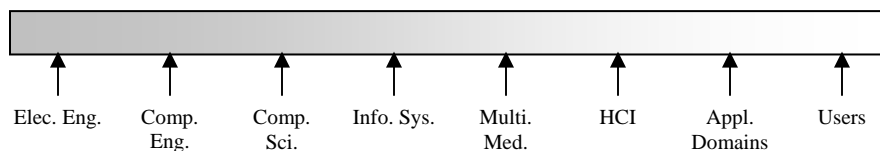


**White Paper for
"Integrative Computing Education & Research (ICER):
Preparing IT Graduates for 2010 and Beyond"**

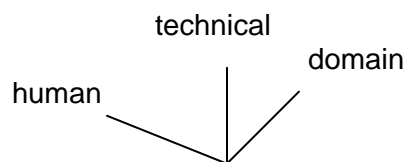
A Multidimensional, Multidisciplinary Perspective

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Our instructions were that we should consider computing as a continuum of disciplines that may include the following (as well as others that the group may identify):



I hate not to follow instructions but I feel compelled to say that in the Indiana University School of Informatics, we view computing as at least 3-dimensional defined by these axes:



Under the "human" we include HCI, and also social and organizational informatics -- the role IT plays (and should play) in society and within organizations, and the social aspects of security. Under "technical" we include traditional computer and information science, and also new developments such as data mining, visualization, complex systems, simulation, modeling, foundations, technical aspects of security. Under "domain" we include such things as bioinformatics, chemical informatics, laboratory informatics, health informatics, music informatics, etc. And of course we include the domain aspects of security (the way that security requirements vary between different application domains). ☺

I mention these various dimensions without suggesting that these are the only dimensions to be considered. There is obviously a business dimension that some schools might include, and some schools might exclude certain dimensions and be say just on the technical dimension to take one extreme (however traditional it might be). And the dimension I have labeled "technical" might be split into 2 or more dimensions, say computer science and information science as I have already alluded to, and maybe electrical/computer engineering (which last clearly also has two dimensions, and so ad infinitum). I am not saying that every computing program (school/department) must have all of these dimensions. In fact I am suggesting that computing programs can position themselves by choosing the dimensions they include or emphasize. Their "ecological" context can play a big role. For example we have chosen not to emphasize business, because IU's Kelley School of Business already has a strong Information Systems Department. However, our undergraduate informatics majors can still do a business specialty if they want. All of our undergraduate majors must have a specialty (called a "cognate") which is the central way that we emphasize for undergraduates the domain dimension of our school. But

the cognate could just as easily be biology, fine arts, geographical information systems, or any of roughly 20 special domains.

The biggest challenge that I face re *preparing undergraduates for computing careers* (in my role as dean of a school that is only 4 years old) is managing and maintaining our interdisciplinary, multidisciplinary, even transdisciplinary nature, and communicating the importance of that to our students. Since we also offer a more or less traditional computer science major it is important that students make a well-informed decision about whether to choose to major in computer science or in informatics.

In terms of *transforming the educational experience* it is important that the larger computing community recognize and publicize that computing now has many dimensions and that students should choose the model that fits their interests the best.

When I think about *models for transforming computing education*, I think that an ideal undergraduate model for computing education would allow students to choose different paths through the curriculum that would correspond to emphasizing various dimensions with differing strengths.

In terms of *inhibitors*, the biggest one is simply the conservatism of the academy. Robert Maynard Hutchins, the great President of the University of Chicago, is supposed to have said that it is easier to move a New England graveyard than to change a curriculum. In terms of *strategies* there must be a significant system of rewards, from NSF, from industry, etc. to encourage change. This conservatism is deeply founded on investments in academic reality.

As to *who might participate*, clearly computer science faculty (and students) should be involved. As I have already indicated, the NSF, perhaps NIH and other agencies should be involved, and certainly the National Academies. I also think industry should be involved, and not just the traditional IT industries, but also other industries that depend upon IT in a big way, such as pharma, health industries in general, manufacturing, logistics, financial, entertainment, etc.

The main change in curriculum that I see is that it should produce graduates who are problem oriented, and as a consequence multidisciplinary and experienced in teamwork. They should be optimistic and innovative. They should also not be “geeks and nerds” but should understand the human aspects and the human importance of information technology (which includes various domain aspects, including the natural sciences). They should also understand the social – political circumstances under which they will work, which includes an understanding of the global IT economy. They should not be victims of CNN’s talk of jobs moving off-shore, but understand where the real jobs are, and how they might work with say someone in India or China, or work in India or China.

The grand challenge is how to do this without computing being absorbed into other disciplines. Mathematics has shown that this can be done. Although mathematics is ubiquitous, it has kept its own unique identity. But mathematics also tends to be isolated as a consequence. Better examples might be business and engineering schools, which have their own niche in the academy but have also become multidisciplinary in many respects. Medical schools might be an even better paradigm. No one seems to mind much if a medical school has a biochemistry department, or even a biomedical ethicist. I think the real challenge for computing is to be transdisciplinary while keeping ties with the traditional disciplines.