

# Developments in Business Simulation & Experiential Exercises, Volume 13, 1986

## PERSONAL COMPUTERS: DREXEL'S EXPERIENCE

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### ABSTRACT

This paper presents a brief case history and evaluation of Drexel University's experience from fall 1982 through fall 1985 with a policy of requiring each incoming freshman to have access to a personal computer for use in all courses. In the first year following Drexel's decision, representatives of over 70 colleges and universities contacted or visited Drexel to seek additional information on how and why Drexel made this decision. It is hoped that relating some of Drexel's experiences may be of value to other colleges and universities considering similar programs.

### THE PERSONAL COMPUTER DECISION

In October of 1982, Drexel University's President announced that all students entering Drexel in the 1983-1984 academic year would have access to a microcomputer. The stated reason for this new policy was "to provide every student with the resources and training necessary to meet the challenges of the future--a future in which effective use of computers will be essential in virtually every field."

One approach considered was to make huge expenditures to expand the University's central mainframe computer and terminal facilities to accommodate dramatically greater student/faculty use. But, for the University and for students, a more economical solution was to have the students and faculty share a large part of the expense by purchasing their own computers. Some benefits were obvious in this latter approach. First, the University could reduce its commitment to technologies that might quickly become obsolete. Second, students would have a greater incentive to take care of the computer equipment since it would belong to them. Third, having access to their own microcomputers would enable students to experiment on their own without the frustration of long waits at the central computer center.

#### Selection Committee

A microcomputer selection committee, composed of faculty representatives from across the university, was promptly appointed to define the university's instructional computing needs and to establish specific requirements for a computer to fulfill these needs. The challenge was to select a machine which would be compatible with the unique character of Drexel University. Approximately one-half of all Drexel students commute to the campus, many hold part-time jobs while attending classes full-time, 95 percent of the students participate in the University's cooperative education program, and students study across a spectrum of fields. Thus, the microcomputer chosen had to be (1) flexible and sophisticated enough for students to use in even the most technically advanced courses--ranging from the sciences to the humanities, (2) a stand-alone unit, and (3) easily transportable so that students could carry it with them from home to school and back.

The Selection Committee analyzed information from five different sources: (a) prior experience with computing, (b) information from potential vendors, (c) published articles and books, (d) input from colleagues, and (e) subjective

factors such as personal reactions to different hardware and software. After a long, complex review process, the faculty Selection Committee developed a set of hardware and software requirements plus a pool of "recommended" manufacturers whose products met the specified criteria. Critical requirements in the decision included flexibility in serving a pluralist university community, sufficient computer power for diverse student or faculty use, "state of the art" features and capabilities, user friendliness, graphics versatility, sound production, growth capacity, reasonable cost, and solid vendor reputation. Although the costs and capabilities of the machine were uppermost, it was essential to select a company that was likely to be in business and offering support services throughout the life of the selected machine. Moreover, since the University would be closely identified with the vendor selected, members of the Selection Committee wanted Drexel to choose a technological leader and innovative manufacturer with a commitment to the education market. Drexel's vice president of academic affairs, chief financial officer, and key members of their staffs met with representatives of all the qualified manufacturers, listened to their presentations, and conducted intense negotiations. The machine finally chosen was Apple Computer Company's Macintosh since it best met the predetermined criteria. Initial cost of the machine to students was to be \$1,000 or about \$250 over a five-year period. Additional costs for follow-on items such as diskettes, paper, maintenance, software, peripheral equipment (printer, external disk drive), and insurance costs could boost this figure to as much as \$500 per year. These potential costs had to be considered in helping students to develop financial plans for completing their college education.

#### Mandatory Computer Use at Other Universities

According to Time magazine (October 21, 1985, p. 71), "Drexel was not the first college to make personal computers mandatory; in 1982 Stevens Institute required its science students to buy their own personal computers, and in 1983 Clarkson and Dallas Baptist extended the idea to include all incoming freshmen. Now computers are required or strongly recommended at more than a dozen schools, including Carnegie-Mellon, Colby, Dartmouth, Drew, Franklin and Marshall, Lehigh, LeTourneau and Sweet Briar. But none of these schools has integrated the machines into its curriculum as thoroughly as Drexel has. And none has been as dramatically transformed by computers as the Philadelphia school."

#### Computer Usage Prior to Personal Computers

Long before the coming of the Macintosh to Drexel, computers were common in the sciences and engineering; and to a lesser extent in the College of Business & Administration. The basic marketing course utilized a simulation game and numerous courses in management employed computers. Administrative and academic computing needs were nearly all handled by the mainframe computer in Drexel's computer center or a nearby commercial computer center. Only a few faculty and students had their own personal computers to aid their research and/or coursework.

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### Personal Computers Within Academic Departments

Within business schools, economics and accounting faculty have been the first to incorporate computer-aided teaching/learning into their curricula because students begin study in these disciplines in their freshman or sophomore years. Courses in disciplines such as marketing, finance, and management are normally not taken until the student's junior year. At Drexel, the economics faculty have best documented their experience with personal computers. economics department is not the only school to use microcomputers in the teaching of economics. In fact, microcomputers have been used at many universities. Microcomputers lend themselves very well to the teaching of economics since almost anything one wants to present in an economics principles course can be displayed through the microcomputer and other electronic media<sup>1</sup>. It is not necessary that schools require student purchase of PCs to use microcomputers in the teaching of economics. Rutgers has a microcenter where students come to work on economic problems with microcomputers provided by the university. Moravian College uses microcomputers to do regional economic analysis and reporting. However, it appears student input is limited to data collection<sup>2</sup>. Numerous other reports of computer use can be found. For example, let us look at some of the papers presented at just one conference last year--the Western Economics Meetings in July of 1985.

### Economics Software

It was reported that MACROSIM has been used at California State University at Fullerton as a valuable tutorial in teaching students to implement key economic policy variables to improve the economy. It has been presented in the classroom but it can be structured for an individual or group tutorial<sup>3</sup>. Lotus 1-2-3 has been used in the teaching of a managerial economics course at Bentley College<sup>4</sup>. Software written in BASIC and running on IBM or IBM compatible personal computers with graphics capability has been used in intermediate economics at the University of Wisconsin at LaCrosse. Many other examples are available of individual faculty members venturing into computer assisted instruction in economics. However, we believe Drexel faculty involvement to be more pervasive than most others. One of the reasons is the early training and support of the faculty.

### Training and Support of the Faculty

The decision to introduce microcomputers into the Drexel curriculum was made with the understanding that faculty attitudes and skills would be crucial to the success of the program. Faculty would have to be familiar with the use of the microcomputer chosen and willing to introduce work on

the computer as a normal part of their teaching. They would also have to devise applications for computers which would be creative--not just perfunctory--additions to instruction in their fields. In order to prepare the faculty, the University embarked upon a massive faculty development effort helped by a \$2.8 million grant from the Pew Memorial Trust.

The initial training machine was not the Macintosh but Apple's Lisa. Faculty were given released time to undertake training on the Lisa. The Lisa, the mother of the Macintosh, had been made available for faculty familiarization and course development prior to release of the Mac. Training was given in LisaWrite, Project, Draw, Paint, Graph and most importantly, for economics purposes, LisaCalc. People in the economics department were especially impressed with the spreadsheet capabilities of LisaCalc. The spreadsheet was so intensely used by the department that an internal publication devoted about a third of its applications to materials developed by the department of economics, the rest of the material came from nutrition and chemistry<sup>5</sup>.

In 1983, a Drexel economist received released time under a grant from the Pew Foundation to develop homework problems for the basic courses in economics--microeconomics and macroeconomics. At the same time, another economist received released time from the Pew Foundation to develop classroom examples that would illustrate various economic principles. Both examples and homework were developed on the Lisa using the spreadsheet and the graphics capability of Lisa. Later, the development of both had to be scaled down to fit the capabilities of the Mac. Presentations of the classroom examples were made in university-wide developers' sessions and special seminars for members of the College of Business & Administration which would allow people from the various departments: accounting, economics, finance, law, management, marketing, and statistics to make presentations of what they were doing and to learn from one another. Also available were special courses in programming and software applications for interested faculty. University-wide developers' sessions continue to meet once a week at lunchtime. Members of the department have actively participated as presenters and commentators in these sessions. Usually, work-in-progress is presented for comment by the group. Sessions are open to all interested faculty and a schedule of weekly topics is found in Boot--a Drexel campus newsletter which provides information on computer activities and developments, e.g., computer shortcuts and discoveries, software bugs and cures, software reviews, the availability of new hardware and software, and brief reviews of books and speeches relating to computer assisted instruction.

### Software Review Center

Drexel, like many other universities, has a software review center which serves a reference function, collecting and classifying existing software along with related manuals, periodicals and books. Faculty come here to explore new software packages for use in their teaching and to research the latest programming and application packages as the basis for developing their own materials. The center has been useful in providing materials for use in economics, such as MacChart, DU Graph, TK Solver, statistical packages, and data management packages. Assistance in software design is provided by an instructional support group. The instructional support group is supposed to provide programming support and offer professional help in evaluating the types and technical

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<sup>1</sup> Richard E. Towey, "Teaching Principles of Economics with a Microcomputer," paper presented at the Western Economic Association Conference, Anaheim, Calif., July 1985.

<sup>2</sup> Kamran Afshar, "Regional Economic Analysis and Reporting: A Teaching and University Service to the Community," paper presented at the Western Economic Association Conference, Anaheim, Calif., July 1985.

<sup>3</sup> Edward Brejtfus, "Using MACROSIM in the Classroom as a Tutorial," paper presented at the Western Economic Association Conference, Anaheim, CA, July 1985.

<sup>4</sup> Evan J. Douglas and Andrew J. Stollar, "A Courseware Package for the Managerial Economics Course," paper presented at the Annual Economic Association Conference, Anaheim, Calif., July 1985.

<sup>5</sup> Lucy Wozny, The Spreadsheet in an Educational Setting, Drexel University, Philadelphia, Pennsylvania (October, 1984).

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capabilities of software which are compatible with different kinds of equipment. The instructional support group has provided assistance at times to the department and at other times has been unable to be of any help, whatsoever. One of the problems is that the center depends upon student assistants who have to undergo training. Once trained to do the job, however many of these students go on their "co-op" job training outside of Drexel and thus are not available to work in the software center.

Some faculty members prefer to do their own programming, but these are the exception. Most faculty request graduate or undergraduate assistants or use the programmers within the instructional support group. The economic department's faculty members have used student assistants and instructional support personnel. Most of the software development has taken place in the College of Engineering because their graduate students tend to be studying in fields requiring programming ability. Whereas, potential software developers in the College of Business and Administration usually have to explain to a programmer precisely what is wanted prior to beginning any development work. For example, the three graduate assistants used over the past two years in economics are majoring in computer science, not business and administration. You cannot expect these people to prepare a disk on a production function or marginal utility without very explicit directions.

Within the School of Business and Administration, software is being developed by the departments of law, management, and quantitative methods. However, as of fall 1985, the most current listing of disks prepared by faculty for course work, shows six listings in economics and none for the other departments.

### Software Copywrites and Royalty Agreements

Several faculty are interested in developing commercial software and are doing so because markets for educational software are growing rapidly, and the laws governing these materials have not yet been formally codified. To avoid potential problems in this area, Drexel is developing its own policy concerning royalty payments for University-sponsored projects. Under the proposed policy (currently under review by Drexel's administration and Board of Trustees), royalties would be split so that one portion would go to the general fund, another portion would be funneled back into other software development projects, and the remainder would be paid to the developer. Both the University and the faculty stand to profit by this distribution. No firm policy is in place yet, but one will be in 1986. Templates and homework problems developed by Drexel's Department of Economics have been requested by over thirty universities throughout the world. Drexel will develop templates and software for use by smaller colleges who cannot afford to develop software. As of the moment there is considerable concern among faculty university-wide that the administration is moving too slowly in marketing faculty developed materials.

### Research and Publication

The microcomputer also offers enhanced research and publication potential. Many members of the faculty have used software tools for the Macintosh to write papers, do statistical analysis, prepare graphs, and carry out other mechanics of research. This is of even more importance in a service department with scant secretarial assistance and several faculty type their own research papers now.

## USING THE MACINTOSH IN ECONOMICS I

First use of the Macintosh at Drexel occurred in the teaching of the general (non-engineer) four hour micro- economics course. The course previously was divided into four small class meetings per week. With the arrival of the Mac and limited classroom projection facilities, the course was consolidated into one large lecture and three small class meetings. Five hundred thirty-six students, a majority of them freshmen, enrolled for the course in the Spring of 1984, as shown in Table 1.

Table 1  
Students Enrolled in Basic Economics Courses

<u>Year</u>	<u>Quarter</u>	<u>Micro General Course</u>	<u>Macro Engineering Course</u>	<u>Micro Course</u>	<u>Macro Course</u>
1984	Spring	536	0	0	0
1984	Summer	0	0	0	0
1984	Fall	189	283	0	0
1985	Winter	64	255	0	0
1985	Spring	53	128	0	0
1985	Summer	0	0	0	0
1985	Fall	NA	NA	NA	0
1984	Spring	536	0	0	0
1984	Summer	0	0	0	0
1984	Fall	189	283	0	0
1985	Winter	64	255	0	0
1985	Spring	53	128	0	0
1985	Summer	0	0	0	0
1985	Fall	NA	NA	NA	0

Note: The computerized lecture format was not used during the summer quarters because of lack of projection facilities and graduate student staffing. The disparity between Spring 1984 and Spring 1985 data is explained by a change in the cycling of students into the basic course. It became a sophomore rather than a freshman course. In the Fall of 1985 the computer was being used in three of the four courses and by the Winter of 1986 all courses had made use of the computer.

The large lecture was to be the focus for the computer work although urged by department members to do detailed planning prior to the initiation of the course; the chairman of the department held that there was a need to be flexible. At best the early experience was chaotic and continued to be so in the second quarter of computer assisted lectures.

With more planning and creative problem-solving, some of these problems might have been ameliorated. But, we learned that there was a need to be flexible and to adapt rapidly to changing circumstances.

### What were we doing?

This is generally a question which gives teachers a great deal of discomfort. But with the introduction of the microcomputer there was a need to think through precisely what we had been doing and what we were going to do. Although we attempted to do this individually we did not coordinate our activities department-wide. We were further at fault in that we allowed the technology to impose a structure on the presentation, and at the start we may have been too willing to be servant to that technology--only later learning to make the technology serve the teaching of economics.

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### Classroom Presentation

We used large lecture rooms equipped with a Mac that was hooked up to a projector. What we were doing at the Mac's keyboard was picked up by the projector. This was projected on a huge screen (twelve feet long and twelve feet wide) that covered the blackboard. For software we exclusively used Microsoft Multiplan to illustrate basic principles and give the students some insight into homework problems. These problems included supply and demand schedules, marginal utility problems, the determination of elasticity of demand, and the functioning of various output models and input markets. One critical difference from the traditional blackboard or transparency method of presenting these concepts was that we were able to change one or several variables and see their impact instantaneously. For example, given five goods and their utility schedules, income and prices, how would the quantity purchased change if utility schedules, prices, or income changed? At the same time we presented the students with xeroxed copies of the templates and asked them to duplicate these models using Multiplan. Additional homework problems were passed out and returned in the lecture room. On the quarter system there was a homework problem due every week for ten weeks.

### What went wrong?

The major problem in the initial quarter was that we tried to do too much in the lecture. And we probably used the computer too much in the classroom. The lecture served as a clearing house for students to pick up problem sets, return problem sets, pickup copies of computer economic examples used in class, take examinations, and return examinations. For lectures of 150-200 students, thousands of pieces of paper were circulating during a fifty minute period.

A ghastly green image of the Mac screen was projected onto the huge screen. Perception of the computer images on a screen varied depending on focus, lighting, size of type, and where the student sat. It could be quite good up close and difficult to read in back; good in the center and difficult at the sides. For good projection lights should be out but this means that notetaking is difficult if not impossible. Another problem was our excessive attachment to examples we created for we tended, at first, to overuse the computer in the lecture leading to student restlessness.

Potential student panic was a serious concern because they had to learn economics, the use of their personal computer, and the application of Multiplan in the same short time. Fortunately this anxiety peaked in the first two weeks and after that complaints were rare. In the first quarter there were some problems with the Microsoft Multiplan software as system errors occurred but these were corrected and Multiplan is now a dependable tool.

A major difficulty was the mixing of students without computers, and upperclassmen (taking the course out of sequence) with freshmen. This was alleviated by arranging for non-computer-owning students to have access to computers at university established clusters and allowing them to purchase their own disks which were in short supply at the time. These adjustments were important because there was alienation among some upperclass students who felt that it was unfair for them not to be able to purchase a heavily discounted Apple Macintosh computer when freshmen were allowed to do so. On the other hand, there was also a feeling among some of the non-freshmen that they were being discriminated against because if they had taken the course prior to the introduction of the computer then they would not

have had to learn how to use the computer, or do the homework problems.

Students copying homework assignments from each other was another problem. In an attempt to discourage this practice, xeroxed copies of homework were not accepted. There is no facile way we know of to eliminate all cheating, but students were told they would be closely examined on the material in the homework problems so they had better be prepared. Three questions out of 30 on the midterm exam were specifically on Multiplan. Some of the other questions were similar to homework problems.

### What Went Right?

There was very little friction between section leaders and lecturers. Only twenty-five percent of the grade was dependent on the lecturer. The student could earn ten percent for 10 homework problems and 15 percent for a perfect examination that was mainly on economics but included a few questions on how to use the computerized spreadsheet. Many students liked the homework problems and this appreciation was complemented by going over similar problems in the lecture so that students were prepared to launch into the homework. This probably eliminated some of the copying that might have otherwise taken place. Discipline among freshmen in a big lecture room is never easy. It was made even more difficult by turning the lights out. Noise was a disturbing factor for some of the early lectures, but this problem was overcome very directly. Two students were ejected and that ended the noise in the lecture. In fact, the tradition carried on to the following quarters. Word got around very quickly. You cannot have a riot taking place where you are trying to teach difficult theoretical concepts. Another thing that we learned was to not leave the lights out too long. In the term "computer assisted lecture," the emphasis should be on "assisted." Eye contact and conversational interaction with students is still a must and are probably more important than an electronic blackboard. Numerous demonstrations can be made, but they should take no more than three minutes. At five minutes a noticeable restlessness develops.

Another benefit of the computer was word processing which gave us the ability to create several different exam question sequences thereby discouraging cheating. Over time, we were able to identify and correct errors or poor questions on examinations, place them in test bank files, and use them with some alterations for future examinations. This also allowed us quick access to makeup examinations.

### THE SECOND ROUND: USE OF THE COMPUTER IN MACROECONOMICS What Were We Doing?

The computer assisted method was not used in the 1984 summer session. The fall of 1984 saw three large lectures using the computer. One class was introductory microeconomics for non-engineers and this essentially repeated the experience of the spring. One professor had two large lectures in macroeconomics where ten different problem sets were used. They were now handed out in a complete packet at the start of the quarter and were returned in the small classes. Class examples projected included income determination, money expansion, comparative advantage, exchange rates, and impact of tariffs. The class examples were now available on two disks that the student could receive by taking two blank disks over to the instructional support group. A copy

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of a data base disk with economic data from 1947 to the present, was also available to students; the data base included GNP, money supply, labor force, CPI, and misery indices by presidential administration.

### What Went Wrong?

Problems occurred at the outset because of the failure to recruit the needed graduate assistants. One did not report for work until the third week of the course. The use of the computer in macroeconomics was complicated by large numbers of pre-junior students who did not have computers. Special arrangements had to be made for them to use the computers in the computer clusters located at various places on campus. Additionally there were complaints during the first week that the macroeconomic homework problems were too difficult, the failure of the disks to explain the homework (although the purpose of the disks was to duplicate classroom problems), and the lack of graduate assistants to help people doing their homework. Indeed these problems of the first week eventually made it to the October 5, 1984 issue of the school paper--the TRIANGLE. It said students were not being treated in a humanistic manner, the disk was impersonal and that students wanted someone to whom they could turn for help. There was also complaints that the lecture accounted for 40 percent of the grade, an increase of 15 percent over the preceding quarter, and since they only spent 25 percent of their time in lecture, the weight was unfair.

### What Went Right?

Assistance had been arranged by the second week including: graduate assistants for homework help, three special help-sessions for students given by the computer support group, access to computer clusters for students without computers, and the first homework problems graded largely on the basis of effort expended. After the initial week students began saying that they were surprised how easily they could understand the spreadsheet analysis and many thought the course was a marvelous experience. Thus, the problem was essentially one limited to the initial panic of confronting computer, economics, and Multiplan at the same time.

### ACADEMIC YEAR 1985

In the winter, spring, and summer of 1985, the computerized lectures were conducted for both the general micro and macroeconomics courses. But, due to scheduling problems and classroom shortages, rooms with computers and projectors were not available to the instructor. This was at first thought to be unfortunate in that the classroom examples or problems similar to the homework assignments could not be presented in the lecture. But it turned out to be a marvelous opportunity for it forced us to see what would happen when disks and facilities were available to students, but not available during class time. Although scientific assessment was not undertaken, the students appeared to be pleased with the lecture. We had gotten our act together in that there were disks available which presented material identical or similar to the classroom presentations, and which also contained homework tips and a sample quiz. Problem sets for the entire term were handed out in the first meeting of the term by the instructors and graduate students were available on a daily basis to handle student problems. Multiplan training sessions were conducted early in the quarter to allay some student fears. In the interim, students were becoming more comfortable with their Macintosh and Multiplan.

### THE FUTURE OF ECONOMICS AND THE MICROCOMPUTER

One of the blessings of the microcomputer is the ability to make changes and instantaneously see the impact of those changes. Change also dominates the computer industry and we are continually subject to changes both in hardware and software. Since the inception of the Mac we have acquired external disk drives and quadrupled the memory. We have gone through two versions of Multi-plan and three versions of MacWrite (word processing). In the very near future, we will probably make a quantum leap in memory. At the start, we were limited to the spreadsheet. Now we have graphic capability and software especially developed for economics. At the outset it should be remembered that this is very much a learning experience. At the same time, the faculty are new to the PC and computerization brings a certain amount of stress which many would prefer to avoid. What can be done?

There are a few instructors who would like to get rid of the PC and go back to the old way of teaching. This means we are vulnerable to criticism for our innovative efforts, as there are always failures as well as successes. But, realistically, once the decision to move to microcomputers is made, it cannot easily be reversed. Secondly, professors can elect to continue teaching just as they have been doing in the past. This means that professors who want to integrate their teaching with the computer can do so through the basic courses while others move to the upper division and graduate courses. The difficulty is that students who have had computer experience at the principles level will be moving into these upper level courses. Is it in the interest of these students to go back to the traditional mode or to continue with computers in the later courses? If the decision is made to use the computer in these upper level and graduate courses, the cost for more sophisticated templates and software development will be higher per student than in the principles courses. If the lecturer wishes to use the computer in class, facilities will be required either in the form of small labs stocked with computers or projection facilities will have to be made available in smaller rooms than is now the case.

We need much better projection facilities in the lecture rooms or more computer labs for students. It would be interesting to test the impact of computerized small labs versus computerized lecture versus home assignments versus no-computer on student performance. At present, two members of the department are receiving support to develop software. Software projects already completed include modules on supply and demand, determinants of supply and demand, elasticity, marginal utility, and pure competition. These illustrate principles, do computations, and allow for student testing. Another project will put homework problems on disks and allow the student to do them as many times as desired and receive the highest grade attained. This would address the copying problem.

### Continuous Access Multi-Course Business Simulation

In the development stage is the use of economics in formulating CAMBUS (Continuous Access Multi-Course Business Simulation) in the College of Business and Administration. This computer game will allow a student to manage a company from each of the line management perspectives during the four or five years he or she spends at Drexel. Each student is responsible for assuming each role, in turn, and making decisions as chief executive officer, chief financial officer, marketing vice president, and production vice president. Of special interest will be the way real world economic data will impact on the game and the way it will combine with simulated market-company interaction and internal company processes. Although much work has gone into the computerization project, we must constantly be aware of the human relations problems which

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are present not only at Drexel but at other institutions as well. These problems manifest themselves between faculty members, administrators, and students. Unfortunately, the human relations problems are often ignored while we cheer on innovation.

### Student Attitudes Toward Computer Usage

When freshmen go away to college they have a lot of new experiences. But the computer science courses turn out to be quite different from any that the new students expected, says Lee Sproull, a researcher at Carnegie Mellon University who has surveyed CMU freshmen over the last three years to assess their attitudes toward computer courses there. Among other things, Sproull says that most College freshmen are surprised, confused, and frustrated during their first year of computer courses. Computer anxiety afflicts incoming students in all majors, but may be particularly severe among liberal arts majors. Over 80 percent of all in-coming freshmen are surprised by the subject matter covered in computer courses. One of every two freshmen are confused by computer coursework, while nearly 70 percent say the courses actually make them frustrated and angry.

Beginning students find computer courses more surprising, more confusing and harder to get a handle on than their other courses. And such confusion over computers is as true of technical students as of liberal arts students. One of the reasons for computer anxiety is that students are often thrust into the computer culture before they learn how computers work or understand the special language used in computer courses. Computing is a part of the whole work activity at many college campuses today. With more traditional subjects like history, math, or physics, students learn in a sheltered, academic environment, and ease their way into the subjects as their ability and understanding increases. But the hands-on experience in computer classes catapults students directly into the real-world of computing, frequently without any prior exposure to the subject or the machines. Students new to computing must use the campus mainframe right beside experienced computer users, which often makes the newcomers feel intimidated and confused. Computer rooms often remind students of something out of 1984 because they tend to be so cold and sterile. Computer rooms should be designed to be warm and user friendly. To ease students' entry into the campus computer culture, colleges can offer computer orientation courses so students will learn the basic rules and terminology before taking the first course taught with the aid of computers. Fortunately, the computer anxiety many freshmen experience decreases as they become more familiar with the subject. Some students become very exhilarated by their new found knowledge and seem to have a lot of fun.

At Drexel, we doubt if the same level of frustration is experienced by Macintosh users, but there are initial problems when the student is simultaneously exposed to computers, a new course, and foreign software. But, generally, there is a feeling of excitement if the Mac is used in a course, and this often translates into enhanced impressions of the course. Be assured, however, that even those students who endorse the coming of computerization will have complaints. So, it behooves the university administration and faculty to be user friendly, too.

### LONGITUDINAL EVALUATION AT DREXEL U.

Starting in spring quarter of 1984, a longitudinal study began on the use of microcomputers at Drexel. Some early results from the study are discussed in the following paragraphs<sup>6</sup>. In

<sup>6</sup> Results cited are from a letter and report titled "Microcomputer Evaluation Study," by Joan McCord,

1983, about 58 percent of the juniors and 88 percent of the freshmen graduated from high schools offering courses in computing. In 1984, 96 percent of the freshmen graduated from high schools offering courses in computing. Over 27 percent of the freshmen considered the Drexel computer policy a very important reason for coming to Drexel. Other reasons included: the cooperative-education program, 79%; academic reputation, 73%; availability of specific courses, 65%; and financial aid, 34%. In 1984, 37 percent of the freshmen considered the Drexel computer policy a very important reason for coming to Drexel. Other categories were the Co-op program, 79%; academic reputation, 74%; availability of specific courses, 65%; financial aid, 29%. Note that the computer policy had moved ahead of financial aid. In 1983, 69 percent of the men and 56 percent of the women in the freshmen class had taken a course in computers before entering Drexel. In 1984, these figures had climbed to 82 and 67 percent. After a year's experience with the Mac, 84 percent of the faculty believed the policy had been helpful in recruiting good students. Sixty-three percent of the faculty reported noticing improvements in Drexel's reputation since the arrival of the Macintosh. Freshmen reporting "being delighted or generally pleased with their work" increased from 67 percent in 1983 to 82 percent in 1984; 66 percent of the 1983 freshmen and 79 percent of the 1984 freshmen reported that they expected to be "delighted or generally pleased" with the computer equipment and assistance available to them. Before they became students at Drexel, males had used computers more than had females. Last year at Drexel, however, men and women were about equally likely to use computers for writing and for course assignments other than writing. Among sophomores, about 80 percent used computers for writing papers and about 67 percent used computers for other course assignments.

In the spring of 1984, 50 percent of the freshmen reported that (excluding courses on computing) computers had contributed to the value of none of their courses. In spring of 1985, only 8 percent said that computers had contributed to the value of none of their courses. In 1985, 38 percent of the faculty reported having improved their teaching. Between 1983 and 1984, freshmen satisfaction with their first computer programming course had risen from 39% to 55%; with their first math course, from 66% to 75%; with their first composition course, from 64% to 74%; and with their first research course, from 56% to 62%.

### Evaluation in Economics

In economics, there was no formal evaluation of what was being done prior to the fall term of 1985. Inaction prior to that time was the result of being too busy developing software, templates and putting the courses together. As a result there is no control group in the university-wide study. But we do have the university results to lend some insight as to what was happening throughout Drexel. An evaluation is now underway based on a survey of students currently taking the basic economics courses in fall 1985. Whatever the results of this evaluation, we know that personal computers are here to stay and we academicians will need to find the best ways to make use of this valuable new tool,

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(Drexel University, Philadelphia, September 26, 1985). Information about faculty beliefs is based on questionnaires returned by 310 of 335 members of the full-time faculty in 1983 and 285 members in 1984. The student trends came from 640 of 1218 eligible 1980 freshmen, 1452 of 1858 1983 freshmen, and 1202 of 1806 whom became Drexel freshmen in 1984.