A New Paradigm for the First Two Years of General Education: 
The Integrated Curriculum for A Science or Engineering Program of Study  
The Physics Sequence 

Elliot Palmer  
Department of Physical Sciences  
Embry-Riddle Aeronautical University  
Email: palmere@cts.db.erau.edu 

Introduction 

It is not uncommon for faculty members to look at a curriculum and ponder what can be done to improve its effectiveness. In the case of an engineering program, this task is complicated by the multidisciplines involved. Students insist that the subject matter is unrelated, and the faculty insists the students are over compartmentalized. For a variety of reasons many faculty members recommend calculus as a co-requisite for physics instead of a prerequisite. A close examination of the topic sequence in a typical engineering three-semester curriculum would show that the math and physics topics are very poorly matched and out of sequence. For example, vectors don't normally appear until the third semester math course as opposed to being one of the very first topics in a physics sequence. If, indeed, the presentation of the curriculum were more effective, one would also hope for the increase in motivation and retention. 

At ERAU the initial step was to realign the math and physics sequences. The physics team took the lead by laying out the topical sequence, but the math team bore the brunt of the work in almost totally reordering the math. Following a suggestion from Texas A & M, the physics sequence opened with geometric optics to allow time for the math team to introduce elementary calculus (derivatives and anti-derivatives). Considerable effort was put into selecting a textbook that was very readable from the student point of view. Serway's Principles in Physics fit this need nicely. At this point the engineering and humanities team members joined the effort in working out the teaming aspects of the program. Very close coordination was maintained throughout. Use of computers in the physics curriculum consisted of limited use of spreadsheet and MAPLE applications until the third semester where the laboratory experience relied heavily on computer assisted data acquisition and analysis. 

The results after repeating the first semester twice are remarkable and repeatable. In a calculus based engineering sequence physics course, the unsuccessful (D, F, WD, AU) rate typically falls between 30% and 40%. After two sequences of the ICE curriculum, the unsuccessful rate has dropped to 15% to 17%. Other positive spin-offs are: the spirit of interdepartmental cooperation and the physics and math topic alignment to better reinforce each other.