WONDERS OF TECHNOLOGY – TEACHING PHYSICS TO NON-SCIENTISTS[1]

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Wonders of Technology is a conceptual physics course developed for non-science majors. The approach taken here in the introduction of the physical concepts is to depict their role in today's technology, specifically the technology familiar to the students, and also to emphasize the connection between technology, art, and culture from the historical perspective.

Why this approach? The traditional method of teaching physics is perceived by many students as "user-unfriendly" – they think physics is difficult, abstract, and, in fact, of little or no relevance to everyday life. The course *Wonders of Technology* alleviates this perception by placing the students on familiar ground that provides a fertile environment for an easier assimilation of knowledge. By examining the technology students use on a daily basis to demonstrate how physics makes things work, students are motivated to seek understanding of the principles underlying their operation. The course was developed within the guidelines of the new general education requirements at Virginia Commonwealth University.

This presentation highlights some of the highly successful features of the newly developed course, with emphasis on responses from the education majors who are enrolled in the course.

Features of the Course

Wonders of Technology is a one-semester course. The course features:

- Multidisciplinary approach,
- Emphasis on technological and real life applications,
- Exercises to enhance critical objective thinking, and design flexibility to allow for vertical curricular integration,
- Unit format that stresses a project / laboratory / hands-on approach,
- Multimedia, highly interactive, and Web-based course presentation.

The text emphasizes the process of socializing scientific information and teaching students how to obtain additional information for life-long learning. Students achieve science literacy

[1]The development of the course is sponsored in part by the NSF-funded Virginia Collaborative for Excellence in the Preparation of Teachers (VCEPT).

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by studying the processes, concepts, and significant details of modern experimental science and technology. They are required to apply the material learned in class to everyday applications. Activities and tests encourage development of the mental skills necessary to think scientifically and understand and respond critically to science articles and programs in the popular media. These activities and tests also give the students some understanding of the relationships of science to religion, ethics, politics, economics, and the arts. The unit format stresses project/laboratory/hands-on components, with high student involvement.

The *lecture component* is multimedia and interactive. During this period the students are introduced to topics from life-related experiences, using films, demos, simulations, etc. The topics are (in the order they are listed):

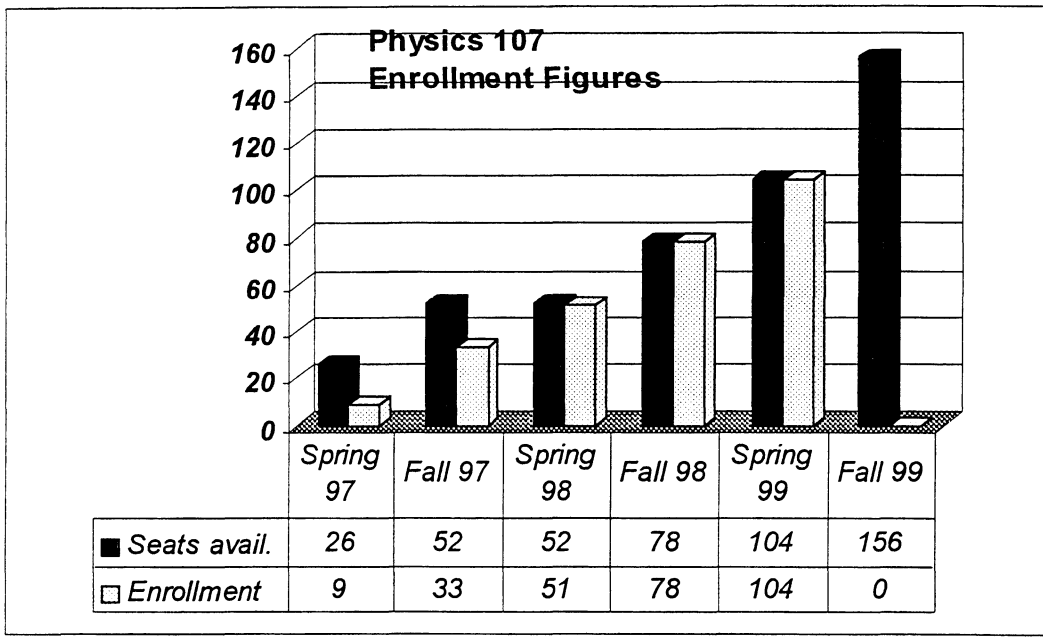
- Balance, Benefit and Doubt (dealing with the science of measurements)
- The Nature of Things (structure of materials from macro to micro)
- The World of Light and Color (develops the laws of optics)
- Bridges over Space and Time (electricity and magnetism)
- The Ultimate Ride (mechanics)
- The Future is Here (latest breakthroughs in physics and technology)

During *the lab*, the students work on projects that have relevance to the problems raised during the lecture presentations. Cookbook quantitative labs are avoided, conversation is encouraged, and speculation is rewarded. At the conclusion of the hands-on project, a *general discussion* of the topic, with its relevance to personal life, technology, and other sciences, follows. The discussions focus on the interdisciplinary nature of the phenomena. Interactive-computer programs are used where appropriate.

Preliminary evaluation and assessment

The course was first offered on an experimental basis in spring 1997. From this tentative start the course enrollment has grown steadily; the number of sections increased to 2 (sections are limited to a maximum number of 26 students), then three, then four and it is anticipated that six sections will be offered this coming fall.

This growth is shown in Figure 1, opposite, and apart from the first two semesters, enrollment in each section has been full well before the registration deadline.



	Spring 97	Fall 97	Spring 98	Fall 98	Spring 99	Fall 99
■ Seats avail.	26	52	52	78	104	156
□ Enrollment	9	33	51	78	104	0

Figure 1. Enrollment in *Wonders of Technology.*

The size limit of 26 for the classroom is used for both lectures and laboratory projects. By keeping the section size low each student receives individual attention and by necessity must contribute to the projects.

Student evaluation is made through project reports, practical exams, quizzes and homework. The final exam is given as projects that, to the extent possible, are pertinent to the students' major.

The composition of the sections has been monitored carefully for the last four semesters. The male/female ratio has remained very close to 50% from the start. Mass Communications and Business are the most common declared majors and the low percentage of Education majors is a bit of a surprise as it can be seen in Figure 2 on the following page.

Comments made by education majors in the evaluation of instruction have been very favorable, indicating that the content and methodology of the course would be of direct benefit to their major.

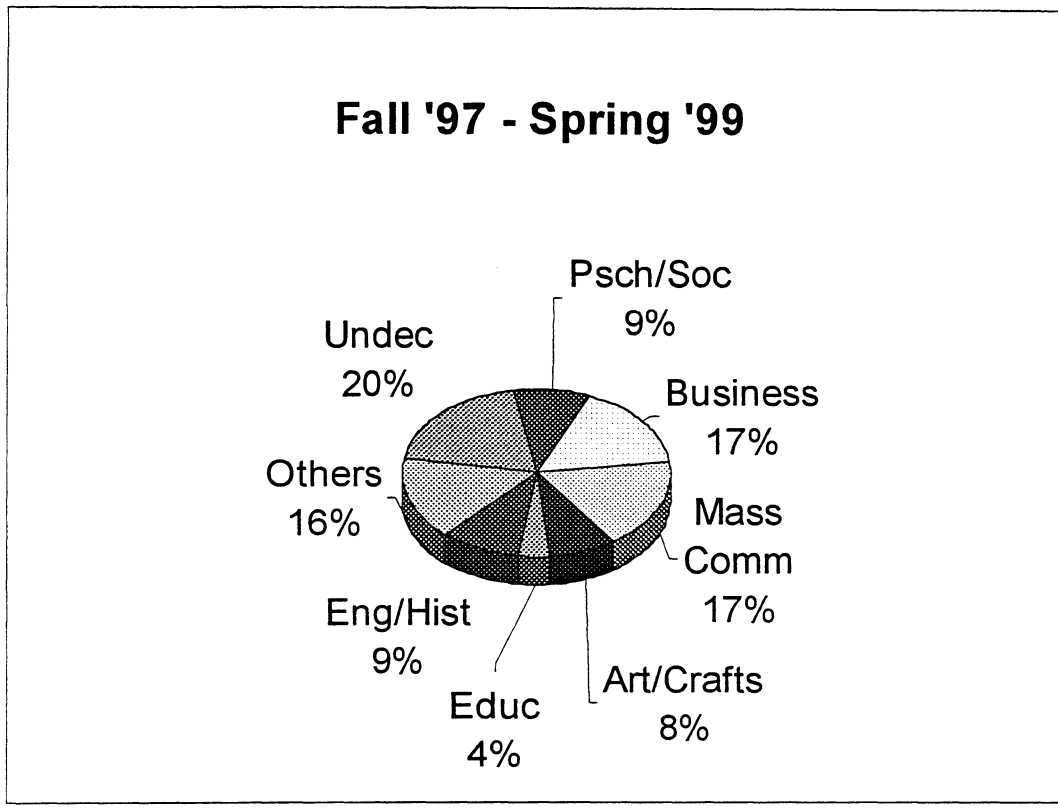


Figure 2. Majors of students enrolled in *Wonders of Technology*.

In the fall of 1998 VCEPT conducted a survey of student assessment of VCEPT courses. A total of 23 students enrolled in *Wonders of Technology* responded, and their reaction is summarized in Figure 3, opposite.

From their answers we feel that to a large extent the goals and objectives have been met. Moreover, an assessment questionnaire given in the spring of 1998 by the committee for implementation of the general education requirements within the College of Humanities and Sciences at VCU, revealed the fact that the students who took *Wonders of Technology* in conjunction with the introductory biology course, performed as well if not better than all the other natural science/physical science sequences. ■

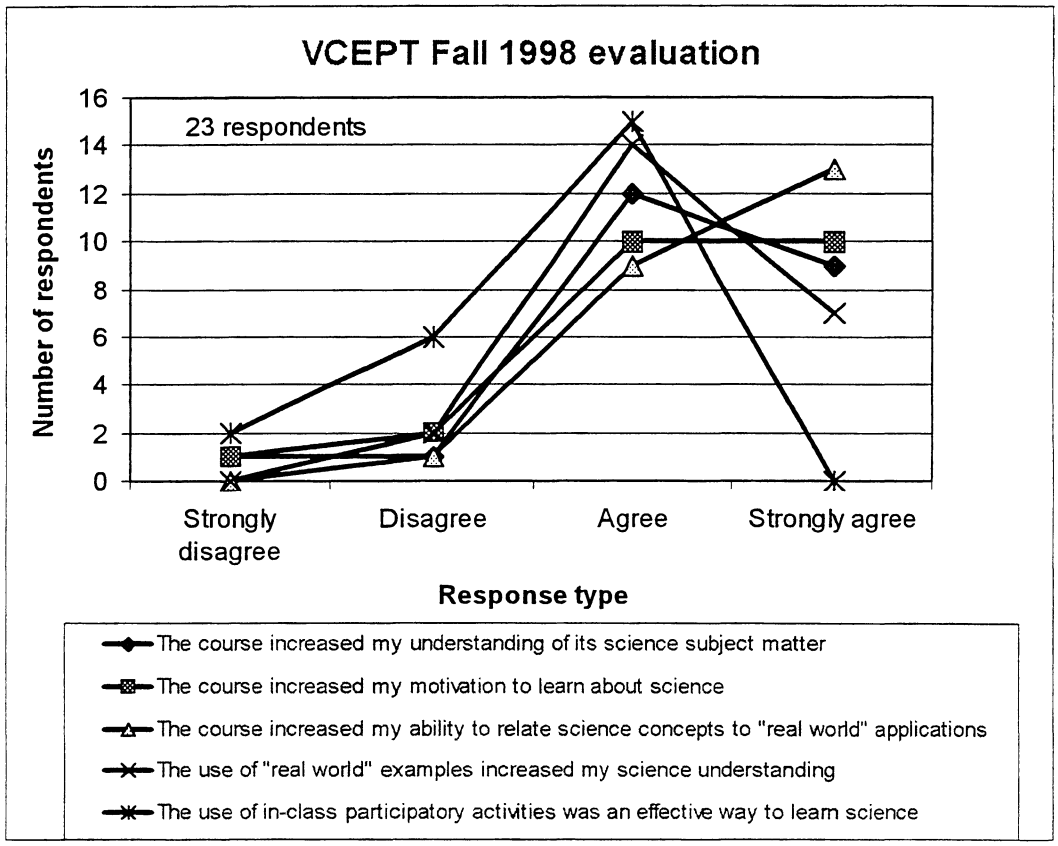


Figure 3. Student assessment of *Wonders of Technology*.