THE INTEGRATION OF COMPUTING INTO ARCHITECTURAL EDUCATION
THROUGH COMPUTER LITERATE FACULTY

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ABSTRACT

This paper discusses the apparent correlation between faculty computer literacy and the success of integrating computing into architectural education. Relevant questions of a 1985 national survey which was conducted to study the historical development of faculty computer utilization are analyzed and interpreted. The survey results are then used as the basis for a series of recommendations given for increasing computer literacy among faculty in architectural schools, thus increasing the integration of computing.

INTRODUCTION

It has been the author's observation through teaching in architectural schools that the success of integrating computing into an architectural curriculum can be greatly enhanced through a computer literate faculty. It has also been observed, however, that encouraging faculty to become computer literate is a very difficult task. Because of a lack of published information in this area, a national survey was conducted in 1985 to study the historical development of faculty computer utilization as well as the integration of computing in architectural education.

This paper will focus upon the issue of how to increase computer literacy among architecture faculty based upon the apparent correlation between faculty computer literacy and the increase in integration of computing into architectural education. Two principal topics will be presented:

1. the findings of a national survey as it relates to faculty computer literacy and utilization, and interpretation of these findings

2. recommendations for encouraging computer literacy among faculty as a means to increase the integration of computing into architectural education
The meaning of "computer literate" must be established as it relates to architectural faculty. For the purpose of this paper, a computer literate faculty member will mean an architectural educator who has an operational knowledge of software applicable to his or her specific teaching areas. An instructor need not be capable of teaching software programs, but must be capable of applying this software to his or her coursework, and of assisting students in that application. For example, a design studio instructor would need an operational knowledge of both two- and three-dimensional CAD, where a professional practice instructor would need an operational knowledge of word processing, spreadsheet, and scheduling programs.

Also for the purpose of this paper, integrating computing into architectural education will be defined as utilizing the computer in coursework not specifically about computers, such as design studios, structures, and environmental control system courses.

SURVEY FINDINGS

The original survey consisted of twenty-seven questions, and was sent to eighty-nine schools in the United States with accredited architectural programs, to obtain the opinions and expertise of those teaching computing in architectural curricula. Thirty-four replies were received, resulting in a 38 percent return. Write-in comments were encouraged for all questions.

Nine survey questions related to the issues of this paper. The raw data and percentage tabulations from these questions can be found in Appendix A. Interpolated results from survey questions 5 and 7 can be found in Appendix B.

The nine questions and their significant responses follow.

1. Why have you included computer courses and usage in your architectural curriculum?

Most schools have included computing courses in their curriculum because of personal interest of individual faculty members. Although not as important, demand from students and pressure to be competitive with other schools also play roles in bringing about the use of computers. Pressure from the professional community played a very small role. Accreditation requirements were the least important issue, which may be true because the National Architectural Accrediting Board has only recently required computer-specific criteria to be met, and many faculty members may not yet be aware of these requirements.

Even though personal interest was the single most prominent answer, utilization of computers due to one form of pressure or another would appear to be the greatest cumulative driving force. Due to this pressure, one might speculate that a vicious circle of attempt and frustration are set in motion. Many instructors
try to utilize the computer without proper assistance, and become frustrated with the entire process, thus inhibiting the original goal of integrating computing into architectural coursework. At this point a highly frustrated, negative individual suffering from Murphy's computer law has emerged. This person must now be treated in a much more personal and interactive manner, and cannot be educated with a stack of computer manuals.

2. What would you say is the current attitude of your college or department regarding faculty integration of computers into their courses?

Nearly two-thirds of the respondents indicated college or departmental encouragement. One-quarter of the respondents indicated that the issue was ignored. Less than 10 percent of schools required integration into coursework.

It appears there is a very positive climate for integrating computing into architectural coursework, as indicated by only 3 percent response that integration is discouraged. This would seem to be highly supportive of the education of a computer literate faculty. Although 25 percent of respondents indicated their colleges or departments ignore the issue, it is doubtful that this means a negative environment has been created. It more likely means that the initiative for utilization and integration has been left entirely up to individual faculty members.

3. How many of your faculty are integrating or have integrated computers into their courses?

Approximately 90 percent responding indicated a 25 percent or less integration of computing into coursework by faculty. No respondents indicated above 50 percent faculty integration.

This question must be examined along with the fact that the average architectural curriculum contains approximately 70 percent coursework in which the computer can logically be integrated. This suggests that the above percentages show a significant growth potential.

4. What prompted them to do so?

Nearly half of the respondents indicated faculty are integrating computing because of personal interest. Having new software available and keeping up with students were also important.

The prominent response to this question was similar to the result of Question 1, why computing courses are included in the curriculum. Again this emphasizes the driving force behind computing curricula, and that is personal faculty interest.

5. What percent of the faculty referred to in the previous question own personal computers?
Upon interpolating the results using a weighted use factor system (see Appendix B), it appears that personal computer ownership is three times more prevalent among instructors who integrate computing into their courses than instructors who do not. Personal ownership is here defined as legal ownership, or exclusive control of a personal computer supplied by a department or university. Specifically, 55 percent of those integrating computing own personal computers, whereas only 18 percent of those who do not integrate computing own personal computers.

6. What hinders other faculty from integrating computers into their courses?

A significant percentage of respondents indicated a lack of interest (26%) and/or time (25%) as primary reasons for not integrating computing. Interestingly, lack of appropriate software (8%) and unfriendly documentation (4%) were not seen as major obstacles to integration. It can be speculated that the low response for these two categories relates to a lack of involvement with computers, and therefore little confrontation with documentation and software.

Separating the available data into personal (lack of interest) versus external (not enough computers) obstacles, twice as many personal obstacles seem to inhibit utilization as opposed to external obstacles.

7. What percent of the faculty referred to in the previous question own personal computers?

Refer to Question 5 and Appendix B. Data has been combined.

8. Are staff resources (such as additional student worker support and staff programmers) available to help faculty integrate computers into their courses?

Respondents indicated that more than 50 percent of schools do not have any type of staff resources available for staff assistance. This would seem to present a major obstacle to increasing computer literacy among faculty since previous questions have revealed that personal solutions are most appropriate.

9. Are courses available to help your faculty become "computer literate"?

Two-thirds responded that some type of courses were available. Of the positive respondents, however, many indicated that only non-architecture-specific courses were available through their university computing center. Only 25 percent of the total respondents indicated the availability of architecture-specific courses such as faculty seminars through their own departments.

Based upon the above questions, responses, and respective implications, a series of recommendations will be made.
RECOMMENDATIONS

Because computing is ideally integrated into standard courses, and not taught only in computer-specific courses where the instructor is an architect with a computing background, it is necessary for many regular faculty members to become computer literate. This, however, raises a significant question: How can schools of architecture persuade an established and many times reluctant faculty to learn about computing? There is no answer that will assure 100 percent success in educating all faculty for there will always be those professors who never intend to put their hands on a computer.

The analogy can be made between the resistance to computers in education and the resistance found in the profession. The most frequently cited reason for resistance in the profession is that many architects feel the computer threatens or inhibits their creativity. The repetition and standardization hailed as the computer's best assets are viewed as interfering negatively with design. 2 Susan Doubilet, Senior Editor of Progressive Architecture, states:

Some architects maintain that the intimate hand-pencil connection is the irreplaceable pipeline communicating their very humanness to the very stones of the buildings they design. For these architects, because of years of habit, this may well be true. But graphite doesn't flow from their fingers; the pencil is just a tool...and so is the computer. 2

Another reason many architects, particularly the more established ones, resist using computers, is that they fear changing from the old methods they are accustomed to. 3 Karolyn Schuerer in an Architectural Record article describes the feelings of practitioners who have had many years of office experience:

Some embraced the computer willingly; others admit that they're hoping to slip into early retirement before being forced to put their hands on one. 4

As this issue relates specifically to educators, it has been suggested that perhaps the only absolute means for getting faculty to become computer literate is to make certain that all newly hired faculty are already computer literate.

The survey solicited comments addressing specific recommendations for encouraging faculty to integrate computing into their courses. These comments, along with the findings of the survey questions discussed in the previous section, have been condensed into three major groups of recommendations to encourage faculty literacy, hence the integration of computing.

The first group of recommendations relates to computer availability for faculty. Faculty members must have easy access
to computers. The survey pointed out three options. The best option is for each faculty member to have a personal computer in his or her private office. Unfortunately, this luxury is seldom possible. Secondly, a number of computers would be dedicated for faculty use only, and located in an area separate from the computers used by students. Finally, there would be enough computers available through the regular departmental computer facilities that faculty would not have to compete with students for computer time.

It has been observed that faculty members prefer to work away from students to avoid constant student interruption, and to avoid the embarrassment of being put on the spot to answer computer-related questions. Because of these two problems, an effort should be made to provide separate faculty and student computing facilities.

The second group of recommendations relates to how faculty learn to use a computer. It must be easy for faculty members, especially established ones, to become computer literate. The survey suggested three possibilities. The best solution is having one-to-one private tutoring available to provide the most non-ego-threatening, non-embarrassing learning environment for a new computer user. New users need personal training, an introduction to appropriate software, and assistance in specific course adaptation.

If it is not possible to arrange one-to-one tutoring, in-house faculty development workshops should be offered. In order to enroll the maximum number of faculty members, these workshops should be offered at convenient times within the department of architecture, by an appropriate member of the architecture faculty. As an incentive for faculty members to attend, paying them through research or grant funds should be investigated.

If neither of the previous suggestions are possible, faculty should be encouraged to preferably register for but at least audit computer-specific courses that are offered to students. Faculty who do this will not only be abreast of what is currently being taught in their school, but will be able to see possible applications for computing in the courses they teach.

Regardless of what training methods are used, faculty members need to be aware of how computing can be applied. They need to work on exciting personal projects so they develop an enthusiasm for using the computer, and they need to see demonstrations of appropriate software so they can understand the potential in their own teaching areas.

The third group of recommendations relates to administrative support. Faculty use and integration of computing must be supported by the department administration. The survey suggested that if the administration doesn't support computer use, faculty are likely to assume that position as well.
The administration should support faculty by giving credit to faculty members at promotion and tenure review for using and especially for integrating computing into coursework. A valid argument presented by non-computer literate faculty is that to become computer literate and to integrate computing into coursework takes a great deal of time, which takes away from more "scholarly" research. Perhaps promotion and tenure committees should reassess faculty computer literacy and integration in light of current and future computing trends, and consider it as worthwhile course improvement.

The administration should make appropriate and applicable software available. This software should be adequately budgeted so faculty access is not difficult.

The administration should provide for having technical staff available to assist faculty in their computing effort. Giving one faculty workshop and then leaving new computer users to struggle on their own is not very effective in encouraging continued use of the computer. Technical staff should be available to provide continuing one-to-one support and encouragement in the learning process.

The administration should find incentives to encourage individual faculty members to purchase personal computers. It has been pointed out that faculty who own their own computers and use them for personal projects are more likely to become enthusiastic about applying computing to their coursework. Incentives such as interest-free loans or university discounts can encourage personal computer purchases.

Carnegie-Mellon University, Dartmouth University, and the University of Colorado are three schools that have made a commitment to assisting their faculty in becoming computer literate. These universities have realized the importance of bringing education into the computer age, and that faculty need to be encouraged to become computer literate. They have either placed personal computers in each faculty office, or have separate computer facilities available for easy faculty access.5,6,7

To produce computer literate students, Harrison Shull from the University of Colorado states that:

... students will find their machines far more useful if faculty members first discover ways to use computers for educational purposes.8

In order to accomplish this, faculty members must want to become computer literate. The above recommendations will aid in encouraging faculty to learn to use computers, become computer literate, and hence incorporate and support computing in architectural education.

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8. Ibid, p. 17.
APPENDIX A
Survey Question Raw Data and Percentage Tabulations

1. Why have you included computer courses and usage in your architectural curriculum? (Check the two most applicable.)

- faculty interest ........................................... 26%
- student demand ........................................... 25%
- pressure to be competitive with other schools ........ 20%
- pressure from professional community .............. 11%
- pressure to meet accreditation requirements ....... 10%

Write-in comments (13%):
- "Personal belief that it is important (not shared by all faculty)"
- "To keep abreast and current with future trends in architecture"
- "Responsibility of our architectural curriculum"
- "Because of effectiveness and applicability of computer-based information processing technology (thinking process) to architectural discipline"

2. What would you say is the current attitude of your college or department regarding faculty integration of computers into their courses?

- encouraged .................................................. 65%
- ignored ....................................................... 25%
- required ..................................................... 7%
- discouraged ............................................... 3%

Write-in comments:
- "Integration encouraged by the chairperson and dean; ignored by the faculty"
- "Somewhat encouraged"

3. How many of your faculty are integrating or have integrated computers into their courses?

- 11-25% ....................................................... 47%
- 1-10% ......................................................... 44%
- 0% ............................................................. 6%
- 26-50% ....................................................... 3%
- 51-75% ....................................................... 0%
- 76-100% ..................................................... 0%

4. What prompted them to do so? (Check the three most applicable.)

- personal interest .......................................... 44%
- newly available software ............................... 19%
- keeping up with students ............................... 13%
- request from profession ............................... 9%
- departmental request .................................. 6%

Write-in comments (9%):
- "Seeking leadership in the field"
- "Response to the trend in the profession"
- "University college and departmental commitment"
- "Presence of computer faculty who also teach design studio"

5. What percent of the faculty referred to in the previous question own personal computers?

- 1-10% ....................................................... 34%
- 76-100% ................................................... 25%
- 11-25% ..................................................... 16%
- 26-50% ..................................................... 16%
- 51-75% .................................................... 9%
- 0% .......................................................... 0%
Write-in comments:
"Furnished by university" corresponding to check in 76-100% column.

6. What hinders other faculty from integrating computers into their courses?
   (Check the three most applicable.)
   - not interested .......................... 26%
   - not enough time .......................... 25%
   - not enough computers .................. 13%
   - difficulty in learning .................. 12%
   - no computers specifically for faculty . 10%
   - no appropriate software ............... 8%
   - unfriendly documentation ............. 4%

   Write-in comments (2%):
   "General apprehension about computers and probably lack of confidence"
   "No one showing them what they might do and how they might do it!"
   "Not enough time (I believe); difficulty in learning (I suspect)"

7. What percent of the faculty referred to in the previous question own personal computers?
   - 1-10% ........................................ 45%
   - 0% ............................................ 29%
   - 11-25% .................................... 21%
   - 26-50% .................................... 3%
   - 51-75% .................................... 3%
   - 76-100% ................................... 0%

8. Are staff resources (such as additional student worker support and staff programmers) available to help faculty integrate computers into their courses?
   - no .......................................... 56%
   - yes ......................................... 44%

   Write-in comments:
   "A worker is available in computer lab to aid students with assignments
   including word processing"
   "Yes if required"
   "No, no money"

9. Are courses available to help you faculty become "computer literate"? If yes, please describe.
   - yes ......................................... 65%
   - no .......................................... 35%

   Write-in comments:
   "The University offers workshops - hard to schedule - motivation is nil"
   "University level introduction computer courses"
   "There are short courses at the University and PCs available at times for their use"
   "No full courses aimed specifically at architecture, although the University offers a number of faculty courses on general applications (DOS, word processing, spreadsheets)
   "I offered a 'required' 8-week course last year. 80% of faculty attended and one of three things happened: 1) They bought a PC or MAC, 2) They started using PCs for word processing. 3) They smiled and forgot it all"
   "1-2 seminars in word processing and spreadsheets will be offered in the fall"
   "Intensive 1 and 3 day sessions in all our software"
   "We may offer CADD workshops for faculty this summer"
   "1 week session on CAD as training"
"Occasional 'faculty intensives' are offered to faculty in-house. On demand small group 'orientation' sessions are available to faculty.

"Sort of - either individual instruction or seminars have been arranged"

"Faculty may audit or register for introduction and CADD courses"

"This summer, for the first time, there will be an introductory seminar, at which time we will set up 'workshop' type sessions for hands-on experience to help faculty get started using available software"

"Some faculty take introductory computer course"

10. What would you recommend as a means of encouraging faculty to integrate computers into their courses?

"More computers in the department"

"Faculty equipment"

"Allow professors more access to PCs"

"Providing each faculty with a PC in their office would have a dramatic effect"

"Demonstrate effective uses"

"Perceived value in using the technology"

"Release time"

"Until the technology improves, integration of computers requires effort and time, and therefore mutual faculty commitment and support are the absolute minimum requirement"

"Time other than during long semesters bit paid for by university and with salary for faculty (maybe with grant funds or research support)"

"Required seminars (rather than optional as currently available)"

"First of all, faculty must be trained to be comfortable with working on computers. Non-threatening and non-nego-offensive approaches are essential to the training, i.e., private tutoring. After they have confidence in their ability to deal with computers, some of them seem to explore their courses with computers"

"Workshops on computer use in architecture. Increase use of computers in their area of interest"

"More push from the administration"

"Somehow convince them that it's worth it. 1) Rewards 2) Punishment?

3) Wait for them to retire? There seems to be no reward for using computers now, so there may even be discouragement in that promotion/tenure committees may not consider computer integration to be worthwhile course improvement. This can be a real problem since integrating computers into a course can take time away from more 'scholarly' research - it could get you fired!"

"Becoming computer literate as a result of personal interest. This might follow from an interest at the level of president"

"Provide software for each faculty member"

"Availability of appropriate software"

"Provide technical support"

"Assistance in helping them develop some level of proficiency"

"More funding for assistants"

"Let the students urge the faculty to integrate computers into their courses"

"I believe that student demands will be most effective, so develop student's abilities"

"Get faculty personally interested in computers - secure university discounts for personal faculty and student purchases. Provide interest-free loans for faculty to purchase microcomputers - this has been responsible for approximately 1/4 of our faculty buying computers"

"New faculty"

"Find dedicated computer faculty and then make sure they are not isolated from other faculty"

"It must be made enjoyable"

"Make exotic peripherals (especially laser printers) available"

"Most (all?) CADD programs are slower/barger to use than pencils for drawing (production in an office is different)"

"Self motivation. Pressure tactics are self-defeating"

"Require all notes, papers, and memos to be machine readable. Require all faculty to show some computer literacy"

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### APPENDIX B
Interpolated Results From Survey Questions 5 and 7

#### Question 5. PC ownership among instructors who integrate computing into their coursework.

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<thead>
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<th>Percentage of Ownership Class</th>
<th>Percentage of Ownership</th>
<th>Weighted Use Category</th>
<th>Utilization Factor (B x C)</th>
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#### Question 7. PC ownership among instructors who do not integrate computing into their coursework.

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<th>Percentage of Ownership</th>
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