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Mary F. Courtney

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MARY F. COURTNEY
Department of Computer Science
Pace University
1 Martine Avenue, White Plains, NY 10606

PACE UNIVERSITY

Mary F. Courtney is an Assistant Professor of Computer Science at Pace University. She is in the midst of completing her Ed.D. at Teachers College, Columbia University. Her doctoral coursework concentrated upon the College Teaching of Mathematics with an emphasis on Computer Science. The title of her dissertation is "Graph Theory in a Lower-Level Algorithms Course."

Professor Courtney earned a B.A. in Mathematics at the College of Mount Saint Vincent in 1972 and an M.A. in Mathematics at Lehman College in 1975. In 1984 she was awarded an M.S. in Computer Science from Pace University. She is currently a member of the Association for Computing Machinery as well as its Special Interest Group on Computer Science Education.

Editor's Note

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This is our Welcome Back to School Issue. We hope that this month marks the beginning of a happy and rewarding academic year. We hope your classes are the best ever (And why shouldn't they be? You've never been a more experienced and knowledgeable instructor!)

The mission of the Technical Report series remains the same for the 1990-91 school year: to encourage the sharing of our collective research, scholarly, and pedagogical interests as well as creative gems of a germane nature (limericks, cartoons, puzzles, games, riddles, etcetera). The difference, this year, is that we are beginning with greater collegial interest and support than ever before.

Interest has been appearing in the form of suggestions for operation, inquiries about editorial policies and the functions of the members of the editorial board, and individuals coming forward to volunteer their help. If you look carefully at our masthead on the outside of the back cover, you'll note that the editorial board has been strengthened by the addition of Connie Knapp. I heartily welcome her to the staff. If you want to join us, please get in touch with me.

As for the particulars on what board members do, mainly we:

> try to be aware of all SCSIS faculty publishing and paper presenting so as to make known current focuses of academic attention in all quarters of the School -- this could lead to new unions of colleagueship and enhanced development;
>
> try to nurture ideas into manuscripts and provide a place for these manuscripts to appear for our collective appreciation;
>
> try to help authors of manuscripts we publish place these in publications with a wider readership.

Concretely, those on the editorial board are asked to send the editor news of publications by members of their department and to solicit drafts of papers in progress. Moreover, we have asked them to urge their closest colleagues with a special interest in one thing or another to write a short paper on it. And, we have assured members of the editorial board that we will do our best to print papers they invite (or papers they recommend to us). From time to time we ask members of the editorial board to read a manuscript in order to give the author suggestions on how it might be improved or to recommend journals for which it might be especially well suited. The associate editors do these same things, but with greater initiative. The editor coordinates the staff's efforts and sees to it that each issue of Technical Reports is printed and distributed.

The main thing is that Technical Reports, functioning under the aegis of the School of Computer Science and Information Systems, is run by SCSIS faculty for SCSIS faculty. It can be anything we'd like it to be, and the editorial board is in no way an exclusive body. All suggestions are welcome; offers to work on it are seized; and, of course, pieces to publish are aggressively sought.

The paper appearing in this "back to school issue" is, fittingly, about school. Overtly and covertly, it advances ideas for making the computing majors more appealing to those who might choose one and for retaining the enthusiasm of those who have set out on a program of study in CS, IS, or OIS. It is the scope of these ideas that makes this paper remarkable. As a post script to one of Mary's observations, that media hype over layoffs in the computer industry could be discouraging students with an eye toward the job market, I offer two items I came upon over the summer as a counter:

from: The Wall Street Journal; Tuesday, May 29, 1990
Page 1, first item in the "Labor Letter"

"Weak hiring seems likely in second half. But bright spots persist. International Business Machines Corp. plans to cut 10,000 U.S. jobs this year. Still, it looks for programmers, engineers, and holders of advanced degrees...."

from: Megatrends 2000: Ten New Directions for the 1990's
by John Naisbitt and Patricia Aburdene
William Morrow and Company (1990), page 130

"...Benetton is ... the world's largest knitwear maker and the largest consumer of virgin wool. Sales have increased from $78 million in 1978 (mainly in Italy) to $1 billion in 1987, when profits hit $108 million....

A key factor in the company's success is its savvy use of high technology. Computers design clothes, ship products, and monitor consumer preference. Benetton employs more computer technicians than seamstresses."

Allen Stix
Department of Computer Science
301 Alumni House
The College of White Plains of Pace University
78 North Broadway
White Plains, New York 10603

Telephone: 914 422-4191

What Happened to the Glory Days of Computer Science?

by Mary F. Courtney

> Computer science is a relatively new and dynamic field. In just over forty years, it has become a central technological influence in our society and a key element in our continuing economic development, international competitiveness, and national security... To use computers effectively, the nation must have a continuing supply of well educated professionals.
> [NSF undergraduate workshop, 1988]

In many aspects the early 1980's were the "Glory Days" for computer science departments. Of the senior students who answered the Student Descriptive Questionnaire (SDQ) on the Scholastic Aptitude Test (SAT) in 1981, 4.12% responded with an interest in CS as a major, increasing in 1982 to 5.69%, to 7.47% in 1983, and in 1984 it was 7.2% .[Grandy, 1989] Since the departments were filled to the brim, many colleges treated CS departments with great respect. Monies were given for conferences; computer labs and faculty offices became well equipped; new faculty were hired; some faculty were retrained and extra duties shared. The Glory Days did not last for long. The number decreased to 2.72% in 1988. Why did this happen? What do we know about the college student today to understand the problem? This paper attempts to explain the situation.

During the Glory Days, there were some colleges that could not properly handle all the extra students. The faculty from these colleges, many of whom were from different disciplines, were not adequately prepared. There were students who chose computer science as a major for the wrong reasons, for example, interest in just playing computer games.

> Members of the IEEE Computer Society and ACM (American Computer Machinery) frequently encounter new computer science graduates inadequately prepared to handle the professional responsibilities implied by their degree. This faulty preparation can be traced to institutions lacking the faculty and facilities to support their programs or meet enrollment demands. The Computer Society and ACM receive inquiries from parents, companies, and government agencies seeking locations of quality computer programs. [Mulder, 1984]

For these reasons ACM and the Computer Society joined forces to form CSAB, Computer Science Accreditation Board to evaluate and accredit Computer Science programs throughout the country. The process began in 1984 and by July 1988, 65 programs had been accredited. [Mulder, 1984] Yet Tom Philips, executive director of CSAB, reports of the first 85 schools requesting accreditation, 20 were turned down. [Hodges, 1988] Programs existed where a computer major was comprised of learning several computer languages; computer labs were insufficient; faculty were overworked and could not properly keep abreast in a fast changing field. CSAB set up tough requirements for the accredited degree program. Did this have any influence on the decline of computer science students?

In the Glory Days of Computer Science, when faculty were concerned with the large numbers of students and their poor performance in class, much research was done on predicting success of the student in CS programs. A good summary of this research is to be found in Evans and Simkin's paper, "What Best Predicts Computer Proficiency?". [Evans and Simkins, 1989]. One set of research examined high school

achievement. In their study, Butcher and Muth found HS GPA and ACT-Math score to be the best predictor for 1/3 of the students who did well in college courses but had not satisfied present admission requirements. Also discussed was the fact that those students who had prior experience in high school did not necessarily do well in their first college course. Some students do poorly on standardized examinations because they simply did not have the course work.[Butcher, Muth, 1985] Taking the SAT exam for a student with one year of HS general math must be a nightmare. It is only with the new Regents Action Plan that NYS required two years of high school math for all students.

Laurie Werth found computer science students to be more introverted, intuitive and thinking than the population as a whole. She discusses CS students as field independent learners who find existing organization in a given situation or if a pattern doesn't exist, they tend to impose structure on their field.[Werth, 1986] Alspaugh in her early research in 1972 found that the "more successful programming student might be expected to possess a personality associated with a low level of impulsiveness and sociability". He would rate high on reflectiveness as measured by the Thurston Temperment schedule. [Alspaugh,1972]

After performing similar studies testing reading comprehension, alphabetic and numeric sequences, logical reasoning, algorithmic execution and alphanumeric translation, Wileman, Konvalina, and Stephens at the

University of Nebraska at Omaho allow students to take elementary computing courses and use that as a judgment for placement in a higher level course. [Wileman, Konvalina, Stephens, 1981] What the research is continually pointing out is that "the task of finding effective predictors of computer proficiency remains unfinished." [Evans, Simkins,1989] Some of the research even contradicts itself. Evans and Simkins chose 34 independent variables to test computing competence including demographic, academic, prior computer experience and behavioral characteristics, but the predictive power of these variables was small. Cognitive processes including underlying reasoning ability appeared more helpful.

It has been difficult to typify the promising CS student. A strong desire to learn the power of computing should not be overlooked. Yes, urge the students to study mathematics as much as possible in high school, but this is needed for all areas of study, not only the sciences. With so many students desiring a business major, proficiency in mathematics is beneficial for all.

"Where Have All the Women Gone" was the title of a panel discussion held at the 1990 SIGCSE conference. Of all the freshman women who responded in the Cooperative Institutional Research Program (CIRP) Survey in 1982, 4% indicated a probable major in CS.[Astin, 1987] That percentage has continually decreased with the last data available in 1989 as 1.6% of women choosing CS as a major.

The percentage for male students has decreased during that time period but not to that extent - 4.9% to 3.1% .[Astin, 1990]

Computer Science was perceived as a field where women and men could be equally involved. As a major that developed since the time of the Women's Movement, shouldn't the CS field provide an equal opportunity for men and women? This sounds optimum, but in reality, as the computing field increased rapidly and demanded "manpower", mathematicians, electrical engineers, and physicists were the first to be employed. And there weren't many women among them. What is important to notice, in the Glory Days of Computer Science, when the colleges were overwhelmed with students interested in computing, and some schools didn't have the hardware and the excellent faculty, the women were there. From Astin's survey, the percentages of freshman who indicated a probable major in CS were

	1981	1982	1982	1984	1985
women	3.2	4.0	3.7	2.7	1.6
men	3.9	4.9	5.4	4.3	3.1

The number of women in the "Glory Days" could have been due in part to the Curriculum '78 where math was established as a corequisite changing the pre-requisite status of Math in Curriculum '68. Why then the drop in the number of women students from 1985 and on? The conditions set forth by CSAB for the CS major are demanding. Pace University requires 48

credits in CS, 20 credits in Mathematics and 16 credits in Science. Even though math became a co-requisite, the entire CS program requires mathematical sophistication. THE CIRP survey reports that in 1981, 23.5% of the women anticipated need for special tutoring or remedial help in mathematics, and that number increases to 27.4% in 1984. Only 19.2% of the men reported this need in 1981, increasing to 21.7% in 1984. [Astin, 1987] Among examinees who identify themselves as white and "who plan to major in math, science or engineering, there has been a difference of nearly a standard deviation between the mathematic scores (SAT Math) of males and females." [Grandy, 1989] The math scores of females are not catching up with males. Grandy points out that the number of seniors taking SAT exam increased by 18% from 1983 to 1988. This is significant in analyzing the SAT scores.

Which major fields have had an increase of interest by women during this time period when the interest in CS is declining? According to Astin's report

	1981	1985
Business related	20.4%	23.8%
Psychology	3.1	4.7
Undecided	5.4	6.9
Elementary Ed	4.6	5.6
Secondary Ed	0.9	1.4
Communication	2.1	2.6
Political Science	1.7	2.3

It is important for the CS Departments to look at the number of undecided majors in 1985. To earn a BS in CS at Pace University there is no room for electives, as is true in many engineering programs. If these students are undecided in choosing their major and yet have an inclination for the math and sciences, counselors should encourage them to take a mathematics course and a computer science course to test the waters.

In 1982, The College Board established the Advanced Placement Exam in Computer Science. The course is excellent, but who participates? The AP teachers and college faculty at a local conference at Barnard College in December 1986 were challenged to encourage women in the field. At that time we were told 1 in 7 of the students who took the exam were women. Even in their younger years, we are faced with less women interested in computers. Hardware setup for computing is far from ideal in the high school. When do students get a chance to do their lab work -in study halls or after school if there is a teacher available? One teacher friend returns to school at 7:00 pm and opens the computer lab for students as she coaches the track team in the afternoon. The students who have computers at home definitely have the advantage. Sherry Turckle in The Second Self reports that there are few women hackers.[Ogozalek, 1989] Who has computers at home -boys or girls? Most of the Nintendo games are action and military oriented. Are the girls swapping Nintendo games on the school busses? One

hundred fifty seven middle school students located in lower, middle and upper income areas were asked to rate 75 software titles for perceived user interest; significantly more of the titles were perceived as being of interest to males than to females.[Miura, 1983] Patricia Lund Casserly has done some excellent research on encouraging the capable female students in the math and sciences. The comraderie formed by girls in the advanced classes proved to be very helpful. Casserly gives several recommendations: actively seeking out female students for AP courses by teachers and counselors, beginning accelerated programs in the early years of junior high, and allowing older girls to influence the younger ones in their mathematics and science classes. [Casserly, 1979] Those of us on the college level should take notice. Forming study groups would be very useful for the female students and good tutoring programs should be established.

Leveson in the "Women in Computer Science" report states that " very few role models exist to provide encouragement for younger women." There are only 33 female full professors (out of a total of 1189) in computer science and computer engineering in the 158 Ph.D granting institutions included in the Taulbee Survey and only 74 female assistant professors out of 909. One third of the universities included in the Taulbee Survey have no female faculty at all. [Leveson, 1989]

Fleming in Blacks in College reports consistently that with the assistance of counselors and encouragement by and relationships with faculty, black students do better in black

colleges than in white colleges.

If success in a major field in college can depend upon faculty encouragement and advisement,it is easy to see that even females having an interest in computing are more likely to drop out. The outlook for women professors in CS is not good. Carrie Brownhill gives statistics and opinions in her paper, "Factors Affecting the Decision of Women to Enter Doctoral Programs in Computer Science." She discusses "lack of confidence, lack of role models and mentors, family consideration, unfriendly environments, self image, expectations and value systems." [Brownhill, 1989]

Only 37% of white female students planning to major in CS in 1986 planned on receiving a graduate degree as opposed to 63% in mathematics and statistics, 81% in physical science, 74% in psychology. [Grandy,1989] This leaves us with very few students to be our future professors or researchers.

In Astin's 1989 survey, we learn that in the reasons noted as important in deciding to go to college, 75.9% responded to be able to get a better job. While that has not changed much over the past twenty years, the percentage who desire to make more money increased from 49.9% in 1971 to 72.2% in 1989.[Astin, 1987,Astin, 1990] The students are very interested in getting jobs that pay well.

"Expectations were too high" says Michael Simmons, president of the Fidelity Investment unit that handles the mutual fund company's high-tech needs. "Kids entering school a few years ago had visions of becoming the next Bill Gates(Microsoft Corp's founder and chairman) or Steve Jobs (Apple's co-founder), 30 year olds with millions and millions of dollars." (Duke, 1987)

News articles in the past few years have reported computer companies folding, and layoffs at IBM. Has this turned students away from Computer Science?

It need not. Many of the layoffs were in the hardware fields. Employment by computer manufacturers decreased by 3% [1990 US Industrial Outlook] "The competition for high potential college graduates with bachelor of science degrees is also forcing up entry level salaries." [Fowler, 1986] John Rice of Purdue states "Currently we are not meeting demand for computer professionals." Salaries are good. Gordan Bridge of ATT Computer Systems states that programmers out of college can receive $25,000 and with experience up to $35,000. For systems analysts, the range is $35,000 to $45,000.[Fowler, 1990]

The US Computer software industry continues its steady growth. "The industry as a whole continues to be one of the fastest growing in the US. [1990 US Industrial Outlook] Computer Programmers and Systems Analysts were rated 9 and 10 out of a possible 250 careers for the job outlook in the Jobs Rated Almanac, 1988.

Engineering departments have had their high and lows in enrollment. Computer Science will prevail as long as it stays current. In 1984 the year accreditation began, the

numbers began to fall. Walters believes the CSAB accreditation has been good for computer science. Not all colleges will be able to support the programs and in those colleges the CS courses may "fold back into the department from which they emerged." Qualified Ph.D faculty will seek employment only at accredited schools. Not every college is able to support an engineering department.

Our CS program at Pace is difficult; the students must love the field to do the work required and reap the benefits. What should we do for our students to help them with the job outlook as it is? Our students should be encouraged in the sciences especially physics and any understanding of telecommunications. CSAB requires 2 years of science, but unless students are interested in pursuing careers in biology or chemistry, physics should be required. All students need not pursue a 48 credit program in Computer Science. We must also allow for combined majors in Computer Science - work closely with faculty in Business, Psychology and the Sciences. Norman Stratland, director at Price Waterhouse warns that some pure computer science graduates don't have the people skills that PW needs in its consultants. They look for double majors such as CS and accounting, CS and Business Administration. [Hodges, 1988]

"The failure of many bright students to successfully complete their mathematical prerequisites contribute immensely to the problem". Community college have a greater "put through" rate in Calculus. [Coleman, 1984]

The colleges should look at their mathematic programs. Are we assisting the students properly? The number of CS majors can be increased with approved articulation agreements with community colleges. Steps must be taken to eliminate the prejudice against girls in learning mathematics in the early years. Software packages and Nintendo games should be developed so they are more interesting for girls. Women in high schools and colleges must be supported. Campbell and McCabe's study shows that while 61 percent of the male students persisted in their study of computer science after introductory courses, only 39% of the female students continued with the major.[Campbell, 1984] "Women working in the computer industry fare better than women in other types of jobs; nationally, median income for women computer workers is 22% less than their male counterparts compared to 35% less for the overall job market.(Raimondi, 1985)

If time and money is spent on increasing enrollment, we must also increase the time and concern we have for our students while they are on campus. The research shown in Fleming's book is overwhelming that students do well when they have good relationships with the faculty and advisors.

"When we enter the twenty first century, computers will have influenced our lives more than any other technology known to civilization. The need for knowledge about computers, computer technology and the theoretical aspects of computers has grown exponentially." [Gruener, 1981] Let us work hard to do what is best for the students!

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