Changes facing the university: our mission and how we may fulfill it (Answering *Voltaire's Bastards*[1])

by

David R. Hill, PEng, Faculty Professor of Psychology,
Dept. of Psychology, University of Calgary, CALGARY, AB T2N 1N4
email: hill@cpsc.ucalgary.ca

ABSTRACT

This paper restates the mission of the university as being: *(1) to create an environment that ensures the acquisition of knowledge–based performance abilities by qualified students; (2) to create new knowledge and act as a knowledge source; and (3) to provide checks and balances against the indiscriminate application of conventional wisdom and political dogma, or the abuse of human values*.

The paper focusses on the first component. The other two components are a natural consequence of the first.

Knowledge-based performance depends on generative models of the world in which we must solve problems. It is contrasted with skill-based performance and rule-based performance, thereby clarifying the difference between *job training* and *university education* in a way that provides an operational template for setting policy, communicating with clients (students, corporations, the government, and the community at large), restructuring teaching, and understanding why research is inseparable from teaching.

The university is different from other post-secondary educational establishments because it has to be. It does a different job. Understanding what a university does and how it does it is vital to maintaining our focus and morale in times of change and fiscal restraint, while allowing society to understand why universities, above all, must be strongly supported into the 21st. century.

If you think education is expensive, try ignorance!

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1 *Voltaire's Bastards* is the title John Ralston Saul gave his book exposing the fallacies of our supposed "age of reason" that began with Voltaire. "Voltaire's Bastards" are the illegitimate ideas that now control our society under the guise of rational governance. The book is well worth reading as part of the background to understanding the current crises in society as well as the focus (or target) of this paper. (Rev1)

1 Introduction

1.1 The university's mission statement: what we actually do and how we can do it

The university's current mission statement is praiseworthy, but does not provide an operational basis for directing the university or explaining it to our various clients[2]. Our mission is "to seek truth and disseminate knowledge … with integrity and for the benefit of the people of Alberta, Canada and the world." We are "dedicated to the practice of scholarship which includes both teaching and research" on the grounds that: "Through research the university makes a direct contribution to society, and through teaching it prepares students to make their contribution." The statement goes on in similar vein, mentioning that we keep a critical watch on society, advance science and technology, foster the development of a variety of human endowments, and aim to balance excellence with practicality. We also assert: the right of the university to be independent from government direction; an obligation to the community at large; and the centrality of a liberal arts education, with special strengths to support professional education. Reasonable people can agree with such sentiments, but it never touches on the core of the matter—*what we actually do and how we can do it*.

There is a great variety of disciplines in the university. I do not advocate some kind of Procrustean straightjacket (actually Procrustes used a bed, but the end result was to try and make everybody fit a narrowly defined model); but in sections 2 and 3 I make concrete arguments that are relevant to generating a variety of teaching approaches, and to explaining the university to the world, in any discipline. The statement of what a university does can be used to set policy, guide the implementation of teaching strategies, and make a proper defence of the university as requiring distinct resources and treatment. The issue of job training *versus* (university) education is central to the debate.

1.2 Job training versus university education

I was amazed when one faculty member stood up in response to my remark at the U of Calgary *Changes* panel on 94-11-29 and said *he* didn't see any difference between job training and university education. It is a common view these days, but is very superficial and misleading. Job training implies a different focus and a more restricted regime than university education. The difference has to do with the specific kind of performance that results from training or education. Job training focuses on skill-based or rule-based performance in contrast to (university) education which focusses on knowledge-based performance. Practical consequences flow from this important distinction. The basis of the distinction is summarised in Section 2 and some consequences and implications for university operations are outlined in Section 3. Knowledge-based performance, its relation to other levels of performance, and how it is learned, are explained at some length because understanding these issues is crucial to action.

1.3 Errors introduced by over-generalisation

Any educational or training system aims to improve the performance capability of its principal

[2] Clients or customers, or some other term? Whichever term is chosen, students are not the only clients of the university. Students gain an education, but industry gains educated employees at disproportionately low cost as a result of the decreased corporate tax share; governments gain both employees *and* payers of increased taxes (plus an element of the infrastructure needed to support government plans); and society benefits generally from all these spin-offs. If our critics say students should pay dearly for their education because they earn higher salaries, we should insist that industry pays higher taxes for the highly educated employees with which they are supplied at heavily subsidised cost, and governments should deduct any fees paid by students from the students' subsequent tax bills. People seem to forget that society is a co-operative enterprise, and we *need* well educated professionals. Neither those who are qualified for higher education nor their parents should be asked to subsidise corporations or society at large. Raising children has enough strikes against as it is.

clients. In that very broad sense some people argue that there is no difference between education and training—they both aim to enhance performance in some activity. But this is precisely the problem with talking in generalities instead of specifics. If you make vague enough generalisations about goals, you can put things in the same category, and have an equally vague idea about how to go about achieving them. It is a serious mistake that I hope to correct in what follows.

I have provided extensive footnotes and some references as an aid to understanding the context for my arguments, and allow the reader to begin to dig deeper.

2 Categories of performance: skill-based, rule-based and knowledge-based.

2.1 Root of the differences between various forms of post-secondary education

The differences between various forms of post-secondary education are rooted in the *kind* of performance on which they focus. There is an excellent paper on categories of human performance and problem-solving by Rasmussen[3]. Alan Kay's video[4] also provides relevant views and concepts that provide background to the arguments I want to make.

According to Rasmussen, human performance can be placed in three broad categories: *skill-based*, *rule-based* and *knowledge-based.*

Skill-based performance is automatic, often "muscle-memory"-type performance. Touch-typing, riding a bicycle, or playing a sport are obvious examples of skill-based performance, but arithmetic performance can also be skill-based, instead of depending on the application of explicit rules. Skill-based performance is largely independent of conscious control or analysis, and is hard to describe or teach except by demonstration and practice. Indeed, thinking too much about what you are doing usually degrades skill-based performance. Training is most often carried out by coaches and craft schools and usually depends on an ability to communicate with non-verbal mentalities in the student (tactile, visual, …)[5].

Rule-based performance is most easily understood in terms of computer-based "expert-systems"—programs that carry out routine problem-solving and help people in their jobs. Expert systems are a sophisticated form of decision table system where *situation/conditions patterns* are paired with appropriate *actions* to be taken. Expert systems differ from decision tables in that they can explain *why* they take (or recommend that *you* take) a certain course of action by tracing the rules used.

The rules in a rule-based system encapsulate knowledge in a usable form, but can only deal with the kinds of problems that have been solved before. Limited generalisation involves recognising that a new situation is similar in relevant ways to one already known about; or recognising that an action can be modified if necessary and still be appropriate. Humans supply the rules used in expert systems.

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[3] Rasmussen, J. (1983) Skills, rules and knowledge: signals, signs and symbols, and other distinctions in human performance models. IEEE Trans. on Systems, Man & Cybernetics SMC-13 (3), 257-266, May-June (it is a hard read)

[4] Kay, A. (1987) "Doing with Images Makes Symbols": Comm. Media Video XMV-57442-01

[5] Tim Galloway's book *The Inner Game of Tennis* discusses such teaching. Alan Kay, inventor of SmallTalk—the first Object Oriented computer language, and father of the Macintosh computer—gives an brief account of Piaget's mentalities and subsequent developments in his video, amongst a lot of other interesting stuff on computers and learning. He also has a segment on Tim Galloway's ideas. Piaget talked in terms different mentalities during development, starting with a kinæsthetic ("doing and touching") mentality up to about age 7, a visual (image) mentality up to about age 12, and then a symbolic mentality (writing and equations) suitable for abstract reasoning. What many people do not seem to realise is that as a new mentality becomes apparent, the old ones do not die or become obsolete. These mentalities [and quite likely others] co-exist, and it is really a matter of which one dominates at a given time or stage. The abstract mentality is suitable for certain types of communication, but other mentalities are important too. Jacques Hadamard (the eminent mathematician) polled his equally eminent friends (100 of the top mathematicians and physicists of the day) to find out how "did their thing" in physics and mathematics. Very few claimed to use logic and symbols, and an amazing 30% (including Einstein) said they *felt* things. You could argue that this suggests genius is an ability to recapture childhood ways of thinking, but it is more likely that genius can simply access multiple mentalities at will, and use whichever is most appropriate for the purpose at hand.

In rule-based performance, the rules *directly* model the limited domain of expertise needed for task performance as situation-action pairs. This means performance is fast, predictable, but rather inflexible. Rule-based performance requires thought, but is routine. If you don't have a rule to deal with a situation, rule-based performance won't get you any further.

Rule-based performance forms the focus of training at trade-schools and technical colleges. It allows great competence at well defined, well-understood tasks to be achieved, but offers relatively little in the way of ability to generalise or deal with the unexpected. If the job changes, additional training will be needed.

Knowledge-based performance requires explicit knowledge of how the world works. This means it needs accurate dynamic, *generative models* of extensive parts of the real world and the ability to apply them. Significant knowledge-based performance has yet to be achieved by computers.

Generative models abstract the underlying *functional mechanisms*, as opposed to simply describing surface appearance. Generative models possess explanatory power, not just descriptive power. For example, the Copernican model of the cosmos was a better generative model than the Ptolemaic equivalent which itself was better than simply describing what was seen in the sky; and Einstein's model of space-time is better than Newton's. Modelling *behaviour* is not as powerful as modelling the *causes of behaviour*. Generative models model *causes*, with more or less accuracy and detail.

One goal of knowledge based performance is to increase the accuracy of the generative models that underpin it, whether they are models of the cosmos, engineering structures, atoms, human societies, corporate organisation, markets, artistic truth or whatever. Accurate generative models allow accurate prediction of outcomes and possibilities without requiring exhaustive experimentation, although tests/experiments on the real world may be needed to supplement and extend internal models as needed. These experiments themselves require insight and design (they also require knowledge-based performance). Generative knowledge, used as part of knowledge-based performance, allows the possessor to test theories about cause and effect and generate potential solutions in a problem-solving situation. It leads to the solution of problems that are not amenable to rule-based performance, and thence to the creation of new knowledge. Of its nature, this takes both time and considerable general knowledge[6]. The process can be learned by close interaction with others engaged in the same kind of activity, but a lot of generative knowledge has to be passed on as well. Also, both rule-based and skill-based performance provide part of the pre-requisite tool set

Over time, knowledge-based results may become abstracted to rule-based form (situation-action style rules), and even ultimately routinised to skill-based performance. Both these steps speed up performance but reduce flexibility. The eminent psychologist Paul Fitts distinguished three phases of learning a skill: the early or cognitive phase [knowledge-based]; the intermediate or associative phase [rule-based]; and the final or autonomous phase [skill-based]. These map almost flawlessly onto Rasmussen's categories of performance. Everyone surely remembers trying to drive before they had reduced driving to an autonomous skill. It is likely that all skilled performance began as an unsolved problem needing knowledge-based performance to begin to solve it, but it is also likely that not all performance can be reduced to the level of an unconscious skill. Creativity in any field requires knowledge-based performance, whether you are talking of arts, sciences, professional fields, or whatever. Performance at any given level usually requires abilities at the lower levels as support, and

[6] Thomas Sebeok, the eminent anthropologist, who gave a lecture in the Distinguished Lecture Series at the U of Calgary a few years ago, believes that the ability to model the world preceded our language ability (symbolic mentality), and that language came very much later as a way of communicating this inner faculty that had been so necessary for our descent from the trees.

will try to draw on whatever performance at the higher level(s) may be available. The lines are not as clearly marked as my simple account suggests. But the important question is where does the emphasis in teaching-learning lie for a university.

Acquiring the basis for knowledge-based performance takes longer than acquiring the basis for rule-based performance (but is far more flexible, even when imperfect). Acquiring knowledge-based performance skills requires a distinct learning environment in which knowledge-based performance is part of the regular scene. The difference between training and education (in particular university education) is that the latter focusses on teaching knowledge-based performance abilities. It is also important to remember that knowledge based performance, and the need to teach it, are not restricted to the sciences.

3 Focus of the university: teaching, research and other activities in the knowledge-based performance environment

3.1 The university focus

It is my strongly held opinion, that the main focus of university education is on the abilities, experience and resources needed for successful knowledge-based performance. This is why a university is special in the sense of needing faculty heavily engaged in research (knowledge-based performance), excellent faculty/TA-to-student ratios, and a generous time schedule. It is much more difficult and time consuming to pass on the generative models and abilities to engage in knowledge-based performance than the simpler models and abilities needed to engage in rule-based performance. When students are dealing with genuinely new knowledge, rather than practising on problems which are simply new to them (when they can be steered by more knowledgeable tutors), the time commitment is ultimately open-ended[7]. It is also more difficult and time consuming for faculty to devise suitable learning situations, and to keep up the practice in such performance that is necessary to be able to teach knowledge-based performance. Creating the mental gymnasium is not easy, but is highly rewarding to all concerned when successful, and very effective.

To teach *rule-based* performance skills one simply has to convey the set of rules needed for the task that will be confronted, and to learn how to identify situations and conditions correctly. Whilst decidedly non-trivial, dealing with rule-based performance is an easier process than teaching knowledge-based performance; it takes less time, and a different learning environment[8]. This is why trade schools and technical colleges are different from universities.

3.2 The university graduate's need for knowledge-based performance

It goes without saying that few university graduates will end up engaging in research *as commonly defined.* Only a a small proportion will become academics, enter industrial research labs, join think

[7] This is why PhDs can take so much longer than MScs, and MScs longer than undergraduate honours projects and why it is probably not such a good idea to place an artificial cut-off on the time to PhD completion. The requirement for pure knowledge-based performance increases with the level of the degree. It is also why I take great exception to the publish-or-perish regime in university research that leads either to a great deal of publication by people who have not yet managed to complete another piece of work worth publishing, which no-one reads, but which is used for favourable assessment. Or it leads to the replication of methodologies that do not break new ground, and could easily be done by technicians (in fact usually is), yet leads to "research" publications. It can even tempt faculty members into more serious abuses of the system. Einstein would never have sustained an NSERC grant, and you must have come across the joke about God and NSERC. This is just one of the insidious but dangerous attacks on the core of the university by "peers" who should know better.

[8] Though it would be untrue to suggest that such teachers never engage in knowledge-based performance. Knowledge-based performance is quintessentially human, but it requires effort, and can be greatly improved by appropriate tutoring in models and methods.

tanks, become creative artists, and so on; but a properly university-educated professional in any career post will be able to cope with ill-defined problems, unsolved problems, and the like, by coming up with workable solutions, based on their generative knowledge of their professional reality and their abilities to use it and extend it. They will then go on to formalise this new knowledge so that it is available to others as (rule-based) expertise. Not only does this allow them to handle role-specific problems appropriate to their specialisation and help create new knowledge, but it also means they are self-sustaining—they can grow with the challenges they meet, and they are able to cope easily with changes in occupation and environment. In this way, what a university teaches is indispensable for our whole society, if our society is to meet the challenges of change. University graduates certainly get "jobs", but their important skills are not specific job skills, rather their ability to deal with the world flexibly and innovatively, using their knowledge-based performance

As already noted, I have drawn stark lines and simplified my account. It is not as cut and dried—not as well partitioned—as I have outlined above, but it does characterise the point I want to make. A university does something radically different to what is done at other post secondary educational institutions, and requires a different regime, better facilities, plus a wide variety of activities and support that to superficial examination do not seem to impinge directly on teaching responsibilities, yet are truly vital to a university discharging its primary responsibility. This is not necessarily because the faculty or students at university are "better", but because they are tackling a different goal. Research activity is essential to providing a functioning university-level learning environment, quite apart from its role in creating new knowledge directly.

3.3 Implications for teaching, community involvement, research; and their relationships

A university environment doesn't work if faculty and TAs are maximising the time they spend standing in front of a class presenting standard lectures, having had their research support cut, their creative time stolen, and their contact with the continually blossoming problems of "the world out there" cut off[9]. It is important that faculty have the time, the resources, and the practice in creative problem solving needed to be able to make an environment where students learn knowledge-based performance abilities. University lecturers (what an unfortunate misnomer) must be actively engaged in research, able to create challenging new problems within the student's growing abilities, and able to fire up some enthusiasm in the students. Enthusiasm is needed because knowledge-based performance is hard work, requires prolonged concentration, and involves an open-ended time commitment[10]. Most people

[9] Senator Barry Prendergast called for more follow-up with employers on the part of the university. I agree that this is an important part of real-world contact. I have certainly done it myself. Contact with the local community is also a component of technology transfer—something I have spent a great deal of effort on. Those academics who regard commercial involvement as anathema should not have their noses rubbed in it. However, they should not be allowed to prevent it either. With suitable guidelines and encouragement, technology transfer can open up important avenues of community contact and feedback, as well as improving the ivory-tower image of the university, and speeding up the flow of new ideas into local and national enterprise. When our new president first arrived at the university and met with departments, I pointed out the invidious position that those engaged in technology transfer are placed in. I am now more convinced than ever that it is almost a case of you are damned if you do, and damned if you don't. The university needs to find a way of integrating such activities into normal university life so that those who do and those who don't both find the arrangements acceptable, without compromising what most call "scholarship" but what I might also call "exercise in a knowledge-based mental gymnasium."

[10] Commander Grace Hopper (inventor of and leading expert on COBOL) told how the US Navy implicitly used the rule-based *versus* knowledge-based performance categorisation in their ship-board repair/replace equipment policy. If a failed piece of equipment could not be repaired within 2 hours, it was thrown overboard and replaced with a working spare. This was because once 2 hours were up, experience showed that the time for repair was completely open-ended. Two hours were enough for technicians to exhaust their rule-based strategies for repair. Once this occurred, they had to cope with the problem using such knowledge-based strategies as they had acquired. Whether or not they had the required abilities, it was cheaper to replace the broken equipment than to try to fix it. This became an issue only after equipment costs fell, compared to the early days when a computer might cost $2M. One of the first expert-system-based computer tutors, SOPHIE (an electronics technician tutor) used exactly this kind of rule-based electronics expertise in its tutoring approach.

acknowledge this problem for graduate work, but the same problem arises in undergraduate work. Undergraduates may not engage in knowledge-based performance all the time, but they must do so for enough time that they gain confidence in their ability to do so successfully. In such a regime, credit must be given for the right *approach* as well as for the right solution, because the approach is more important than the solution of any specific problem when approaches are what you are trying to learn.

Marking and tutoring become very important in this kind of model of a university because knowledge-based performance is best learned from a practitioner. It is a tragedy of modern education that there is so little small-group contact between most of our faculty members and the undergraduate students, and that marking is seen as a grading exercise rather than a teaching strategy. When I was an undergraduate, I sat in large classes for lectures, but I worked in small groups on practical problems, and I spent a great deal of time trying to solve problems I had not met before, and meeting with a tutor in the context of my successes and failures. I do not agree with the way some tutorials at the U of C are run, where a TA subjects students to yet more lecturing. Lab and tutorial classes should be small, and attendees should have worked on problems (whether artistic, scientific, professional, or whatever). The TA should tutor very small groups on their successes and failures. Ideally students would also meet for an hour or two a week—in groups of 2 or 3—with a senior researcher or faculty member in their discipline, to talk about their problem-solving efforts in general (rather than on a course specific basis). Carefully executed marking, with tutorial comments, is also valuable, though time consuming for the marker, especially when dealing with artificial notations such a mathematics or computer languages. *It would be better to have far fewer formally assessed course components*, but make sure they are done with individual effort, and fully and properly commented. Small group contact is one strategy to help in this.

The teaching style is important. Lecturing should not be a passive process, and requires planning, and a certain flair. I am convinced that good lecturing is a branch of the dramatic arts. If you do not capture a student's attention, you are wasting your time. As Tim Galloway puts it, "Learning occurs when attention is focussed." Formal lectures have some place in the scheme of things, as they are a very efficient way of signposting some areas of formal knowledge needed by the students, but they are not a panacea. Good students should be able to acquire the same kind of material from good texts, which in any case provides the kind of detail that *all* students need *as a supplement to lectures.* No-one should expect to give or receive all the formal knowledge background needed in the lecture theatre. The inability of many students to gain information by independently reading texts shows a serious lack of preparation that I have heard commented on by many faculty, and have been all too aware of in my own classes.

The lecture provides the bones of an area, the flesh and everything else is acquired through *reading*, *problem solving* and *practice*, preferably under the direction of a tutor who already has the skills the student needs, but refrains from using them to solve the student's problem's *directly.* With enthusiastic, knowledgeable teaching, most of the learning will occur outside the lecture room as students work on problems. I would like to see entering students given a short course on what a university is trying to do, how it is trying to do it, what students should expect, and how the students should organise themselves to achieving the mutually desirable goals. Learning at university is a step beyond being taught at high school, and the differences, advantages and disadvantages should be spelt out. This could avoid many misunderstandings, and give a much more solid basis for student evaluation of courses and lecturers[11].

[11] Student evaluations have other problems too. Students, especially those lacking experience, may not be the best judges of all—or even any— aspects of a course, for many reasons.

The creation of interesting, engaging appropriate problems, and steering students through their creative solution, is one of the more difficult tasks facing a faculty member. When it is appropriate, setting some practical task is likely to raise the required ill-defined and unsolved problems[12] in the course of its execution. This is a strategy I have used very successfully in fairly large enrolment classes at the third year level (e.g. the Human-Computer Interface course) and especially in smaller enrolment classes for final year students. Given the right kind of problem environment, with their interest aroused (likely by allowing the students to define their own projects, or by proposing intrinsically interesting problems for them to choose from), students learn at an incredible rate, and usually end up teaching the faculty member a thing or two. But the faculty member must be intimately involved, which takes time.

Summary: if faculty members are doing research—it almost doesn't matter what sort of research—they are involved in knowledge-based performance all the time. This provides examples to students, keeps the faculty in practice, and generates new knowledge at the same time. It can also motivate students if its relevance is made specific (as it can be during the introductory short course to the university, using the knowledge-based performance model as justification). If you cut out research, increase class sizes, reduce the support staff, eliminate the capital budget, eliminate or denigrate contact with the community[13], and demoralise faculty, you have destroyed the well springs needed to sustain a university in its primary function. To produce graduates capable of knowledge-based performance, you require a ferment of research, smaller classes, excellent facilities[14] (in which the best undergraduates can be involved through part-time work and senior class projects), and excellent support staff who subscribe to the methods and goals of the university. In addition, the community at large needs to realise that faculty members are not on holiday from mid-April to mid-September, nor do they work only a 9 hour week!

4 Concluding remarks: a revised mission statement; elitism, excellence and gatekeepers

4.1 A revised mission statement

If you want action, and the achievement of agreed goals, the goals have to be concrete. I feel very strongly that a mission statement like "Create an environment that ensures the acquisition of knowledge–based performance abilities by qualified students" is far more concrete and realisable than "[prepare] students to make their contribution" since we have some fairly clear ideas (in terms of richness of environment, student-staff ratios, teaching-learning style, etc.) on how to achieve the first mission. The form of the solution is explicit in the mission statement, which also says something about entry requirements. How can you teach students at university level if they are not adequately prepared, at least in terms of basic literacy and study habits?

[12] Unsolved as far as the student is concerned, that is. One difficulty is that last year's problems soon get known by this year's class, and (at best) solutions by rule-based instead of knowledge-based performance appear. Keeping good, potentially solvable, new problems flowing is difficult, which is why the project oriented solution may be a help. Even when the problems are similar, the context is different, and monitoring the means of solution becomes easier. The same problem arises in examinations, of course, where it may be more difficult to deal with.

[13] Or simply fail to reward contact with the community. Technology transfer, whether scientific, artistic, or business oriented takes a great deal of time. Many faculty think it endangers "scholarship", but so can building a summer cottage. Contact with the local business, industrial and government communities can be a great source of ideas for new knowledge creation needs—i.e. research. It does not have to become crassly commercial. Because of the ivory-tower bias, however, faculty who engage in such contact are often denigrated and certainly not rewarded. The actions taken can be quite subtle and quite devastating.

[14] It is an interesting fact that students in computer science encounter far better facilities for their personal use when they get into their first jobs than were ever available at the university. This says something about the problems of keeping up in a rapidly evolving field like computer science—a field that has been supported quite generously by the university. Without an adequate equipment budget, I shudder to think what the future holds, and I am sure other disciplines must be similarly placed.

However, this simple formulation fails to emphasise two further vital components of our mission. Although they flow naturally from the first, it is important to make them explicit. Taken together, the three components capture the essence of the existing mission statement, but also provide a concrete basis for action. I therefore propose the following:

> *The university's mission is: (1) To create an environment that ensures the acquisition of knowledge-based performance abilities by qualified students; (2) to create new knowledge and act as a knowledge source; and (3) to provide checks and balances against the indiscriminate application of conventional wisdom and political dogma, or the abuse of ethical human values.*

This paper focusses on the first of these components because of the connection and for reasons of space, not because there is any difference in importance. I don't mention excellence, because excellence is a *sine qua non* of ethical activity, which is covered by the third item.

Elitism, excellence and gatekeepers

In conclusion, when I say that we need to educate, not train, I have in mind the knowledge-based performance goal for our graduates, because I am sure that is: (a) what distinguishes a university from other post-secondary educational institutions; and (b) why university graduate may not have *immediately applicable job-specific skills* the day they graduate. However, the capability for knowledge-based performance explains why university graduates are, in the long term, an indispensable investment for a company and a country. They are adaptable, knowledgeable, innovative, and can solve problems in ways that more narrowly trained graduates are less well equipped to deal with[15]. Some of the best will go on to teach in universities, hopefully after they have gained some experience of the world[16] together with an understanding of the real value of knowledge-based performance.

I hope that my arguments provide concrete ideas for explaining the difference between education and job training to those who see no distinction. My point is not elitist, but rather an attempt to focus on what I regard as the core issue in guiding the university through the changes leading into the 21st. Century. But while on the subject of elitism, I should say that we need gatekeepers. If we seek excellence, we have to be prepared to distinguish excellence from adequacy. We have to provide incoming students with some guidance on what we are trying to achieve (knowledge-based performance), how they should approach the university learning environment, and what our expectations are[17].

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[15] People in general undoubtedly use some degree of knowledge-based performance all the time, but the university graduate is specifically directed and educated towards the use of these skills, or should be.

[16] I think it is a great pity that there is not a requirement for faculty members to spend some years in the work force before being allowed to teach at university. This seems to be to be just as valuable as gaining a PhD or equivalent, though it may be very different. It would dispel a lot of the mythology about town versus gown, and greatly facilitate communication and mutual respect. I don't expect all my university colleagues to agree with this view, as it is a very emotional subject. But isn't this part of our problem? Are we so uncertain of our mission that we feel it will be compromised by fraternising outside our own community?

[17] I do not think, for example, that it does any service to our graduating students to set up a system that leads us to tell half of them they have won degrees with distinction. But that probably merits another study.