Personal View:
Engineering Education in the Future

MIKE McMASTER
McMaster & Associates, Badgers, Bigfrith Lane, Cookham Dean, Berks SL6 9UQ, England

THE OTHER day, a well-educated friend was telling me of her shock when a school teacher she met on a walking holiday said that they no longer taught Euclidian geometry in school. The teacher said that it was 'old fashioned' and not relevant any more. Her shock was in discovering the distance between her own education and the current state of knowledge.

We are in the early stages of an evolutionary shift and our education is based in the previous era. This is as true for engineering as for any other field. We are not yet sufficiently shocked by the gap between our education and the current state of knowledge.

What I want to consider here is not engineering as a technology, which has probably changed equally dramatically (consider 'simultaneous engineering' of new products), but the areas of education that were left out as seemingly not relevant. It was not considered important to learn about communication, management, commitment, relationship or possibility—to create an incomplete list.

If you are asking yourself, 'What did these have to do with engineering?' then you can see the gap beween what is called for today and your education. Even if the relationsips are obvious, the advances in all of these areas have made obsolete most of what might have been taught. The advances are as new as the era of microprocessors, which is just beginning.

I once talked to a group of Silicon Valley engineers, who were heading a recent start-up making miniature disk drives, about doing communication and team work with their production employees. They said, 'The employees don't make any difference. It's the engineering and process design that creates productivity here. We only want people to do what they're told.' When I asked what they thought it would be like to work in a place where the management and professionals thought you did not make any difference, they decided to work with me. They passed breakeven for the first time in the following month—even after not receiving a shipment of blanks from Japan and having to do massive amounts of rework of previously scrapped blanks.

The thinking of these engineers, of a company in a modern 'high-tech' industry that is now an industry leader, matched very closely the statement by Frederick Taylor, the father of scientific management and creator of our production line approach, who said, 'Under our system, a worker is told just what he is to do and how he is to do it. Any improvement he makes upon the orders given him are fatal to success'.

The paradigm of engineering is based in thinking of Descartes and Newton, and our view of human beings and organization has also become based in that thinking. However, current thinking in physics, language and systems, to name a few areas, has created new models that are much more holistic and ecological. Modern technology, created by the microchip, has made old ways of organization and communication obsolete.

Let us consider what Michael Rothschild said in a recent book *Bionomics*. 'A firm's efficiency is constrained only by its technology, and its technology is limited only by its members' ability to work together as an intelligent, creative, learning organisation.'

The challenge to engineers is to be able to engage with new paradigms of organization, management and working with people that are contrary to the engineering paradigm. That is not to say that engineering has been overthrown but that its principles do not, in fact, apply to the whole world—particularly not to the possibility of human cooperation.

An organization is more like an organism or a rainforest than a machine or a zoo. The thinking that is appropriate to the latter does not work in the former. In fact, it is detrimental to health—of both the subject and the thinker.

We are in the most difficult of historical periods. We are in the transition from one era to another. We have learned to think in a machine age, we have developed management for a machine age, we know how to cooperate in hierarchical structures, we know how to do our isolated jobs. But we are moving into a microprocessor age where access to information, vastly increased communication with strangers and other disciplines, education levels and a population that has choice and is not primarily concerned with survival key features. The language, relationships and structures of the machine age will not suffice any longer.

The language that we speak, listen and think with, develops historically to match the cooperative demands of society in its technological age. We develop language to deal with the social questions created by our technology. These have changed dramatically. One of the main challenges of our organizations and everybody in them is to learn the language and processes of developing common intentions as a community (team, group) activity and then maintaining them until they are realized.

The largest challenge might be to develop the ability to create possibility and to be able to commit to something that cannot be proven in engineering terms. The most difficult, as well as the most challenging and exciting times, are when a new paradigm is replacing the old. Those that resist suffer; those that engage realize a new possibility for their own lives.