

Strategic Programs For Innovations In Undergraduate Physics At Two Year Colleges

A Project of The American Association Of Physics Teachers

A CASE STUDY

GREEN RIVER COMMUNITY COLLEGE Auburn, Washington

Institutional Setting

Named after the river that winds through most of its service area, Green River Community College is a two year public college that offers degrees and certificates in academic and professional and technical programs, as well as courses in continuing education and developmental education. Located on 186 acres, Green River Community College (GRCC) has been committed to maintaining the ecological integrity of the campus's forested growth. Students enjoy this beautiful campus in its safe and peaceful environment.

A core of about 120 full-time faculty and 210 part-time faculty teach daytime and evening classes. The student population is approximately 9,000—both full-time and part-time students—and features a growing diversity of ages and ethnic backgrounds.

The roots of GRCC stretch back to 1945, when the Auburn School District started a program of adult evening education, which soon became the largest in the state. The popularity of the program convinced citizens from the surrounding communities that the Green River Valley needed its own community college. Local committees began working to secure state approval to start a community college in 1959. In 1963, the determination of local citizens paid off when the State Board of Education approved the community college.

GRCC's professional and technical program began in September 1964 at a location near the Auburn Boeing plant. A year later, Green River Community College opened its doors at its present location on Lea Hill, east of Auburn. This favorable location is easy to reach from local communities and is a 40-minute drive from either Seattle or Tacoma. With increasing demand for higher education, GRCC has opened satellite campuses in Kent and Enumclaw. The 1967 Washington State Legislature defines Green River Community College's service area as District 10. A five-member board of trustees governs the college. Financial support comes from state appropriations and student tuition.

The physics program provides a broad range of courses including a one quarter physics course for liberal arts majors, a one quarter astronomy course, a three quarter algebra-based physics sequence, and a three quarter calculus-based physics sequence. The physics program also offers a two-credit hour course in electromagnetism for physics and certain engineering majors and a three-credit hour course in Modern Physics. In addition, the physics program actively participates in a three quarter interdisciplinary science sequence for future elementary school teachers. GRCC has three fulltime faculty members, several part-time faculty members, and a laboratory technician to support the physics program.

What Has Been Done

Over a number of years, the Physics Program at Green River Community College has developed an innovative, successful program. To accomplish this program change, GRCC's Physics Program has done the following:

1. The inquiry approach to teaching introductory physics has been adopted in all physics courses. The inquiry approach is used by all full-time and part-time physics instructors.
2. Longer class periods have been instituted in physics classes that allow more time for activities during every class period. In many physics classes there is no distinction between “lecture” and “lab”.
3. Microcomputer-based activities, video-based activities, spreadsheet and computational activities have been instituted and are used extensively in all physics classes.
4. A three-quarter interdisciplinary science sequence has been created for pre-elementary education majors.
5. A special course in electricity and magnetism was created for physics and electrical engineering majors to better prepare them for their upper division undergraduate courses once they transfer to a four year institution. A modern physics course is also annually offered to aid these students.
6. A third full-time physics faculty member has been added to accommodate increased demand for physics classes. Additional sections are also being added for both the calculus-based sequence and the pre-elementary education interdisciplinary science sequence.
7. Faculty have consistently tracked students after they have transferred from GRCC. This tracking of students has given faculty valuable feedback on how well their GRCC programs have prepared students for their transfer programs and has led to significant program changes.
8. Consistent and long-term collegial interaction with other science, technology, engineering, and mathematics (STEM) faculty members has led to a number of team taught courses as well as changes to both the physics program and physics courses.
9. Long-term cooperation and communication with the GRCC administration has benefited the physics program.

Indicators of Success

The GRCC Physics Program has a number of strong indicators to demonstrate their success over the last few years.

1. GRCC has a large number of physics majors. GRCC transfers 3 to 7 physics majors each year to four year colleges and universities. This is an unusually large number of physics majors for a two year college.
2. The physics majors who transfer from GRCC have consistently obtained their baccalaureate degrees. Many of these physics graduates have received employment immediately while several have chosen to pursue graduate degrees in physics.
3. The number of STEM majors for an institution the size of GRCC is large. GRCC transfers over 50 engineering majors, 3 to 7 physics majors, and a number of other science, mathematics and technology majors each year. Of the transferring physics and engineering majors, 94% intend to get a baccalaureate degree in a STEM field and 54% plan to pursue an advanced degree.

4. During the past several years, only one student that has graduated from GRCC with a pre-engineering degree has failed to complete a bachelor's degree in engineering. (This is out of about 400 students!!)
5. GRCC has strong minority and female student enrollments in all of its physics courses.
6. The use of inquiry methods in all physics classes has led to greater student retention and understanding.
7. GRCC has very high retention rates in all its physics courses. The retention rate for the calculus-based sequence has been around 80% and for the interdisciplinary science sequence over 80%.
8. GRCC physics students have performed extremely well on national assessment instruments. Post test scores and gains on the Force Concept Inventory have been much higher than the national average.
9. GRCC has an unusually strong emphasis on students who plan to become K-12 math and science teachers. The pre-elementary education program, as represented by **Project Teach**, originated in the physics area and now involves all the sciences and mathematics. Project Teach is a nationally-recognized, exemplary program and is a model being copied by various other institutions around the country.
10. Students are actively involved in the instruction and excited about what they are learning in physics. This student involvement has led to active student organizations.
11. The GRCC administration from division level through the Office of the President are aware of what the Physics Program is trying to accomplish and supports both financially and morally their endeavors.

Keys to Making the Changes

There are several "keys" that have allowed the GRCC Physics Program to make the programmatic changes that have led to their success.

1. *There is a strong collegial spirit among the STEM faculty.* Some of this collegial spirit is enhanced due to the close office proximity of the math and engineering faculty to the physics faculty. Collaboration among the faculty is recognized as an essential ingredient in both the hiring and evaluation process of new full-time faculty and part-time faculty. There is a process in place for removing faculty who do not align with the mission of the Physics Program. There exists a strong mentoring program for new full-time and part-time faculty.
2. *The GRCC Physics Program has had long-term (for over 30 years) quality leadership.* One or more strong faculty members have a clear vision of the future direction of the physics program. GRCC has benefited from having multiple full-time physics faculty members. There was a well-defined transitional period from old to new leadership within the physics program. In part due to this long-term leadership, transfer institutions have respect for the GRCC physics program and the physics faculty as individuals. GRCC offers an attractive environment where there are rewards to staying a long time.
3. *The faculty and the Physics Program have an attitude stressing innovation and a commitment to inquiry-based teaching.* The GRCC faculty union gives the faculty freedom to innovate with the support of the administration. The commitment to inquiry-based

teaching is stressed even in the hiring of new faculty. There is institutional support for curricular improvement in the form of grants and released time.

4. *There is a strong student commitment to the program.* The physics faculty is dedicated to student learning. Active student organizations enhance student participation and student learning. There is a well defined and functional advising process and students receive sound advising from the faculty. The physics program is recommended by other STEM faculty and the administration.

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