness.

Student enthusiasm for the STEM Boot Camp is evident. Projects involving high altitude data collection and an on-campus seismograph station were presented during the campus visit, and clearly stimulated the students involved. In view of their considerable commitment to these projects, the students should receive some sort of formal credit for them.

Courses

The current Physical Sciences offerings are

- a three semester calculus based sequence (280, 290, 291) using Halliday, Resnick & Walker's Fundamentals of Physics,
- a two-semester algebra based sequence (186, 286) using Cutnell, Johnson, Young & Stadler's Physics,
- a one-semester Introduction to Physics (185) using Hewitt's Conceptual Physics, and
- a more advanced one-semester course in Engineering Mechanics (294) using Merriam's Engineering Mechanics.
- one semester courses in Energy & Society (100), Astronomy (111), Climatology (112), Geology (113), and Meteorology (114).

All of these courses, with the exception of Engineering Mechanics, have a 3 hour/week lab component.

With the growing percentage of courses taught by adjunct professors there is very little control over course content. Common final exams should be considered, especially for such courses. In instances where common finals pose logistical problems, choosing at least some questions from a bank of common questions is advised. Optimally, in my opinion, even the grading of final exams should not be the sole responsibility of the lecturer. This is useful not only in terms of making sure that adjuncts are covering and testing the appropriate material, but also so that lecturers (both adjuncts and full-timers) can be viewed by their students more as coaches and guides, and less as evaluators.

Furthermore, critical input on hiring and reappointment decisions should come from faculty *within* the relevant discipline. Evaluating an applicant's competency with specific subject matter and pedagogical abilities in a particular field of knowledge are central components in hiring and reappointment decisions. This not something that an administrator can be expected to do, unless the administrator happens to have training in the relevant discipline.

Respectfully submitted by
Dr. Neil Basescu
Westchester Community College
October 26, 2015



ACS Assessment Tool for Chemistry in Two-Year College Programs **Notable Practices Report** **2015**

The *ACS Assessment Tool for Chemistry in Two-Year College Programs* was developed in 2012 as a resource to facilitate the identification of strengths and opportunities for growth in the context of the *ACS Guidelines for Chemistry in Two-Year College Programs*. Users of the tool have the opportunity to submit their report to the Assessment Review Panel, a group of chemistry faculty who are familiar with the tool and the two-year college landscape.

In 2015, 11 two-year colleges submitted their reports for review. The Assessment Review Panel noted a number of particularly effective practices that may serve as models other institutions. These practices are described below.

Institutional Information

- Acquisition of a grant from the Department of Education Hispanic-Serving Institutions Science, Technology, Engineering and Mathematics, and Articulation Programs supports efforts to engage the local Latino population in STEM programs. Additionally, grant activity provides additional financial support for the college and makes the work of the institution more visible to stakeholders.
- A well written mission statement that aligns with the institution's mission facilitates strategic planning and highlights program's contributions to the college.
- The assessment tool was completed as a collaborative effort among faculty. This provides a more comprehensive analysis of the program and better ensures future implementation of suggested changes.
- Providing a chemistry-based technology program, in addition to the general chemistry program, supports a range of student goals and learning styles.

Institutional Environment

- Faculty input into chemistry curriculum **requires** communication between the college and transfer institutions. This interaction benefits students since allows for a seamless transfer and it also helps faculty by maintaining both standards and a guide on requirements.
- Institution has an award program for the adjunct faculty. Faculty recognition programs support job satisfaction and communicate effective practices among faculty. Moreover, colleges that make an effort to engage the adjunct faculty often demonstrate higher engagement among permanent faculty.
- Restructuring of the department chair position from an academic position with a reduced teaching load to allow for administrative duties to a 12-month administrative position with a minimum teaching expectation of 2 classes per calendar year. The change accurately reflects the varied responsibilities of the position and supports successful execution of those responsibilities.
- Having an experienced grant writer in the administration has facilitated getting funding for several programs.
- STEM tutoring center has been established with the following features:
 - Developed from a Title III Rural Student Success Project

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- Supports tutoring and a STEM Student Union, which help students attain their goals and provide a means for students to connect to the campus which may increase their ability to persist and complete their educational programs.
- Hosts office hours for several faculty. The presence of faculty members not only increases student access to additional help, but also provides opportunities for informal mentoring and advising. This is a win-win situation for faculty who noted that there is often insufficient collaboration with counselors, sometimes resulting in students receiving incorrect information or no information on course selection and career opportunities.

Faculty and Staff

- Full and part-time faculty have support through an Employee Assistance Program for funds ranging from membership affiliations, to conferences attendance. A separate travel fund for attending conferences is also available on a first come/first serve basis through a separate Employee Assistance Program.

Infrastructure

- Laboratory renovations improve laboratory safety, facilitate hazardous waste management, foster use of in-depth experiments and group work, and enable ADA-compliance. Inclusion of a two-way hood system supports demonstrations and increases student engagement.
- All laboratory activities performed in the school are environmentally friendly, introducing students to green chemistry principles early and reducing costs associated with hazardous waste management.

Curriculum

- The Chemistry Department requires a passing score on a Chemistry Placement Test as a pre-requisite for the General Chemistry I course. Enforcement of a minimum score on a placement test before matriculation into a course makes it less likely for a student to be under-prepared for the course. Appropriate placement and strong pedagogy foster student success.
- A half-semester preparatory chemistry course is offered at the end of summer and fall semesters to increase student readiness for general chemistry courses. This enables students who are enrolled in the first semester of general chemistry an opportunity to reassess their readiness and take remedial action, making it more likely they will be successful in the college level course.
- A master schedule within the science division allows all appropriately prepared science majors to complete science programs within two years. Having a long term plan supports student retention and completion.
- A central teaching center is provided, and faculty are encouraged to attend pedagogical workshops.

Original Scholarly Research and Related Activities

- Honors programs or capstone projects are culminating experiences to assess students' capacity to apply program knowledge and skills. These programs can also be used to start student research programs.
- Chemistry and Environmental Science faculty have partnered with a local conservation area to complete a survey of their soil. Soil samples were collected by environmental science students. Environmental science students collect pH data and determine the physical properties of the soil as part of their regular labs. General Chemistry students determine calcium, phosphate and nitrate content of the soil as part of their regular lab. One student helps to develop new laboratory techniques for general chemistry courses, including the phosphate, calcium, and nitrate analysis labs.

Development of Student Skills

- Students volunteer for hands-on science experience nights and science fairs at K-12 institutions. This promotes the development of teamwork, leadership, and communication skills. The college students also serve as role models for the middle and grade school students potentially inspiring them to consider STEM disciplines.
- An experienced librarian visits lab during the beginning of the semester in the general chemistry sequence to demonstrate the current search engines available on the campus. The librarian also describes common pitfalls of literature searches.
- The faculty have developed a number of assessments to measure students' chemical literature skills that are parallel to what would be expected at the professional level. There is also evidence of strong collaboration between the chemistry faculty and librarians resulting in a well-designed introduction to science literature research methods. This experience will enable the students to be prepared for research opportunities at their transfer institution.
- Case studies developed for chemistry courses relate chemical concepts to current events such as ocean acidification, a jet fuel spill into an aquifer, arsenic in local well water, how BPA works as a hormone mimic, etc. The use of case studies is a very strong pedagogy which may often ensure a deeper, more connected understanding of chemical concepts. It also allows students to learn and practice interpersonal skills necessary to effectively work in group settings.
- The assessment of individual participation by group members, as well as the faculty, provides ideal formative feedback that may improve group dynamics, both at the individual level as well as the group level.

Student Mentoring and Advising

- Secured a grant to compensate faculty for mentoring students and improving student success.

Partnerships

- Strong partnerships exist with local chemistry-related industries. Partnering with local employers provides opportunities to incorporate the needs of employers into the curriculum (increasing the likelihood of graduate employment) and provides opportunities to pool resources.

Thank you for your participation in the 2015 assessment review cycle. Please contact the ACS Undergraduate Programs Office (2YColleges@acs.org, 202-872-6108) with any questions or concerns.



Dr. Gary Porter, Professor
Bergen Community College
400 Paramus Road
Paramus, NJ 07652-3500

December 7, 2015

Dear Dr. Porter,

Thank you for submitting your assessment report on Bergen Community College. The ACS *Assessment Tool for Chemistry in Two-Year College Programs* was developed as a resource to facilitate the identification of strengths and opportunities for growth in the context of the ACS *Guidelines for Chemistry in Two-Year College Programs*. We hope you found the development of your assessment report from the tool to be a valuable exercise.

Your assessment report was reviewed by the Assessment Review Panel, a group of chemistry faculty who are familiar with the tool and the two-year college landscape. Their feedback is enclosed. The feedback consists of three sections:

- **Strengths:** these are practices at Bergen Community College that support excellent, sustainable chemistry-based education. The panel hopes you will maintain and grow these practices.
- **Suggestions for improvement:** these are ideas intended to encourage your institution's continuous improvement. Please use whatever ideas support your efforts and disregard those that are not aligned with your institution's needs.
- **Useful resources:** these resources were suggested by the panel to either build on your strengths or support continuous improvement. Additional resources can be found at www.acs.org/2YColleges.

Two other items are enclosed for your reference. One is collection of notable practices that the Assessment Review Panel culled from all of the 2015 reports. These may give you additional ideas for continuously strengthening education at Bergen Community College.

The second item is a toolkit for talking to your administration about potential changes. Many faculty have used their reports to talk to their administrations about needed changes. The enclosed toolkit is intended to help you frame such discussions.

Thank you again for using the ACS *Assessment Tool for Chemistry in Two-Year College Programs*. We hope that you and your colleagues find both the tool and the results to be useful as your program grows. Please contact the ACS Undergraduate Programs Office (1-800-227-5558, ext. 6108; 2YColleges@acs.org or undergrad@acs.org) with any questions or concerns.

Sincerely,

A handwritten signature in black ink that reads "Heather M. Sklenicka".

Heather M. Sklenicka, PhD
Chair, 2015 ACS Assessment Review Panel

American Chemical Society

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ACS Assessment Review Panel Feedback Bergen Community College

Strengths

The Assessment Review Panel noted a number of strengths at Bergen Community College. These practices support effective, sustainable chemistry-based education. You are encouraged to continue and grow these practices.

Institutional Information

- All full-time faculty were involved in the assessment. This ensures that the assessment will be of value to the department as a whole.
- Bergen Community College has a diverse student body; exposure to peers of different backgrounds and ideologies has been shown to strengthen student learning.

Institutional Environment

- Faculty are involved in the establishment of teaching loads, promotions, leave policies, hiring practices, faculty recognition, teaching assignments, selections of full and part-time faculty, and chemistry curriculum. This high level of faculty involvement supports the development of effective policies and promotes faculty engagement and job satisfaction.
- The chemistry program resides with physics in the Physical Science Department, which provides an opportunity for interdisciplinary projects and initiatives. As a trained scientist, the chair understands the needs of a science department. This can encourage meaningful discussions concerning laboratory, curriculum, and equipment needs.
- The college has strong student support services, including an advising center and advisor specialist for the chemistry department. These support services help students move toward attaining their goals. Student clubs and the lecture/workshop series enable students to network with others who have similar interests and with the faculty sponsors. These opportunities provide a means for students to connect to the campus, which can encourage them to persist and complete their educational plan.

Faculty and Staff

- All of the full-time faculty at Bergen Community College have excellent credentials, which demonstrates that the faculty have the depth and breadth of knowledge and experiences to teach the chemistry curriculum effectively.
- The full-time faculty workload is aligned with the recommendation in the Guidelines. This gives faculty the time needed to meet with students outside class, continuously assess and improve their teaching, maintain their own professional growth and contribute to the college through service on campus-wide committees.
- The percentage of chemistry sections taught by full-time faculty is in line with the suggested 75% in the Guidelines. Maintaining this ratio provides consistency in instruction and supports a professional faculty committed to student success.
- Having a staff member with a dedicated responsibility for safety compliance is an excellent asset to the department since this provides consistency in the application of safety standards throughout the department and enables the faculty to focus on teaching and mentoring students.

Infrastructure

- The college has a wide variety of instrumentation available in the laboratory. This instrumentation supports hands-on student learning. The array of instrumentation and access to technology and computers provides the laboratory experiences needed for students in the chemistry courses offered at the college.
- Limiting the lab sections to 24 students, as recommended by the Guidelines, helps ensure a safe environment and increased faculty-student interactions. The instrumentation and other equipment available for student use are extensive and provide students with hands-on experiences in the characterization and analysis of synthesized compounds.

Curriculum

- The faculty are encouraged to use a variety of pedagogical techniques. Prerequisites are also established and enforced, making it less likely for a student to be underprepared for a particular course. Appropriate placement and strong pedagogy foster student success.
- The program offers an appropriate range of courses, including honors sections and a general education chemistry course, in several different modalities multiple times throughout the year. This enables students to complete the course work they need in a timely manner.
- Consistent with the Guidelines, online courses include hands-on laboratory experiences, enabling students to develop basic laboratory skills, as well as problem solving, critical thinking, and communication skills.

Self-Evaluation and Assessment

- There are published outcomes for each chemistry course. In addition, formal self-evaluations of the chemistry program are routinely performed. These self-driven and self-initiated assessments promote the continuous improvement of the program and ensure that curriculum adapts to the changing needs of the students.

Strengths, Challenges, and Opportunities

- The chemistry program at Bergen Community College is large and encompasses several campuses. There are many strengths of the program and an emphasis on student success. The faculty have diverse training and technical experiences, which demonstrates dedication to improving students' critical thinking and problem solving skills. A noteworthy aspect of the college is the student support services, including a dedicated tutoring center, a STEM lab, and a Math Walk In Center. Routine review sessions are held and faculty are involved with one-on-one tutoring programs and advising students in the Advising Center. This gives students the personalized expertise that can guide them toward success..

Suggestions for improvement

The Assessment Review Panel also made several suggestions that might help you strengthen your program. They are intended to provide a starting point for your own continuous improvement of the program. Please use whatever ideas support your efforts and forgo those that are not aligned with your institution's needs.

Institutional Information

- Developing department-specific mission and goals can aid self-assessment. Aligning the language of the departmental mission and goals to that of the college can highlight the contributions of the department in discussions with administration.

Institutional Environment

- Faculty have input into most of the faculty policies; however, establishment of faculty salaries lies with Human Resources. Faculty input into this area encourages improved faculty morale and helps to attract and retain high-quality chemistry faculty.

- Although the department's budget is remaining constant, the program is still vulnerable to external economic challenges exacerbated by declining enrollments. As a result, replacement positions are limited, which could adversely impact program growth and quality. It may be beneficial to identify alternative funding sources, such as grants and partnerships, to fund supply and equipment needs.

Faculty and Staff

- The full-time faculty demographics do not match the student population. Like many two- and four-year institutions, the diversity of the faculty is not aligned with that of the student body. Broadening the candidate pool when hiring new full-time faculty may lead to a more diverse faculty over time.
- In the Guidelines, it is recommended that a minimum of 75% of the courses be taught by full-time faculty to ensure consistency of instruction throughout the program. This ratio may be in jeopardy if course assessments show challenges providing consistent, high-quality instruction to all students. It may be necessary to hire additional full-time faculty.

Infrastructure

- The majority of full-time faculty do not have private offices. The use of shared office space for faculty offices can promote collaboration. However, it may also interfere with faculty productivity; it may be beneficial to provide private space for faculty to focus on course preparation and grading and engage in confidential discussions with colleagues and students.
- It is recommended in the Guidelines that a minimum of 50 square feet of net laboratory space be provided for each student, including lab tables and benches. These conditions support a safe learning environment and comply with most federal, state and local regulations. Given the square footage reported in the assessment tool, reducing seat count to 18-20 is a simple way to meet this space requirement.
- There is demonstrated need for additional work in the area of compliance with the National Fire Protection Association's (NFPA) labeling codes used on all reagents and storage facilities. As the program moves toward compliance with respect to labeling, consider utilizing the new Globally Harmonized System of Classification and Labeling of Chemicals (GHS).
- The department is aware of an issue regarding timing of hazardous waste removal. The department might consider pre-treatment of some laboratory generated waste to minimize volume and need for frequent waste removal.
- While the SDS sheets are available in a prep room, in case of an emergency and for ease of access, consider posting the SDS sheets online or providing hard copies in each lab.

Original Scholarly Research and Related Activities

- The faculty-led research program in which students analyze microorganisms using DNA is an excellent way for students to develop critical thinking and problem solving skills, as well as to provide a deep, meaningful experience in the lab. Consider broadening the research program to include more chemistry-based topics. This investment is justified by its impact on student learning and the richness it adds to students; and faculty members' scientific experiences. Students have the opportunity to develop communication skills through the publication of journal articles and external poster presentations. Participation in such programs can have a positive effect on student success. These opportunities are valuable mechanisms for engaging students, developing student skills, facilitating student transfer, and preparing students for the workplace.

Development of Student Skills

- While students at Bergen Community College have access to many chemistry-related journals online and in print, there are not many opportunities for students to develop their

chemical literature skills. An option to incorporate these skills could be assigning a journal article project. Becoming scientifically literate early in their career will make it easier for students to transition into higher level courses and research when they transfer. To broaden the available number of publications, it may be necessary to explore open access options or access through a local four-year institution.

- In order to develop a culture of safety and to continuously improve student safety skills, consider increasing student's input into identifying potential safety hazards and disposal techniques in all courses offered. This can be accomplished to some degree by having students evaluate key sections in SDS sheets in all courses. This will help them begin to appreciate and assess the level of hazards they encounter.
- Other student skills, such as oral presentations and teamwork, can be more fully developed by expanding on practices and techniques already utilized in courses. Presentations of lab results or problems can be incorporated into all courses. Collaborative groups can be utilized in the classroom setting as well as the lab to promote team building and leadership

Self-Evaluation and Assessment

- Since there are clear, measurable, published learning outcomes for each chemistry course, more frequent assessment of content mastery and student skills would provide valuable data for continuous improvement. The use of a variety of assessment tools, including common tools across multiple sections of a course, followed by the use of that data can help to improve the quality of students' educational experiences and increased student success.

Partnerships

- Communication and collaboration with transfer institutions can help ensure alignment among curricula and facilitate student transfer. It may be useful to invite local high school chemistry teachers on campus to see the facilities and meet the faculty. Such interactions can be a good recruiting tool, as local teachers often recommend your programs to their students.
- Establishing partnerships with professionals and hiring managers at local industries can provide access to resources and internships, as well as assist in career development.

Strengths, Challenges, and Opportunities

- The faculty has outlined the department's strengths well. The faculty recognize the positive impact of student participation in long term research projects on the development of critical skills that will serve the students well regardless of their ultimate career choices. Opportunities to develop partnerships with four year institutions and industry through this research program could lead to additional collaborations that would benefit a larger number of students and help support the program despite economic challenges.

Useful resources

ACS compiles resources to support two-year colleges at www.acs.org/2YColleges. The Assessment Review Panel felt you might find the following resources particularly helpful:

Institutional Environment

- Consider applying for grant monies from the National Science Foundation (NSF), National Institutes of Health (NIH), or ACS. A number of NSF programs either actively seek participation from two-year colleges or target them exclusively. You may be particularly interested in the curriculum development track of Improving Undergraduate STEM Education (IUSE). Visit www.nsf.gov/funding, <https://grants.nih.gov/grants/oeer.htm> or www.acs.org/content/acs/en/funding-and-awards/grants.html for more information.

Infrastructure

- For information on labeling requirements under the revised OSHA Hazard Communication Standard aligned with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), go to <https://www.osha.gov/Publications/OSHA3636.pdf>
- Addressing safety concerns, especially storage and disposal of chemical solvents, is a challenge for many two- and four- year institutions. The survey report, Two-Year College Chemistry Landscape 2012: Safety Practices, compiles a number of innovate safety practices from institutions across the country. It can be downloaded at www.acs.org/2YColleges.

Development of Student Skills

- ACS journals are available for online search at <http://pubs.acs.org>; ACS members can download up to 25 articles per year without subscription. If your institution's budget cannot accommodate ACS journal subscriptions, you may be interested in the open access options available at <http://acsopenaccess.org>.
- The following references provide information about incorporating collaborative work in the lecture and options for developing teamwork skills.
<http://www.acs.org/content/acs/en/education/resources/twoyear/pedagogies-and-slos.html>

Self-Evaluation and Assessment

- Exams published by the ACS Exams Institute provide a means to administer nationally normed common assessment tools. <http://chemexams.chem.iastate.edu>

Partnerships

- Information on partnerships with academic institutions and industry can be found at <http://www.acs.org/2YColleges>. ACS local sections (www.acs.org/LocalSections) and the ACS network (www.acs.org/network) can be valuable resources for connecting with potential partners.

Strengths, Challenges, and Opportunities

- The *Use of the ACS Guidelines for Chemistry in Two-Year College Programs: A Collection of Case Studies* highlights some ways in which the Guidelines have been used to address hiring issues.

Other Resources

- ACS student chapters can provide a wide range of activities that enhance students' college experience and prepare them for successful careers. Information and resources are available for ACS student chapters, including information on funding for starting a student chapter, can be downloaded at www.acs.org/studentchapters

Thank you for your participation in the 2015 assessment review cycle. Please contact the ACS Undergraduate Programs Office (2YColleges@acs.org, 202-872-6108) with any questions or concerns.