

Strategic Programs For Innovations In Undergraduate Physics At Two Year Colleges

A Project of The American Association Of Physics Teachers

A Case Study

Howard Community College Howard County, Maryland

Institutional Setting

Howard Community College is located in Howard County, Maryland, just north of Washington DC and southwest of Baltimore. The college was established in 1970 and now has about 6,000 students following an academic transfer or career path making up a population of approximately 4,000 FTE. Another 12,000 people take courses for personal or professional development. Unduplicated students number 8000 headcount. There is about a 60/40 ratio of students in transfer to career path programs. Howard Community College is currently the college of choice for 46% of all undergraduates from Howard County, an increase from 20% of the same student population in the early years of the college's existence. Students cited three reasons for choosing Howard Community College, "we can stay at home," "the cost is affordable," and "the college has a good reputation." Fees for in-county students are less than half of those for in-state but out of county residents.

Community colleges in Maryland are organized and funded, in part, at the county level. Howard Community College's current budget is funded approximately 40% by county appropriation, 40% by tuition, and 20% by the state appropriation. A Governor appointed Board of Trustees composed of Howard County citizens oversees the operation of the college, approves tuition, hires the president, etc. The Maryland Higher Education Commission approves all new programs and the Maryland Association of Community Colleges provides some coordination between course offerings and programs. However, there is no statewide system of course descriptions, objectives, or numbering.

The Physics Program is located in the Science and Technology Division with Chemistry, Earth and Space Science, Biology, Engineering, and Technology programs. There are currently two full-time faculty members teaching in the physics program, with the second person mainly responsible for the new two-semester sequence for pre service elementary teachers. A shared full time faculty member is responsible for teaching many of the physics and chemistry laboratories. A laboratory manager is responsible for setting up and stocking most of the laboratories for physics and chemistry courses.

The HCC Physics Program offers a wide range of physics courses including a one semester technical physics course, a two semester physical science and earth and space science sequence, a two semester algebra-based physics sequence and a three semester calculus-based physics sequence.

What Has Been Done

1. Microcomputer-based laboratories (MBL) have been introduced in all the physics courses, especially the calculus- and trig-based sequences. Over 65% of the first semester laboratories and 50% of the second semester laboratories use MBL equipment. Data analysis is carried out using Excel spreadsheets and the Vernier Graphical Analysis software. Some of the funding for adding MBL to the physics program was provided by a Howard Community College challenge grant.

2. Although the “lecture” and laboratory portion of the course are not integrated, special attempts are made to address student misconceptions in the lecture portion of the course using interactive lecture demonstrations (ILD), web-based activities, Interactive Physics, and similar resources. A Science Problem Solving CD-ROM was developed by Howard Community College faculty to use in several science courses including physics.
3. Misconception pre-tests are given before most units in the trig-based sequence to identify those concepts that need extra attention in the classroom presentations. The in-class activities and assignments are designed to address those concepts.
4. The Force Concept Inventory, Conceptual Survey in Electricity, and Conceptual Survey in Magnetism have been used occasionally as pre- and post-tests, especially for the outcomes assessment projects that are done periodically throughout the Division of Science and Technology and the college.
5. A two-course sequence has been developed for pre service elementary teachers. PHYS-106, Earth and Space Science, and PHYS-107, Physical Science. The courses have been designed to cover the essential topics identified in the Maryland core physics, earth/space and chemistry standards for K-8 students. Both courses make heavy use of inquiry-based lab activities taught in a constructivist learning style. A new full time faculty member, Sharon Lyon, has been hired to teach the Earth and Space Science course.
6. Howard Community College Faculty Summer Grant Program and Teaching Improvement Project funds were obtained to purchase new equipment, fund travel to meetings and workshops, update course objectives, and develop problem and concept worksheets.

Indicators of Success

1. Positive student comments on questionnaires and numerical ratings for Teacher Improvement Projects.
2. High passing grades on the science/mathematics portion of the Cardio-vascular Technology Certification Science Test by the students in the Technical Physical Science class.
3. Increasing enrollments in the last 3 years for most of the physics courses, especially the courses for pre service elementary teachers.
4. Anecdotal evidence that students transferring to colleges and universities in the Maryland system are very successful. Former Howard Community College students interviewed during the site visit were very complimentary of the preparation they received in the physics program.
5. A very positive relationship exists between Howard County’s K-12 system and Howard Community College, especially the two full time faculty members involved in the physics program.
6. Enrollment in physics courses by minority students has a similar profile as the number of minority students enrolled in the college. Minority students make up about 40% of the enrollment in physics.
7. Enrollment in all physics course by female students is greater than 40% as compared to a college enrollment by females of approximately 60%. Enrollment by females in the calculus-based sequence is typically close to 30%.

8. The high percentage of Howard County students that enroll at Howard Community College sometime during their higher education experience.

Keys to Making the Changes

1. *Faculty Focus on Student Learning.* Professor Russ Poch has been teaching physics at Howard Community College for 31 years. He has been responsible for obtaining funds and other support to upgrade the laboratories with MBL equipment and other technology. Professor Poch regularly participates in faculty development opportunities that result in new learning and assessment methods being introduced to the classroom.
2. *Strong Administrative Support.* There is strong support for the physics program and the changes being made in the program by all levels of the administration from the Science and Technology Division Chairman, Dan Friedman, to the President of the college, Dr. Mary Ellen Duncan. Funds have been provided to the physics program to support the introduction of MBL equipment in the laboratory, as well as faculty participation in various workshops and other professional development activities.
3. *Strong Community Support.* There is strong support for Howard Community College from the citizens of Howard County. The county provides significant support to the college through its tax dollars that allows the college to provide the infrastructure and quality instruction that encourages students from the county to enroll in the programs offered by the college. The recently completed classroom building that includes computer laboratories and high tech classrooms to bring the total number of computer workstations available on campus to more than 3,000 is an example of this significant support.
4. *Cooperation among Faculty and Administration.* There is a very strong collegial relationship between faculty and between the faculty and administration. Both entities seem to have the welfare of the students as their greatest area of concern.
5. *Active Outreach to Pre College Teachers.* Professor Poch has played an active role in K-12 science education at the county level. He currently serves as chairperson of the Howard County Science Advisory Committee that advises the public school system on science curriculum issues.
6. *Faculty Involvement in the Development of State Teacher Standards.* Professor Poch served as the Howard Community College representative to the state-wide Maryland Articulation Partnership for Teachers (MAPT) committee that developed the science curriculum for the Associate of Arts in Teaching degree for pre service elementary teachers. He is also serving on the MAPT committee that is designing the curriculum for the Physics Secondary Education Transfer program.

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