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A SURVEY OF FACULTY COMPUTER EXPERIENCE, USAGE, NEEDS, LITERACY AND ATTITUDES

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ABSTRACT

The faculty were surveyed concerning their computing experience, usage, needs and attitudes. The respondents were divided into two groups, users and non-users of computing facilities. Responses concerning computers in curriculum and computer attitudes in general were compared between the two groups. Statistical tests show significant differences in opinions between the two groups on various subjects. Results of the survey on computer usage, experience and needs from the users group is also reported in this paper.

Introduction

146 faculty members responded to the survey out of a possible 307. The respondents were partitioned into two groups based on response to the following question:

HAVE YOU EVER HAD ANY EXPOSURE TO COMPUTERS
OR MADE USE OF ANY COMPUTING FACILITIES?
(NOT INCLUDING HAND CALCULATORS)

Those who answered "yes" were classified as USERS and those answering "no" were classified as NON-USERS. There were 104 USERS (71.2 percent) and 42 NON-USERS (28.8 percent) who responded. It stands to reason that most of the faculty members who did not respond are among the NON-USERS. For purposes of statistical analysis we will assume that the USERS who responded and the NON-USERS who responded represent a random sample from their respective groups.

Questions and Results

Results of the survey will be reported in four parts: general information, curriculum attitudes, computer attitudes and responses from the USERS group on experience, usage and needs. In the first three parts response choices for each question are indicated along with the mean response for the USERS (US) and mean response for the NON-USERS (NU). A T-test was used to measure the difference in the opinions between the two groups. α represents the confidence level at which the difference in the means are significant. α = NS indicates "not significant" ($\alpha > .1$). Some of the survey questions were taken from Slonneger's paper [5] and modified slightly. Other questions were generated from some of the ideas presented by Mosmann [4]. Most of the questions came directly from the author.

1. General Information (USERS and NON-USERS)

1. RANK

	User	Non-user
1. Instructor	3	4
2. Assistant Professor	35	10
3. Associate Professor	33	15
4. Full Professor	29	13
5. Visiting Professor	1	0
6. Adjunct	1	0
no response	2	0

US = 2.93, NU = 2.88, α = NS

2. EMPLOYMENT STATUS

	User	Non-user
1. Tenured or continuing appnt.	54	27
2. Non-tenured or term contract	46	14
no response	1	0

US = 1.48, NU = 1.34, α = NS

3. TERMINATING DEGREE

	User	Non-user
1. Bachelor	1	0
2. Masters, L.L.M.	9	16
3. Ph.D., J.D.	89	25
no response	5	1

US = 2.89, NU = 2.61, α = .002

4. TOTAL YEARS TEACHING

US = 11.3, NU = 14.1, α = .084

5. TOTAL YEARS TEACHING AT T.U.

US = 6.97, NU = 10.05, α = .052

6. DO YOU THINK THERE IS A NEED FOR AN "INTRODUCTION TO COMPUTING" SHORT COURSE GEARED ESPECIALLY FOR FACULTY WITH LITTLE OR NO COMPUTING EXPERIENCE?

US = 80.0 percent yes, NU = 77.5 percent yes, α = NS

7. WOULD YOU ATTEND SUCH A COURSE?

US = 47.8 percent yes, NU = 72.5 percent yes, α = .009

II. Curriculum Attitude (USERS and NON-USERS)

8. ARE STUDENTS IN YOUR DISCIPLINE REQUIRED TO TAKE AN INTRODUCTORY COMPUTING COURSE?

US = 46.9 percent yes, NU = 2.7 percent yes, α = .000

Questions 9-11 were answered by those responding "NO" to question 8.

9. WHAT PERCENTAGE OF STUDENTS IN YOUR DISCIPLINE TAKE AT LEAST ONE COMPUTER COURSE?

US = 19.8 percent, NU = 1.0 percent, α = .002

10. DO YOU ACTIVELY, AS AN ADVISOR, RECOMMEND TO YOUR STUDENTS TO TAKE AT LEAST ONE COMPUTER COURSE?

US = 54.3 percent yes, NU = 12.5 percent yes, α = .000

11. DO YOU THINK YOUR DISCIPLINE SHOULD REQUIRE AT LEAST ONE COMPUTER COURSE?

US = 48.8 percent yes, NU = 3.5 percent yes, α = .000

12. INDICATE THE LEVEL OF COMPUTING SKILLS YOU THINK STUDENTS IN YOUR DISCIPLINE (UNDERGRADUATE) SHOULD HAVE IN ORDER TO PERFORM SUCCESSFULLY AS STUDENTS AND AFTER THEY RECEIVE THEIR DEGREES. ALSO INDICATE YOUR ESTIMATE OF THE ACTUAL LEVEL OF YOUR GRADUATES. CHOOSE ONE OF THE FOLLOWING CATEGORIES:

	RECOMMENDED LEVEL	ACTUAL LEVEL
1. NO CAPABILITY	_____	_____
2. GENERAL AWARENESS	_____	_____
3. INDIRECT ABILITY	_____	_____
4. ELEMENTARY PROGRAMMER	_____	_____
5. INTERMEDIATE PROGRAMMER	_____	_____
6. ADVANCED PROGRAMMER	_____	_____

Definitions of the above terms are given below:

1. NO CAPABILITY

2. GENERAL AWARENESS
(GENERAL AWARENESS OF SOME OF THE COMPUTING FACILITIES THAT ARE AVAILABLE BUT LITTLE OR NO ABILITY TO USE THE FACILITIES WITHOUT HELP)

3. INDIRECT ABILITY TO PROGRAM
(ABLE TO USE PACKAGED PROGRAMS AND INSTRUCTIONAL MATERIAL ON THE COMPUTER, BUT NO PROGRAMMING CAPABILITIES OR TRAINING ABOUT COMPUTERS)

4. ELEMENTARY PROGRAMMER
(ABILITY TO WRITE A SIMPLE PROGRAM IN A HIGH LEVEL LANGUAGE SUCH AS FORTRAN, BASIC, COBOL.---ONE COURSE IN PROGRAMMING OR EQUIVALENT)

5. INTERMEDIATE PROGRAMMER
(TWO COURSES IN COMPUTER SCIENCE OR EQUIVALENT. A GOOD WORKING KNOWLEDGE OF A PROGRAMMING LANGUAGE, AND MORE KNOWLEDGE ABOUT COMPUTERS THAN JUST PROGRAMMING.---ABILITY TO TEACH AN INTRODUCTORY COURSE)

6. ADVANCED PROGRAMMER
(THREE OR MORE COMPUTER SCIENCE COURSES OR EQUIVALENT. AN ABILITY TO TEACH A COMPUTER SCIENCE COURSE ABOVE THE INTRODUCTORY LEVEL)

Recommended level of computing skills:

$US = 3.53$, $NU = 2.53$, $\alpha = .001$

Actual level of computing skills:

$US = 2.97$, $NU = 1.78$, $\alpha = .020$

III. Computer Attitudes (USERS and NON-USERS)

RESPONSE CODES:	STRONGLY AGREE	= 5
	MOSTLY AGREE	= 4
	NEUTRAL OR NO OPIONION	= 3
	MOSTLY DISAGREE	= 2
	STRONGLY DISAGREE	= 1

13. COMPUTERS ARE A TOOL JUST LIKE A HAMMER OR A SAW.

US = 4.36, NU = 4.15, α = NS

14. COMPUTERS WILL CREATE AS MANY JOBS AS THEY ELIMINATE.

US = 3.85, NU = 3.37, α = .018

15. COMPUTERS CAN BE PROGRAMMED TO SOLVE ANY SCIENTIFIC OR MATHEMATICAL PROBLEM.

US = 2.89, NU = 2.68, α = NS

16. COMPUTERS CAN WRITE POETRY AS WELL AS ANY HUMAN.

US = 1.45, NU = 1.52, α = NS

17. COMPUTERS SLOW DOWN AND COMPLICATE BUSINESS OPERATIONS.

US = 1.81, NU = 2.23, α = .043

18. NO ONE PERSON WILL EVER BE ABLE TO UNDERSTAND ALL THE "INNER WORKINGS" OF A COMPUTER.

US = 2.61, NU = 2.25, α = NS

19. COMPUTERS WILL IMPROVE EDUCATION.

US = 4.14, NU = 3.15, α = .000

20. IN TEN YEARS A COMPUTER IN THE HOME WILL BE AS COMMON AS THE TELEPHONE IS TODAY.

US = 3.52, NU = 2.97, α = .006

21. MOST COLLEGE GRADUATES ARE COMPUTER ILLITERATE.

US = 3.92, NU = 4.15, α = NS

22. IT IS POSSIBLE TO DESIGN COMPUTER SYSTEMS WHICH PROTECT THE PRIVACY OF DATA.

US = 3.31, NU = 3.03, α = NS

23. SOMEDAY COMPUTERS WILL BE ABLE TO REASON AS WELL AS HUMAN BEINGS.

US = 2.33, NU = 2.25, α = NS

24. COMPUTERS ARE GOOD AT TRANSCRIBING FOREIGN LANGUAGES.

US = 2.67, NU = 2.92, α = NS

25. EVERY COLLEGE GRADUATE SHOULD BE REQUIRED TO TAKE AT LEAST ONE COMPUTER COURSE.

US = 3.71, NU = 2.87, α = .001

26. COMPUTERS WILL REPLACE MOST LOW SKILL JOBS AND CREATE JOBS NEEDING SPECIALIZED TRAINING.

US = 3.23, NU = 2.85, α = .025

27. PROGRAMMERS AND OPERATORS MAKE MISTAKES, BUT COMPUTERS ARE, FOR THE MOST PART, ERROR-FREE.

US = 3.99, NU = 3.41, α = .008

28. A GOOD WORKING KNOWLEDGE OF A COMPUTER LANGUAGE SHOULD BE ALLOWED AS A SUBSTITUTE FOR NO MORE THAN ONE FOREIGN LANGUAGE IN PARTIAL FULFULLMENT OF AN ADVANCED DEGREE. (IN YOUR DISCIPLINE)

US = 3.63, NU = 2.64, α = .001

29. IN THE U.S. TODAY, A PERSON CANNOT ESCAPE THE INFLUENCE OF COMPUTERS.

US = 4.63, NU = 4.47, α = NS

30. COMPUTERS ARE BEYOND THE UNDERSTANDING OF THE TYPICAL PERSON.

US = 2.26, NU = 2.67, α = .067

31. COMPUTERS ARE BEST SUITED FOR DOING REPETITIVE, MONOTONOUS TASKS.

US = 3.32, NU = 3.27, α = NS

32. COMPUTERS CAUSE THE GENERAL PUBLIC MORE GRIEF THAN BENEFIT.

US = 2.00, NU = 2.42, α = .021

33. THE INCREASING INFLUENCE OF HAND CALCULATORS IN OUR EDUCATIONAL PROCESS IS PRODUCING STUDENTS WEAKER IN THE FUNDAMENTALS OF MATHEMATICS.

US = 2.64, NU = 3.40, α = .001

34. MOST COLLEGE GRADUATES ARE UNAWARE OF HOW COMPUTERS ARE USED IN THEIR FIELD.

US = 3.61, NU = 3.82, α = NS

35. WE HAVE BARELY SCRATCHED THE SURFACE OF THE FULL POTENTIAL OF COMPUTERS.

US = 4.15, NU = 3.97, α = NS

36. OVERALL, COMPUTERS IMPROVE THE "QUALITY OF LIFE" IN THE U.S.

US = 3.78, NU = 3.12, α = .000

IV. Responses from the USERS group:

37. 75.7 percent have written a computer program.

38. 48.5 percent have taken a computing course (not a short course).

39. 58.7 percent have attended a short course on some aspect of computing.

40. 8.7 percent were required to take a computing course for their Bachelor's degree.

41. 21.2 percent have taught an introductory computing course.

42. 45.0 percent have taught an introductory computing course or feel qualified, with little preparation, to teach an introductory course.

43. 30.1 percent have used the computer in a course to assist in administrative duties such as bookkeeping, grading or storing exams and assignments.

44. 83.8 percent have made use of the computer at some time or another to assist in research projects.

45. 51.5 percent have assigned computer programs to students in their courses.

Among the USERS who have assigned computer programs to their students:

46. 78.8 percent have their students using the computer in a batch processing mode as approved to a time-sharing mode.

47. 82.0 percent think the quality of their course would significantly improve if more time-sharing terminals were available to students.

48. 85.7 percent would be willing to change the orientation of their course from batch processing to time-sharing.

49. 51.0 percent would favor charging students a nominal computer usage fee in order to finance instructional time-sharing terminals.

50. 50.0 percent characterized the role of computing in the structure of their courses as an integral part, 48.1 percent as supplemental and 1.9 percent as incidental.

51. 26.9 percent estimated the overall effect of computing on the quality of the course as much better, 73.1 percent as better, 0 percent as no effect and 0 percent as worse.

52. The single most important benefit of computing in the course was reported as follows:

(1)	DEVELOP INTUITION AND SHARPEN INSIGHT INTO SUBJECT.	14.8 percent
(2)	ENHANCE "REALISM" OF THE COURSE THROUGH THE SOLUTION OF PROBLEMS THAT ARE DIFFICULT OR IMPOSSIBLE TO DO BY HAND.	48.1 percent
(3)	ENHANCE "REALISM" OF THE COURSE THROUGH THE MANIPULATION AND ANALYSIS OF LARGE AMOUNTS OF DATA.	22.2 percent
(4)	SPEED UP, OR DEVELOP THROUGH REPETITION THE REGULAR SUBJECT OF THE COURSE.	0.0 percent
(5)	TEACHING COMPUTING, "THE CAREFUL DEVELOPMENT OF PROCEDURES."	11.1 percent
(6)	OTHER	3.8 percent

53. The level of computing skill among the USERS group was reported as follows: (see Question 12 for definition of terms)

(1)	NO CAPABILITY	6.8 percent
(2)	GENERAL AWARENESS	24.3 percent
(3)	INDIRECT ABILITY TO PROGRAM	12.6 percent
(4)	ELEMENTARY PROGRAMMER	20.4 percent
(5)	INTERMEDIATE PROGRAMMER	20.4 percent
(6)	ADVANCED PROGRAMMER	15.5 percent

Mean Response = 3.70

54. The frequence of faculty computer usage at the University was reported as:

(1)	DAILY	14.6 percent
(2)	ABOUT THREE TIMES PER WEEK	10.7 percent
(3)	AT LEAST ONCE A WEEK	7.8 percent

(4) AT LEAST ONCE EVERY TWO WEEKS — 9.7 percent

(5) ONCE A MONTH — 16.5 percent

(6) ONCE A SEMESTER — 13.6 percent

(7) NEVER — 27.2 percent

Mean Response = 4.52

55. The frequency that the faculty users required others to assist them in their computing needs was reported as:

(1) EVERY TIME — 17.1 percent

(2) OFTEN — 17.1 percent

(3) SOMETIMES — 35.5 percent

(4) SELDOM — 25.0 percent

(5) NEVER — 5.3 percent

Mean Response = 2.84

56. 52.0 percent think the availability of computer consultants (within their department or the computation center, etc.) to assist them in their computing problems is adequate.

57. 52.4 percent use the computer primarily in a batch processing mode as opposed to a time-sharing mode.

58. 82.7 percent would like to be able to use the computer more.

59. 17.6 percent felt the present supply of time-sharing terminals was adequate for their needs or their students computing needs.

60. Other than terminals, 39.8 percent felt the current University facilities (both software products and hardware) was adequate for their needs or their students computing needs.

61. 29.4 percent have used computer facilities outside of the University for University work.

62. 57.1 percent think the frequency and nature of the short courses and seminars available are adequate for their continuing education in computer usage.

Conclusions

The concept of computer literacy has been around for some time. In 1960, Richard Hamming [1] proposed a 36-hour "computer appreciation" course for a broad class of liberal arts undergraduates. In 1970, an educational report [6] stated, "Computer literacy should be required of all college students and of all high school students too, whatever their field of work might be". Today there is hardly a vocational area that is not now using digital computers. Mosmann states in his report [4] that, "Commonly, graduate schools as well as employees expect the college graduates they admit or hire to have some basic computer literacy". There are a number of definitions of "computer literacy" in the literature. Hunter [2] for example defines "computer literacy" as "Whatever a person needs to know and do with computers in order to function competently in our society". Hunter further states that one or more of the following skills and knowledge may be required by a computer literate person: "(1) skill in writing algorithms and computer programs, (2) knowledge of computer applications in one's field of endeavor, (3) understanding of computer systems and their impact on society".

Our concern is that every graduate of this University have some level of computer literacy. One of the purposes of this survey was to determine to what extent other faculty agree and if not why not. The results show that both the USERS and NON-USERS groups agree most college graduates are computer illiterate and do not know how computers are used in their discipline (see questions 21 and 34; hereafter denoted as Q 21, Q 34).

However, they disagree on requiring a computer science course for graduation or allowing a computer language substitute for a graduate foreign language requirement (Q 25, Q 28). Both groups recommend that their students have more computer literacy than they are currently receiving (Q 12). However, Q 8 through Q 11 clearly shows that students are not getting this exposure to computing especially those students of NON-USERS faculty. At first glance this looks like an unfortunate case of computer illiteracy propagation of faculty onto students. However, the survey further reveals that most NON-USERS faculty felt there was no current computer course geared especially for their students (i.e. a "computer appreciation" course). Our introductory computer courses cover the FORTRAN language only. As a result we have developed an introductory computer awareness course. As of this writing, it has been taught one semester. The response to the course was very favorable and heavily populated. The course deals with computer awareness, appreciation and the impact on society and social issues. Numerous articles have appeared in recent years in the literature describing such courses.

Results of the survey also indicates that the NON-USERS group seems to be more skeptical of the benefits, uses and role of computers in society. (see questions 17, 19, 20, 26, 27, 30, 32, 33, 36). Both groups agree that a need exists for an introduction to computing course for faculty (Q 6) and a high precentage of the NON-USERS group indicated they would attend (Q 7). In response to this we have increased the number and frequency of our faculty seminars on computing and are working on an introductory computing course. Morrison [3] gives some good points on training college faculty members in the use of computers.

Among the USERS group results show that 45 percent have taught or feel qualified to teach an introductory course on computers, yet only 35.9 percent are intermediate or advanced programmers (Q 42, Q 53). Twenty-five percent of the USER group do most of the computing and 57 percent use the computer once a month or less and 27 percent never use the computer (Q 54)! The level of computing skills is uniformly distributed when the six levels are paired into three levels: 31.1 percent low skill, 33 percent medium skill and 35.9 percent high skill (Q 53). Furthermore, the frequency of computer assistance is also uniformly distributed: 34.2 percent requiring assistance every time or often, 35.5 percent sometimes and 30.3 percent seldom or never (Q 55).

We have used the survey to determine attitudes toward computing and how, why, and by whom the computer facilities are being used at the University. We have also determined the shortcomings in computer hardware, software and services to assist in using the computing facilities (both faculty and student). We have responded to some of the shortcomings already and will be continuing to analyze the results of the survey and respond appropriately in an effort to improve understanding and the effectiveness of computing in the entire educational process.

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