CAD IN EDUCATION:

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Acknowledging the integral role of computers in education, to assure effective access to computing resources, universities across the US have been requiring that their students purchase a personal computer to serve them throughout the program. While this trend was initiated by exclusive private universities some 10-15 years ago, even mainstream public universities seem to be catching up with it. There is evidence that many Architecture schools are now contemplating this option. This column features two distinct views on this topic by Henderson and Johnson.

Rationale For Requiring Computers
Henderson

When we graduated from architectural school we owned and learned with our own tools. The skills that we developed in school allowed us to gain an entry-level position in the profession. However, times have changed. There is a new and wonderful tool that is transforming architectural education, professional practice and the whole building industry. We cannot deny our successors the digital skills to make them successful and innovative practitioners because of short - sighted academic computer policies.

Taking a "CAD" or "3D modeling studio" class is insufficient for developing digital skills for future architects. Because of limited lab resources every student cannot have the 24 hour - 365 day access to a computer which is necessary to become facile with the tool. With the emergence of the inexpensive PC, students can now own their own systems. The cost of hardware and software is a small percentage of the overall cost of a professional education. Lab fees can then be used to support studio networking, digital infrastructure, collaborative environments, etc.

In designing digital systems and pedagogy architectural educators need to observe and understand how professionals are using digital tools. This research can help educators create farsighted and innovative architectural pedagogy. If architectural firms can provide computers for each employee, why shouldn't architectural students have their own system?

Finally, the most important issue is one of educational equity. Architectural schools that require computers will have a competitive edge over schools who do not. The students who have their own systems can have an educational edge over those students who do not. Ultimately it is an ethical issue. Unless the issue is resolved, as educators are we creating two classes of entry level intern architects.

One way to create digital equity among architectural schools is to involve the NAAB. Should the NAAB require architectural schools to mandate that all students own computers as part of the accrediting conditions?

If architects working in competitive business environment can create a digital office, why can't architectural schools create digital learning environments? The Boyer report sug-gests that education and practice be more closely linked. Digital tools could be common link between practice and education.

The Argument Against Mandatory Computer Ownership
Johnson

First let me point out that whether students should *learn* about computers is not the issue. Of course students should learn about them. They should learn fundamentals about how they work, and learn firsthand how they are beneficial or even indispensable for various architectural and scholarly activities. This is not the issue. The issue is whether they should have to *buy* them. Buying them is neither a cause of, nor a prerequisite for, learning about them. Neither is it a substitute for instruction. Requiring students to buy their own computers, without making them an integral part of courses throughout the curriculum, would be hollow, hypocritical, and irresponsible.

However, integration into the curriculum raises other problems. Programs like AutoCAD, form•Z, and Radiance don't run on certain platforms. If a school requires a particular platform, some instructors may be prevented from using the software they want in their courses. If the school requires only that students buy any one of an approved variety of platforms, then the school must be prepared to make alternate platforms available for students who chose the wrong one for a particular course.

Even with mandatory computer ownership, schools need to provide high-end machines for graphically or computationally intensive tasks. This results in a computer-to-student ratio greater than 1.0, which is not an efficient use of resources.

Hardware, software, and maintenance are all expensive, and some schools must resort to making their students pay for computing resources. But if this must be done, the school is obligated to at least spend student money responsibly. Instead of making every student spend $2000 on a computer and software, a school could impose a $100 a year computing fee. For a department with 400 students, this would generate $40,000, enough to buy 20 of the same machines per year, which would keep a lab of 80 machines in operation, assuming machines were retired in 4 years. Or even better, the school could buy 16 new $2000 machines and 16 $500 upgrades for 2-year old machines, keeping a lab of 64 more up-to-date machines in perpetual operation. This should be adequate for 400 students, especially given that a significant number of them will choose to buy their own machines, anyway. The University of Michigan's College of Architecture and Urban Planning currently operates with a similar ratio.

If a school must pass the cost of computing off on the students, mandatory computer ownership is not a good way to do it. Assessing a computing fee, while providing means for students to use their own machines if they wish, is a much more egalitarian and fiscally responsible way to solve the same problem.

(Visit www-personal.umich.edu/~sven/noreqmt.html for an unabridged version of this position statement)

Discussion

Recent surveys indicate that six out of ten college students own computers, even though only 2% of the colleges instituted such a requirement. In this light, one advantage of such a mandate would be that the students can count the expense in financial aid calculations. As hinted by Henderson's argument, perhaps something like this would create an even playing field, since the wealthier students would bring computers along either way! However, before rushing to such a conclusion we need to search for answers to some of the compelling questions posed by Johnson as far as their effect on the curriculum.

Reflecting on his experiences at Mississippi State, Charles Calvo contends that there are important issues to be resolved for a successful implementation. These include faculty training, increasing support staff, systematic assessment of curricular integration issues, advising students on purchasing flexible systems, and providing centralized high-end computer facilities. One of the most interesting and practical points brought up by Prof. Calvo is that of system support. In contrast to a typical digital office environment, which typically boasts one support staff for about thirty workstations, academic settings offer may be one support staff per three or four hundred workstations. Kelly McCollum elaborates on how this can put an additional burden on Professors. She also points at another important fact that majority of the existing classrooms in US campuses are not simply designed for delivery of this kind of technology.

Conclusion

The bottom line is that we do not fully understand all the implications of such a requirement. We are probably doing it because some of us feel it is the right thing to do, just the way Wall Street is betting on internet stocks! Is that prudent? Or do we need to think critically about the following:

- **What is the ideal machine?** Laptops vs. Desktops, Windows or Mac or UNIX;
- **Do we have the physical setting?** Network/power connections, security, projection systems, classroom lighting/acoustics;
- **Do we know how it affects classroom activities?** Such as note taking, hand-outs, lecture presentation, student presentations, interaction;
- **Do we have a grasp of its effects on the costs of education?** How much is enough, leasing vs. buying, have and have-nots, financial aid/loan, maintenance, support, printing costs, upgrades, repairs, switching majors requiring switching hardware/software;
- **Do we know how it affects the role of teachers?** E-hours, preparation time, setting up projection systems, familiarity with systems, technical support, dealing with computer/software limitations;
- **Do we know how to assess its impact?** Do students learn better? do teachers teach better? does it enrich the educational experience?

Perhaps we should strive to answers these questions before we justify "student computer requirement" as a *necessary expense*.

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Student work @ Univ. of Buenos Aires, submitted by Pedro Bonta