Undergraduate programs in computer science

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Since the publication of "Curriculum '68", that landmark report has been subject to numerous discussions, enlargements, and criticisms. An updated version of this work is currently under preparation. Some of the more significant criticisms which were directed at the original report concern the lack of attention to the physical aspects of computer science, the limited consideration of data processing as a profession, and the absence of courses in the area of computers and their impact on society. The computer science graduate and undergraduate programs at Worcester Polytechnic Institute were developed and implemented over the same time frame as "Curriculum '68". While the departmental computer science academic program was developing, Worcester Polytechnic Institute itself was simultaneously engaged in an exciting and unique experiment in undergraduate science and engineering education entitled the WPI Plan.

The experience in this unusual milieu has served as a basis for the computer science undergraduate program now in effect at WPI. It is believed that the ideas generated by this symbiosis of a new academic discipline along with an unusual approach toward science education can be successfully incorporated in other computer science undergraduate programs to broaden and deepen the undergraduate exposure to computer science as a profession.

The WPI Plan stresses the attainment of the Bachelor's degree through the demonstration of competence while allowing a broad freedom in course selection supported with academic advisory assistance. The basic B.S. degree requirements at the Institute are, along with course work, completion of a competency examination in the major field of study, qualification in a minor field of study (normally in the humanities), and two projects, one of which is in the major field, and the second, preferably one relating technology to society. As can be seen, the framework of the WPI Plan has led the Computer Science Department to quite naturally supplement some of the major shortcomings voiced about "Curriculum '68".

The project activity has been particularly beneficial. It gives the undergraduate computer science major a perspective on the real world of computing. The department has a number of projects developed in conjunction with local industry. In this respect, WPI is quite fortunate to be in close geographic proximity to a number of major computing equipment manufacturers and large computer users, such as, Digital Equipment Corporation, Data General Corporation, Sanders Associates, and Honeywell Information Systems Division, as well as Norton Company and State Mutual Insurance Company.

Actual projects have ranged from software verification to contributions to the design of a computer based information system for the juvenile court of Worcester. Student reaction to the projects both of the on and off campus varieties has been uniformly excellent. The experience of organizing and executing the computer science activities required is now of a much larger scope than normally encountered in regular course work and reaction by students is extremely positive. In addition, the exposure to various employers of computer science students is a fortunate side-effect for students and often leads to offers to join that firm upon graduation. Several of our outstanding students have been hired by local computing equipment manufacturers or computer application firms as a direct result of their project activity.

The requirement to produce and administer a competency examination in computer science has forced the department faculty to come to grips with a very difficult problem: defining the essence of computer science in such a manner that an undergraduate student's competency in this field can be quantitatively measured. This is difficult in any academic field of endeavor, but even more so in an area such as computer science with its dynamic growth and broad areas of applications.

To accomplish this goal students are usually allowed to select one of three projects. These problems are designed to permit a broad latitude in the actual solution. The student can bring to bear wide ranges of knowledge and experience in developing the written answer to this portion of the competency exam. The second phase of the examination is an oral review. Here the student explains his written solutions or enlarges it after he has time to think about it. In addition, other concepts of computer science may be examined at this time. Our experience with the competency examination has been gratifying. The students usually think of it in advance as a traumatic experience, an obstacle to be overcome. But after taking the examination, the general comment has been that the examination was fair and helped crystallize many aspects of the profession of computer science that they had not thought about previously.

The need for one to one advising as required by the WPI
Plan during the development of the undergraduate program for each student has also caused each member of the faculty to be intensely interested in the general aspects of an academic program in computer science, as well as employment opportunities or graduate school availability.

In total then, the unusual and innovative aspects of the WPI Plan along with the basic core curriculum have caused our students to receive a much more individualized and broader education in computer science than the traditional lock-step program might have allowed.

From the employment point of view, the results have been also positive. We have a limited base as far as numbers of graduates from the Plan are concerned, however, those students graduating to date have had little difficulty obtaining the types of jobs they have wanted. In general, they have had several offers to select from. Thus far, most of the students have gone to work with equipment vendors in the local area such as Digital Equipment, Data General, and Honeywell. But a significant number are beginning to join major insurance, banking, and other financial institutions as well as manufacturing plants in the region.

The practical project activity, a careful and individualized advising system and a continuous examination and concentration by the department on what they consider to be the essence of computer science is certainly transportable to any computer science undergraduate program. This concern and commitment by computer science departments should improve the probability of employment for their graduates and help to effectively answer a number of criticisms leveled at current computer science programs by employers.