

Strategic Programs For Innovations In Undergraduate Physics At Two Year Colleges

A Project of The American Association Of Physics Teachers

A Case Study

Lord Fairfax Community College Middletown, Virginia

Institutional Setting

Lord Fairfax Community College is a comprehensive, non-residential, two year public community college located in northwest Virginia. The college was founded in 1970 to serve the citizens of Clarke, Fauquier, Frederick, Page, Rappahannock, Shenandoah, and Warren Counties and the City of Winchester. The service area encompasses 2,559 square miles and has a population of approximately 237,500 people. Between 1980 and 2000, the Colleges service area population increased by over 23%. Lord Fairfax Community College's annualized full-time equivalent (FTE) enrollment has doubled over the past decade reaching an enrollment of 2,470 in 2001-2002 (1,981 at the Middletown Campus and 489 at the Fauquier Campus). The unduplicated headcount has increased from 4,482 in 1991-1992 to 6,630 in 2001-2002.

The College operates as part of the Virginia Community College System that is administered by the State Board for Community Colleges. The Chancellor is the chief executive officer of the system and is responsible for statewide planning and coordination of the 23 campus system. The chief administrative officer of the College is the President, who is responsible for the organization and operation of the College in accordance with the policies, procedures, and regulations of the State Board, the Virginia Community College System, and the local College Board. Lord Fairfax Community College is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award the associate degree.

The 2001-2002 budget for the college was \$13.8 million dollars, 97% of which comes from state funds with the remaining coming from grants and the college foundation. All colleges in the Virginia Community College System charge the same tuition which is currently \$57.71 per credit hour.

The typical teaching load for faculty is 12-15 credits per semester (15-20 contact hours). There are approximately 50 full-time faculty and 189 part-time or adjunct faculty. The interim president estimated that 50% of the FTE are taught by full-time faculty and 50% by adjunct faculty.

The Physics Program at Lord Fairfax Community College is located in the Division of Mathematics, Science, and Technology. The program has one full-time faculty member at the main campus in Middletown and a part-time faculty member at the Fauquier campus. An adjunct faculty member is employed occasionally to teach astronomy. There are no other support staff available to the program except shared secretarial support through the Division Dean's office.

What Has Been Done

Lord Fairfax Community College offers three physics course sequences that serve the transfer and career needs of the current students: a calculus-based three semester sequence (PHY 241, 242, 243) taken primarily by engineering students and a few physical science transfer students; an algebra-trig-based two semester sequence (PHY 201, 202) taken mainly by engineering technology, life science, and liberal arts students; and an algebra-based conceptual-level sequence (PHY 101, 102) intended primarily for pre service K-12 teachers.

1. Professor William Warren, who has been at Lord Fairfax since 1984, made a significant change in the way these courses were taught beginning in 1992 when he began to use Workshop Physics in all the physics courses. The Workshop Physics approach was extended to the PHY 101-102 sequence this past academic year.
2. All the courses are taught in three 2-hour blocks or two 3-hour blocks each week for a total of 6 contact hours for the 4 credit courses. Students work through a 20 page handout each week in a collaborative arrangement of three or four students at each station.
3. All the physics classes include the use of a significant amount of MBL equipment that was purchased with a NSF ILI grant and matching college funds in 1992. Plans are in place to replace the aging microcomputers used in the laboratory with either new Macintosh or high end PC machines before the start of the 2003-2004 academic year.
4. The Force Concept Inventory is used as a pre and post test in the first semester of all courses and the gains in student scores average about 20-30%. This is about double the gain obtained before Workshop Physics was implemented at Lord Fairfax.
5. By moving to the Workshop Physics approach, the Physics Program has been able to continue offering low enrollment sections of PHY 242 by “stacking” the section with a section of PHY 202. Students from both classes meet at the same time and work independently through similar materials but at a slightly different level and pace.
6. Virginia has instituted a Master Course File system for the Virginia Community College System. Every course in the community college system with the same number has the same course objectives. This simplifies the transfer of courses to any public institution in Virginia. In addition, transfer guides to all institutions in the state are available online.
7. The PHY 101-102 conceptual physics sequence provides a very strong inquiry-based sequence for pre service elementary teachers. Because these pre service teachers can complete their entire four year program at LFCC through Old Dominion University’s TeleTechNet distance learning system, there is a good potential for growth in enrollment of this course.

Indicators of Success

1. Lord Fairfax Community College’s Office of Planning and Research does a follow-up survey of transfer students after one-year and three-years with about a 30% return rate. A transfer summary for recent LFCC physics students from the State Council for Higher Education for Virginia (SCHEV) showed 50% of the students transferring to STEM programs with 80% of those students being in good academic standing.
2. The limited data provided to the site visit team and interviews with some former students indicated those students are adequately prepared to make the transition from Lord Fairfax to the 4-year programs. There is anecdotal evidence that the Lord Fairfax transfer students do better than native students. SCHEV collects data that may make these kinds of comparisons possible.
3. New STEM programs are being developed in conjunction with the building of a new \$11 million science building (scheduled for completion in March 2005). Healthcare programs and associated support courses are very strong with over 500 students enrolled in healthcare programs. There is good potential for increased enrollment in physics courses that are required for these programs.

4. A large number of pre college students from the region enroll in dual enrollment courses that ease the transition from high school to college. LFCC serves a very important bridging role between secondary and higher education for residents of its service region.
5. Although it varies by county, approximately 50% of college-bound residents from the service region enroll at Lord Fairfax Community College.
6. The number of females enrolled in the college is much higher than males, approximately 60%, mainly due to enrollment in health care programs. The percentage of females in the physics courses is about 30%, still significantly higher than the national average for introductory college-level physics courses.

Keys to Making the Changes

1. *Innovative Curriculum.* Professor Warren's initiative to change all the physics offerings to the inquiry-based Workshop Physics approach has resulted in significant learning gains by students taking physics. All current and former students were very complimentary of Professor Warren.
2. *College-wide Commitment to Student Learning.* College faculty members are dedicated to student learning. More than half of the FTE are taught by full-time faculty because of the concern that the faculty have for quality teaching. Adjunct faculty must adhere to the same objectives and outcomes as the full-time faculty.
3. *Support for Professional Development.* All faculty members (including adjunct) are eligible for up to \$550 of professional development funds and additional travel funds are available through Maintenance and Operation funds. Professor Warren has participated in workshops at the national and local level.
4. *Supportive Administration.* There is evidence of substantial cooperation between the faculty and administration. There is strong support for the changes Professor Warren has made in the physics program at all levels of the administration. Even though Professor Warren's student evaluations were less positive when he first instituted Workshop Physics, the administration supported his use of inquiry-based methods because of the increase in student learning that he was able to demonstrate.

For More Information Contact

William Warren
Lord Fairfax Community College
173 Skirmisher Lane
Middletown, VA 22645, Phone 540-868-7178
lfwarrb@lf.vccs.edu