Training Programs

It probably will not be possible for an individual to develop expertise in all of the above through courses or training programs. Consequently, some of the required expertise may have to be picked up "on the job". The following, however, would represent useful courses or training programs to take:

* Computer science and information systems technology - understanding of modern computer operations and available software management systems.
* Accounting - a good knowledge of accounting with particular emphasis on fixed/variable costs systems, program budgeting and zero-base budgeting.
* Operations reserach/industrial engineering - this should include a course in elementary statistics, and some of the more well-known operations reserach techniques such as inventory analysis, queuing theory, and possible simply Markov processes.
* Administration/organization theory - as we have indicated above, new styles of management organization and incentive/reward systems can be very useful in view of the changes that are going to take place in the hospital environment.

Finally, the personal traits required include the ability to apply background and techniques learned within a particular context to the very different and complex environment of the health care area; the curiosity and desire to learn enough about the health care/hospital environment to be effective in it; and the ability to interact and communicate with individuals of completely different kinds of professional backgrounds.

DISCUSSION

Gerry Purdy . . .

I think that someone who is planning to be a consultant must have the ability to see the whole picture. He has to quickly be able to see the forest from the trees. A person with such talents will find moving into the consulting field easy and natural. This person must also have the ability to determine objectively what will work out best for the client and not necessarily the system he likes the most or has the most prior experience with.

How do you get started as a consultant in information systems of medical/health computing? I think there are two ways: 1) formally by working for a consulting company and 2) informally through moonlighting (where, three or four years later you end up having your own profesional consulting practice).

SUMMARY COMMENTS

Gerry Purdy

I have a few summary comments concerning this session. First I think there's a definite need for summer job experience programs. An internship program is needed for those planning to go into the applications problem solving arena rather than planning to go on to the more theoretical Ph.D. level. I've hired students on a co-op basis and for summer jobs. I find it provides much needed experience for the student in addition to the educational program. I would encourage all of you to consider using this type of pre-employment training program; you might find that you'll be able to hire the "cream of the crop" without making full-time commitments.

As a result of reading the papers, hearing the presentations, and listening to the comments, I've put together a summary of careers and training programs. In each area there's a motivation for establishing cost containment concepts as a foundation or basis for the career, i.e., all of these careers should keep cost containment under consideration.

In the hospital, there are careers in administrative and clinical systems. In the university, there are careers in teaching, research, and services/administration. For computer vendors, there are careers in technology and marketing. In the consulting field, there is the career to be an advisor, making observations and recommendations for many different application areas. We're going to be developing more hospital information systems in the future. These systems will need to generate information to meet state and Federal regulations as well as assist in management decision making - all this in addition to the standard data processing function. There's going to be an increase in the number of training programs in medical computing, and many of these programs will emphasize information systems. A lot of opportunities are going to come about, and, hopefully, as a result of this Symposium, we can help influence the development of these training programs.

I've chosen to divide the training programs into two areas: the specialist and the non-specialist, as adapted from the IFIP study a few years ago. The specialists are the people who are dedicated to the design and development of information systems. Training of these specialsts should be done with two degree programs: the M.S. (worker/applied) program and the Ph.D. (theoretical) program.

As a result of what's been said here, I have noted seven areas that medical/health computing training programs in information systems should include:

1. Medical vocabulary and basic physiology.
2. Systems science - system design.
3. Biomathematics, statistics, operations research and modeling.
4. Business, accounting and finance.
5. Hospital operations - what they do, how they operate.
6. Human communications - management, technical writing, psychology, and interpersonal relations.
7. Internship programs.

The non-specialists need a knowledge of health care information systems, i.e., how they work and how they can be used. Certificate programs are needed for these health professionals. We need to take hospital administrators, department specialists, nurses, and physicians and try to bring them to some basic understanding of what medical/health computing is and what it is trying to accomplish.

The non-specialists need "hands-on" use of computing systems, much like the atmosphere at UTHSCD described by Dr. Mishelevich. They need to feel very comfortable that computing is a natural part of the total health care system. Second, they need an introduction to computing, i.e., the nature of information processing, algorithms, and programming. They don't have to become programmers, but they need to have an understanding of the programming process. I think we have a big problem that many non-specialists see everything as "programming". People, systems, and programming appear as one process - "programming". Therefore, these people should have an introduction to the system development process.

In the area of computing systems, there should be a base course from which both specialists and non-specialists begin. The non-specialists need an idea of modularity, the concept of files, and what an end-user interface is and how you describe it. They need to understand batch versus interactive, distributed processing, and the concept of turn-key systems. They must also understand throughput, i.e., how do you measure the system's value, how do you benchmark it, and how much does it cost? All these concepts are necessary so that the non-specialist can communicate their needs to the specialists.

I would like to see the ACM Committee on Health Computing Education focus on these areas. We need specific degree programs, certificate programs, and a course structure outline that might serve as a reference for others to use when designing their programs.

DISCUSSION

Jeffrey Rothmeier . . .

I would certainly want to second your proposal to structure the education of medical/health professionals in the medical computing field. It's a morass right now. I'm not sure what's the best way to do it., i.e., whether we should take the approach of the biomedical engineering community which a decade ago included the computer people too. Now, the biomedical engineering community has established a firm foothold in nearly all medical environments that use instrumentation. They define their own curricula. They are springing up in universities all over, and they're apparently doing a fine job. It's entirely possible that this same approach will work in the medical computing field.

The seven item specialist training program outline Dr. Purdy suggested seems to be almost overwhelming. It sounds like Dr. Mishelevich is taking that approach at UTHSCD. I don't know how many years someone must be in school. I think you hit on the key things with the possible exception of the basic sciences. I'd really like to see some emphasis on developing the thought process itself. I've seen some medical curricula which include a two week course in teaching you how to think, and this seems a little wrong to me. I don't believe you can really teach people the logical process of thinking in two weeks. Maybe you need to have one seventh of your entire program a bona fide science emphasis even if it isn't really related to the contribution that these people who are trained would make to the medical computing field.

Gerry Purdy . . .

Would that be part of the program or a prerequisite?

Jeffrey Rothmeier . . .

We haven't even defined whether we're talking about undergraduate or graduate programs, let along prerequisites. Where these poeple are going in the various sectors that we're talking about is another fascinating questions. Here's my conception of where they ought to go. In private industry, there ought to be more people on the order of Vice President for Information Systems. There ought to be a classic sort of operations structure, among other things, that this person is responsible for. Ideally, the heads of companies will have some background in the area of computing, but that may be too much to ask for because they have so many other skills they need to use. Then, there should be subspecialists under these Vice Presidents. Within academic environments, it would be good to have Associate Deans or Vice Chancellors with some of this computing background. These would be long term career goals. In hospitals, from 200-beds and up, there ought to be an administrator on the staff with some computing background. I think that's important. The amount of resources that are increasingly applied to knowledge of information systems will go up. Computing is one or two percent of the Gross National Product right now. It's probably not unreasonable to assume that in the health field in general, computing will consume 10 or 20 percent of the total resources. I think it would be good if we could come up with a Proceedings from this Symposium that would define some curricula and determine the value of these curricula. That would be a major accomplishment.

Gio Wiederhold . . .

Let me make one remark about the two week programs on thinking. They don't teach people how to think. They help you to introspect into your thinking process so that you can transfer that process and diffuse it to other disciplines. The typical medical training program needs to include some pattern of thinking because much of the educational process is done by showing. The typical physician during his training period sees one or two of each kind of case, and he is expected to extrapolate from that. The thinking process can be very dangerous when the physician looks at a computer system when he sees one or two examples of where computer systems can be beneficial. He may easily overextrapolate. He may go to the information scientist for a request based on a generalization that may not be valid. In computing, doing Task A well may be very impressive, and it may be a very small conceptual step to doing Task B well. But the next step up in complexity, however, can be quite far. The typical example is that I can translate Russian into English with a 300 word vocabulary. Therefore, I can translate (in general), and it's easy to extrapolate that only a little more work is required to translate all Russian into English. The fact that there tends to be an exponential increase of complexity is easily forgotten in the medical thinking pattern. The mathematician will typically ask why I've used induction with a lot of negative examples. If we only cite negative examples, no one would ever go into medical computing, right? But the fact there are single failures does not invalidate medical computing in general. It really invalidates a mathematical algorithm in general.

I think some discussion of how thinking processes occur, since there are, in fact, perceptible differences, can be useful. Mathematics itself has been helped along in this area by books like Induction in Mathematics which really gave mathematicians some insights into how they work. Since we're working here in a multidisciplinary area, we really want to defend some of these educational areas. The certificate programs are very beneficial, but we have to get away from considering them. We're awfully optimistic if we expect success from ACM-sponsored certificate programs for people who are not basically ACM members and who are not computer scientists. I think the way to approach certificate programs is to start working with the American Hospital Association and the hospital administrator, who has considerable clout, to develop joint curricula there, and also possibly with the American Medical Association and the Association of American Medical Colleges. Some of the specialty institutions and groups such as the American Academy of Family Practice Physicians are quite oriented towards data bases, data principles, and I think joint certificate programs where some of the scientific input comes from the ACM would show a great deal of promise. But that's where people want to get their professional credits. They don't want to get them from the ACM.

Gerry Purdy . . .

They've got to have these continuing education credits anyway, so it makes sense to think in terms of jointly developed programs. I think Dr. Duncan emphasized this earlier. We have got to get cooperation from a number of professional organizations.

Gio Wiederhold . . .

In fact, I would tend to look toward smaller organizations that have more direct influence on the physician. I really think that the specialist groups would be more receptive than the AMA.

Roger Shannon . . .

Rob Roy (author of the Rob Roy Bill) was a representative from Kansas and active in legislation. He gave a mandate for physicians. He observed that the AMA was unable to respond to the general needs, because of its structure, of the two areas where physicians can participate: speciality organizations and invididuals who expouse their own cause. If he is correct on that, I think it's support for your perception and comments, Dr. Wiederhold.

Joe Brashear . . .

There exists a very large pool of resources. Somebody mentioned where the graduates from our programs might go, but consider for a moment where they might come from. The pool of resources is such that it could alleviate some of the problems we've talked about here today. This is, simply, the woman who is re-entering the work force. At the University of Minnesota in the Industrial Psychology Department, we've been doing studies on this group of people for the last couple of years. If you can recall that from about 1968 until 1972 or 1973, we had a fairly tremendous influx of female programmers into the profession. It was marked and noticeable in all the groups that I am concerned with. But from about 1973 up until quite recently there was also a marked reduction in the number of female programmers. It's a known fact that women still have two roles. One is in career and the other is raising a family. We're theorizing that a lot of these people have dropped the two roles, gone through their homemaker role, and are not ready to come back to their careers. So we have a group of people who have four or five years of programming experience, who are ready to come back to work, who are concerned about the fact that they've been out of the work force for a number of years, and know that they need retraining. Also, they might well be suitable for the health care computing profession, as opposed to industrial computing because they might start back to work part-time. I'd really like to see some work done in developing certificate programs or going out and actively recruiting the re-entering women for some of the Master's level programs that we've talked about.