

Strategic Programs For Innovations In Undergraduate Physics At Two Year Colleges

A Project of The American Association Of Physics Teachers

A CASE STUDY

GAINESVILLE COLLEGE Gainesville, Georgia

Institutional Setting

Gainesville College is a college, which is a unit of the University System of Georgia. It is located in Gainesville, fifty miles from downtown Atlanta, on the shores of Lake Lanier and is the gateway to the Northeast Georgia Mountains. Gainesville College was established in 1966 and has grown to an enrollment of 3500+ students. Gainesville College (GC) has recently opened a campus in Athens, Georgia, which has shown significant growth in a period of a few years. Gainesville College has primarily an academic mission with an adjoining institution, Lanier Technical College, that has occupational and vocational programs. Gainesville College has developed a reputation for teaching excellence and innovation in the University System, which is validated by several measures. GC students do very well upon transfer to baccalaureate programs and increase their GPA on the average. The College received the most exceptional commendations in its recent self-study and re-accreditation process.

The Physics Department is in the Division of Natural Sciences, Engineering and Technology that is administered by a Division Chair. There are two options available to students within the physics program – Associate Science Degree in Physics or Associate Science Degree in Physics Education.

Gainesville College provides the typical range of physics courses including the two semester algebra-based physics sequence and the two semester calculus based physics sequence designed for science and engineering majors. A two semester integrated science sequence serve the general education needs of non-technical and non-STEM majors and education majors.

What Has Been Done

Over the last few years, the Physics Program at Gainesville College has developed a successful program. To accomplish this program change, GC's Physics Program has done the following:

1. The GC Physics Program utilizes innovative use of technology. It has implemented not only microcomputer-based laboratory (MBL) activities in all its physics courses, but it has also implemented use of the internet to supplement in-class instruction, homework, and out of class activities. GC's MBL uses modular self-contained stations (12) which allow minimum setup and tear down time for different physics classes. GC's MBL utilizes traditional MBL activities, digital video analysis, and 3-D activities using global position system units. Instructors use a SoftBoard
2. (allowing them to quickly upload their lecture notes to their webpage) as part of their instruction with wireless keypads to poll their students during instruction. By using WebAssign and WebCT as an instruction tool, physics instructors give students access to quizzes, homework and other resources designed for their individual use.
3. All physics classes are taught as a combined lecture/laboratory class allowing students the ability to perform activities and labs at any time during instruction.

4. GC Physics Program expanded its facilities when the Division moved into its new building in the Fall 2000. The new building allowed a technology update for the program and more integrated use of technology within the physics courses and program.
5. Gainesville College is a Regents' Engineering Transform Program (RETP) institution which guarantees that qualified students who complete their pre-Engineering curriculum at GC will transfer to the Georgia Institute of Technology. GC sends 15 to 20 students a year (all physics students) to Georgia Institute of Technology as part of the RETP.
6. A Society of Physics Student chapter has become very active and provide many activities that are also attractive to engineering and mathematics students.

Indicators of Success

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

1. GC has a large number of physics majors. It has had 2 to 4 students each year who are physics majors and who later transfer to four year institutions to obtain their baccalaureate degree in physics. Additionally, GC has about 5 students each year who later become a K-12 physical science teacher.
2. GC has a large number of STEM majors who take physics. In addition to a growing number of pre-professional and allied health majors, the physics program has a healthy number of technology majors and majors in geographic information science. Physics students from GC have an almost 100% rate of completion of a baccalaureate in a STEM discipline.
3. The GC Physics Program has seen a steady enrollment growth the past three years, due primarily to the growth of engineering majors, growth in other STEM areas, and expansion and updating of facilities when the Division moved into the new Science Building. This growth has been particularly large in the calculus-based sequence.
4. Students from GC who transfer to four year institutions (nearly 400 during the academic year 1999-2000) actually improved their grade-point averages at the four year institutions. This same trend is true for physics students who transfer to the University of Georgia, North Georgia College and State University, and Southern Polytechnic State University. Virtually all physics students transfer to four year institutions.
5. The number of female physics students has increased and is comparable to the national average. The number of minority physics students has increased and is now significantly higher than the national average and the Gainesville College average. GC is the largest transfer feeder school to Southern Polytechnic State University. GC physics enrollment has about 60% of its students who graduated from rural high schools and approximately 50% of its students are first generation college students.
6. Physics students polled during the last two years have consistently indicated satisfaction with the technology used in the physics program. Of the nearly 59 students polled, well over 90% thought the lecture/lab combined class made for a more effective learning experience, thought that the WebAssign homework aided their physics learning experience, that collaborative problem solving in class was helpful to learning, that "cycling" through lecture-activity-lab was helpful in learning physics, and that the technology used in the class added to their physics learning experience.

7. The GC Physics Program has received strong administrative support from the Division Chair to the President in the form of funding for equipment and facilities and recognition of the efforts of the physics faculty. The Division Chair in particular is intimately aware of the goals of the physics program and actively supports them.
8. Strong collegial support from other faculty members in mathematics, engineering, life sciences, and other physical sciences have led to a common goal in the SMET programs. Faculty members work together to promote each other programs and they conduct with their students science educational programs for the community and K-12 schools including giving science shows and providing professional development opportunities for K-12 teachers.

Keys to Making the Changes

There are several “keys” that have allowed the GC Physics Program to make the programmatic changes that has led to their success.

1. *Supportive Administration.* The administration is well aware of the excellent work that the physics program does both on and off the GC campus. Empowerment has been given to the deans, division heads and the program director to experiment, develop new ideas and programs, and receive training for the betterment of education and teaching in general.
2. *Supportive Technical Structure.* The Information Technology (IT) Department provides outstanding support for the physics program as well as others. Many of the IT employees are ex-physics students and understand what the program is striving to achieve. Both the director and the Science Division IT specialist were “in tuned” with and supportive of the mission of the Physics Program.
3. *Supportive Collegial and Professional Leadership.* Gainesville College has a very collegial environment with a lot of interaction between faculty across all disciplines. The ‘Learning Communities’ project further encourages interdisciplinary professional interaction and curricular design. The Natural Sciences, Engineering and Technology Division is also a very collegial group and they all have a rich personal and professional interaction. This professional interaction helps fuel a non-competitive yet richly active professional environment.
4. *Faculty Leadership.* The professional leadership provided by the faculty is the cornerstone to GC’s superior program. The faculty is extremely enthusiastic about teaching physics, brings a positive attitude to work everyday and demonstrates mastery of the subject matter. The results of faculty leadership can be seen in the well planned out curriculum package. It can be seen in the well thought out and planned science building, and also the culture and communication abilities that are brought into the program.

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