# Student Ownership of Personal Computers

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## Abstract

Objectives for requiring personal computer ownership included implementation of a computer thread in the engineering curriculum and alleviating the overload on the computing facilities. Techniques employed for meeting these objectives are described. The unanticipated benefit of PC ownership facilitating participation in the computer revolution in the future is explored.

## Introduction

In 1983 Stevens Institute of Technology became one of the first colleges in the United States to require personal computer ownership by all undergraduates. A reason behind this move was to further an objective of the new engineering curriculum; namely, that there be a computer thread throughout the curriculum.[3] The other reason pertained to facilities. The mainframe was severally overloaded and was not able to accommodate the anticipated additional usage. It was felt that personal computer ownership would do much to alleviate this situation.

Selection of the original computer and the subsequent evolution of the required machine are described. At the outset, relatively few students were computer-literate and hardware, software, and documentation were not particularly user-friendly. Consequently, a crucial element in the success of the plan to require computer ownership was the support mechanism provided to the students. In addition, a strategy was needed to implement the computer thread. Furthermore, the integration of computers and communications has provided an opportunity to take further advantage of student-owned computers to keep pace with rapid technological changes.

## The Personal Computer Plan

Initially, the facilities issue was addressed by a pilot project in 1982 that required all entering freshmen in the Systems Planning and Management Curriculum to purchase Atri 800 computers. The success of this project lead to the Personal Computer Plan the following year. Under this plan all entering freshmen were required to purchase a DEC PRO350. This computer used a PDP11 processor and listed for $10,000, but with a subsidy and a discount was sold to the students for $2,000. Faculty participation was encouraged by allowing them to purchase the PRO350 for $1,500.

The subsequent dominance of the IBM PC would appear to have made the PRO350 a poor choice. In 1983, however, a networking facility, a hard disk, language capabilities, price, and lack of acceptable alternatives justified selection of the PRO350. The subsequent dominance of the IBM PC eventually rendered this machine obsolete. Therefore, since 1987 a PC has been the

specified computer. The manufacturer has changed a number times and the processor successively has been a 286, 386, 486, and Pentium. Since 1983, the cost to the students has remained at approximately $2000, with ever-increasing capabilities. For the class entering in the Fall of 1997, a Pentium Pro MMX processor with a two gigabyte hard drive was specified with a notebook computer version as an option.

## Providing Support

Even before the first PRO350 was delivered, it became evident that a student support mechanism would be required.[6] Advanced copies of the documentation included some field test versions that attempted to make up in quantity what they lacked in quality. As a result, the first component in the support mechanism was a user-friendly comprehensive manual written by a faculty member with the assistance of computer-literate undergraduates.[4] This was followed by a decision to permit pickup of computers by incoming freshmen during the previous summer. Students who took advantage of this option could get acquainted with their computers over the summer. In addition, a series of summer workshops, taught by faculty-supervised computer-literate undergraduates, covered both introductory and advanced topics.[7] Those students who did not take advantage of the summer workshops, were asked to attend an intensive version of the workshops immediately before the start of classes in the fall. In this manner all students were in a position to take full advantage of their computers from the outset.

Soon after the start of the fall semester, a number of freshmen began experiencing hardware and software difficulties. Included were problems loading and using software and differentiating between hardware malfunctions and software difficulties. As a result, the Personal Computer Assistance Program (PCAP) was organized.[5] Under the direction of a faculty member, computer-literate students made room calls in the freshman dormitories. They provided assistance in loading and using software and with computer-related homework assignments. Hardware problems were identified, but repairs were not attempted.

Hardware malfunctions were referred to the Computer Service Center that was established on campus. Since the PRO350 came with a warranty, each student was assured of obtaining service on campus without the inconvenience and expense of seeking help outside the campus.

## Implementing the Computer Thread

The principal mechanism for implementation of the computer thread was the Computers in Engineering Education Plan (CEEP). The strategy was to integrate computer usage into individual courses and to coordinate this usage among courses to establish the thread. Computer integration meant that the computer was to be woven into the course, rather than merely appended it to existing material.

Funds were obtained from various agencies and foundations, as well as Stevens' internal funds. These funds were employed to support faculty projects during the summer. Each project had as its objective the integration of computer usage into a particular course. Faculty wrote proposals that included budgets for summer salaries for faculty and graduate students, software, secretarial

assistance, and supplies. Coordination among projects was provided by the Director of CEEP, periodic meetings, and project reports.

One project involved the course in circuits and systems.[2] Computer integration was to be centered on a computer-aided circuit analysis program. Since no such program was available for the PRO350, the principal activity in the project was to implement a program. This was accomplished by converting a BASIC program written for the Radio Shack Model I by a faculty member into FORTRAN for the PRO350. The result was a package capable of performing steady-state analysis of ac and dc circuits.

In addition, a graphing program to run on the PRO350 was written for use with the circuit analysis package. This program was employed to study the effects of variations in parameter values and frequency. A manual patterned after the manual for the PRO350 was prepared to give instructions for both the circuit analysis and graphing programs. The manual also contained a set of projects that were to be performed and submitted for credit. The circuit analysis package did not have a time domain analysis module, but one project involved the time domain analysis of an RLC circuit. This analysis was performed using FORTRAN, thereby reinforcing programming learned in a previous course.

## Benefits of the Personal Computer Plan

One of the objectives of the Personal Computer Plan was to alleviate the overload on the computing facilities. The principal computing resource on campus had been a DEC System10 mainframe. Before the PC plan, access during the peak afternoon hours was nearly impossible and those who succeeded in logging on were faced with extremely slow system responses. The PC plan did not provide instantaneous relief since initially only freshmen owned personal computers. Three years later, however, when all undergraduates had PC's, the overload on the mainframe disappeared.

The other principal objective of the PC Plan was the implementation of the computer thread. This called for use of the computer in every course where such usage would be reasonable and feasible. Here too results were not immediate, however, courses where computer usage was integrated through CEEP, provided an impetus for faculty in other courses to employ the computer. In addition, the ready availability of the computer inspired more faculty members to use the computer in their courses. An unanticipated benefit of the PC Plan was that most of the nay sayers who believed the computer had no part in engineering education were converted, or at worst retreated into the closet.

Student ownership of the computers also provided for yearly updates of the machines; i.e., the computer specified for the incoming class always is the latest model. This is in contrast to equipment that belongs to the school, which hopefully might be replaced every five years. Since the machines supplied to the students come bundled with the latest software, the plan also provides for yearly updates of the software.

One of reasons for selection of the PRO350 as the first required machine was its network

capability. This was an important decision, since shortly after initiation of the PC plan, it was possible to network the entire campus. This in turn lead to early use of e-mail and recently facilitated connection to the World Wide Web.[1]

## A Link to the Future

For over a decade faculty and students have had ready access to e-mail via the campus wide network on-campus and dailup from off-campus. E-mail first was used to send messages among students and faculty. This use gradually expanded to communication with colleagues from other schools and professional organizations. Educational activities have included posting assignments, schedules, downloading software, and file transfer in general.

As a result students and faculty were posed to take immediate advantage of the World Wide Web. Some functions performed by e-mail now are handled more effectively via the internet. Many departments, administrators, faculty, and students have their own web pages. For example, the Department of Electrical and Computer Engineering's web pages contains information about faculty, programs, and course descriptions. Faculty web pages include research interests, course information, and sometimes a photograph. The latter is provided for those students whose sparse attendance in class might preclude recognition of their instructor.

The internet also presents an unprecedented opportunity for innovation in the educational process. In one circuits course students may interactively solve homework problems. A chemistry professor is developing interactive lectures via the web. Web-based assessment is being used to perform student evaluations of courses. In some instances the whole idea of what should be taught and what should be left to the computer is being investigated. For example, what techniques are essential to the understanding of the subject, and what techniques are merely by rote procedures that can just as well be handled by a software package?

## Conclusions

The objectives of requiring Personal Computer ownership were facilitating implementation of the computer thread and solving of the problem of an overburdened mainframe computer. Clearly these objectives have been met along with the establishment of an undisputed role for computers in engineering education. In addition, Stevens was positioned to take immediate advantage of e-mail and subsequent connection to the World Wide Web. The computer with the web promises to provide the impetus for innovative methods to enhance the learning process.

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