How Significant is Computing for Higher Education?

by Richard L. Van Horn

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Computing in higher education raises fundamental issues that deserve to be addressed and answered at most institutions. In this article, I will take a specific position — one not everyone will agree with — that many institutions are addressing these issues inappropriately. Many institutions are so enmeshed in the complexities of technology that they have lost sight of any strategic direction.

For any problem, a basic strategic approach says the investigator should define goals, and in the process of defining goals, identify the problems. One of the aspects of this approach is identifying problems without being constrained by existing trends or solutions. Let us apply this approach to higher education computing.

In analyzing the significance of computers for higher education, many problems arise because the discussion centers on how to improve technology, teaching, classes, costs or other aspects of higher education. Our real goal is to "improve the performance or productivity of students in society once they leave institutions of higher education." The goals of improving the mechanisms of higher education and improving the performance of students probably are related, but are not necessarily the same.

With a goal to improve higher education, much attention gets focused on two issues: computer literacy — i.e. "How do you teach people about computers?" and how to manage technology — i.e. "How do you forecast where the technology is going in order to make good decisions on how to deal with it?" The above issues are troublesome and challenging, but not central.

The central issues of concern are: What is good education, how do you use computing to enhance good education, and, are there robust approaches to this end? Worrying about technology and how to manage technology risks overlooking relatively robust approaches that focus on improving education. We have ample evidence that the introduction of technology by itself automatically will not improve higher education in ways that improve the quality and effectiveness of students once they leave our institutions.

Several considerations are of special relevance to higher education for the good of society. One concept emphasized in the press recently is "liberal-professional education." Many students now have a professional orientation, but to meet the mission of a university, they also should receive a broad liberal base. These joint goals create conflict, because in four years we may not have enough time for both liberal and professional education. Most Deans of Engineering would like five years just to provide engineering education, let alone a liberal base. So we have an education problem that society has to solve if we believe that a good liberal professional education increases the social value of graduates.

Second, a university education, now more than ever before, is not a lifetime education. Universities, at best, prepare students to learn on their own once they leave the institution. What can we do to improve the ability of students while they are at universities to learn independently? In addition, universities should do more than cram knowledge into students minds; they must develop in students the ability to apply knowledge and to solve problems — quite different processes. Education, traditionally, is much more oriented towards providing knowledge than solving problems.

Third, can we find a systems approach to higher education? Universities obviously have many facets, including faculties, classrooms, a social structure, and students. Employers also are important because much education beyond the bachelor degree comes through employers, not universities. Employers are becoming much more active in the educational process and are an important part of the overall educational system. The last important link in the systems approach to education is to understand and respond to the roles students will play in society.

With this overall system, how might one

proceed to improve education? Faculty and classrooms are probably reasonable in their present forms. The evidence suggests that our basic instruction systems, which have been around since about the 12th century, work well. Faculty members and classrooms in their present form deserve at least a B and maybe an A minus. Do the other parts of the educational environment work as well?

Should we change the university structure? By and large, the evidence again suggests that the social structure of a university, i.e. — getting people together into group environments for learning, is a good approach. We probably will not realize large gains from changing the social structure.

We know that students spend most of their time outside class, and the evidence indicates that a large part of learning takes place out of class. What activities or facilities of the university support a student outside the classroom? Institutions of higher learning don't offer much for students outside of class. Students can talk with faculty members or work with other students, but these activities are informal mechanisms. The library is the major and perhaps only formal university learning resource designed for students to use independently outside of class. Improving the learning that takes place outside of class certainly appears to be the most promising and highest impact component of the system.

With a broad systems approach, another important question is "What can we learn from history?" You hear much today about the fact that we live in an information society. In truth, we always have lived in an information society. Information processing is part of the basic definition of life, so people by definition, live in an information society. Two major innovations in the information society were languages, which enabled people to function and work in groups, and printing, which changed cost effectiveness of information storage and transfer. If we can change the cost of information handling, is it likely to have an impact on society? Evidence from history shows that printing, which changed drastically the cost of information handling, had a tremendous impact.

The United States represents what some have called a post-modern society or a knowledge-based society. Regardless of name, the new structure has major impact because it changes our primary role in the future of world economy from one of physical productivity to one of innovations and creativity. Putting robots into the automobile industry is important. But the long run future of the United States lies in intellectual productivity. Universities in this future society are more important than ever, because many of the things we do affect the intellectual productivity of our society.

From an understanding of goals, system, past, and future, we can derive some ideas of how to go about building computing environments in higher education. For example, the library, our present example of an independent learning resource, is one good model for the way computing should be used. It is one of the few activities on campus that encourages independent use. Students go to the library and make decisions or learn on their own. If a university wants to use computing effectively, then it should learn from the library and make computing available for independent use by students.

Some computing will and should happen in the classroom, under the direct guidance of a faculty member. Computing in the classroom can substitute for faculty time or increase faculty productivity, certainly desirable goals. But computers in the classroom are unlikely to have a major impact on higher education. The impact on higher education will come when computing is available to students who make decisions about how to use it and when to use it. If computing is to change higher education for the good of society and not for the good of higher education, we have to understand how to use computing along the library model.

For students to use computing, they need good access. Networks of workstations can provide good physical access. But access has a second dimension, psychological access. If you wish to become a professional librarian, you must go through a number of courses. Librarians are expected to have specialized knowledge. We don't expect users of the library to have that same kind of knowledge. Most institutions don't require students to take one, let alone a number of, courses to use the library. We believe that college students, with simple handouts and a brief talk from library staff during orientation, can learn to use the library effectively. When students have problems they ask the librarians or often other students for help. Most students learn just enough to find or to use the materials they want.

Why is computing different? Why do we think we should give every student a computer literacy course? Why should every student know the intimate details of computers and how to program them? If computing is really useful and valuable, then we should be able to use the power of computing to make computing easy to use effectively. The basic argument is that students can use computing the same way they use the library. Some students will want to take programming courses. But forcing all students through an intensive programming or computer science course probably does more harm than good. At a minimum, it focuses attention on the wrong issue. We want students to use computers to improve learning, not just to learn about computers.

In the public view, computers are often viewed as big, fast adding machines. Numerical computation is not a central issue for most people. The true potential of computing is to extend the function of the traditional library. Computing can provide better access to the knowledge and skill base, just as libraries have done in the past. Computing as a different representation of the library forms a new independent learning support function for students. Computers only incidentally are adding machines. We named everything wrong. We probably should rename "computation centers" to be "knowledge centers." Twenty years from now much of our knowledge and skill base will exist in machine-readable form. The real role of computing is to provide better access to a rapidly expanding knowledge and skill base in an interactive form that encourages problem solving.

Much of the current discussion on computing in education revolves around how to use computing in a course. For a long time, universities have been cursed with the idea of a "course." No one at a university believes that dividing up the knowledge base into courses is a good idea. We do it because it's a practical requirement of the way universities operate. Why, when computing comes along, should we trap ourselves in the same framework?

If we think about computing within the artificial boundaries imposed by courses we diminish the value of computing. At a minimum, we can think about "computing for disciplines" — the kinds of computing that political scientists, philosophers,

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