Myths and Realities in Education and Research: the problem of knowledge and judgement in democracies

Dr. John S. Cowan
Principal, Royal Military College of Canada

I think it was very courageous of you to invite an academic to speak to you at lunch time. You know, of course, that all academics are conditioned to talk in 50-minute blocks, and to try to stuff in 90 minutes of material. Fortunately, the antidote to that is the military cultural imperative to stay on schedule, so you probably won't have to sneak out the fire exits.

I'm very honoured to be asked to give the W. B. Lewis Memorial Lecture, and I feel that way for at least three different reasons. First, we live in an odd time, when large numbers of otherwise logical folks have become inappropriately sceptical about the possibility of progress through science. Such a view would have been anathema to Wilfred Bennett Lewis, who never lost confidence in the ultimate benefit to humankind of advanced scientific knowledge. I share that opinion and delight in the fact that you honour his memory. Secondly, I am honoured to be counted amongst the ranks of the erudite crew who have carried out this annual task for you since 1988. And thirdly, ever since I first visited Chalk River as a young undergraduate physics student some 44 years ago, I have been convinced that the Canadian approach to nuclear power made more inherent sense than the approach of other nations. Both geopolitical and environmental events of recent years have strongly reinforced my original biases.

I am pleased to bring you greetings from the Royal Military College of Canada. RMC is Canada's only military university, and is Canada's only federal university. As such, we are a walking constitutional crisis, or so it might seem, until one discovers that we were created in 1876 under part 91.7 of the Constitution Act, the part which deals with defence of Canada, and not under part 93, which deals with education and is provincial. We do grant our degrees via an Ontario act passed in 1959, and so we adhere, voluntarily, to all accreditation systems used by Ontario universities. Some 43% of RMC's full-time undergraduates become engineers. But we are also very graduate studies intensive, and grant one masters or Ph.D. for every two undergraduate degrees, a ratio unmatched by any other Canadian university. About 15% of our graduate students are civilians with no connection to defence. The average faculty member at RMC attracts over $130,000 a year of extramural research resources, or about the same as faculty at Waterloo. And RMC is one of the few Canadian universities offering degrees in nuclear engineering.

Faculty at RMC have academic freedom, and seek extramural support wherever they wish. And yet most of them choose to do at least some research which is defence relevant. So you would think that the institution would have a strong bias towards very applied research and would show less interest in basic research. Fortunately, this is not the case, and fundamental research remains strong at RMC. And this leads me to my first substantive observation, which is a caution against underestimating the extent and the

alacrity of the impact of basic research on real human progress, and exaggerating the anticipated impact of certain projects of applied research.

Since I work in a military setting, in my world this debate often centres around the so-called Revolution in Military Affairs (RMA). We are in the midst of an unprecedented accretion of knowledge, covering almost every field of human endeavour. Increasingly apparent is the constant interplay of the entire range of advances, from the most fundamental discoveries to the most specific applications. Today there is broad consensus that the RMA is a natural consequence of the knowledge explosion, writ large. But this realization that you can't just order up RMA by issuing a development contract is relatively recent.

A third of a century ago the United States Air Force, in a deeply flawed study called "Operation Hindsight", concluded that the momentum for critical advances in applied technology was the result almost exclusively of applied research and development. The authors claimed that the technological revolution, and RMA owed little or nothing to fundamental, or curiosity-oriented research, which, according to them, normally had no practical use for at least 50 years.

Doubting the conclusions of that study, two great American medical scientists, Julius Comroe and Robert Dripps, conceived and executed one of the first large-scale research studies on the subject of research and discovery itself. Focussing on fields they knew, they undertook to learn what were the real antecedents of the 10 most critical practical advances in cardiovascular and pulmonary medicine of the period 1945-1975, including things we now take for granted, such as heart-lung machines. The international panels they conscripted eventually identified some 1500 seminal discoveries which led to those ten critical advances, and followed the trail of discovery as far back as Andreas Vesalius, the famous Flemish anatomist who taught at Padua in the 1540's and Hieronymus Fabricius of Padua, who discovered the valves in the veins some 60 years later. They also identified 112 critical enabling discoveries, which they called "nodal points". And that is where it got interesting.

Comroe and Dripps discovered that over 40% of the nodal points were pieces of basic, curiosity-oriented research, and another 20% were discoveries made during applied research projects which had been intended to yield completely different results for other purposes.

Furthermore, they found that the time lag from basic research discovery to the practical application was sometimes very short. In almost 10% of cases it was less than 12 months, and in 20% was less than a decade. Their findings debunked "Operation Hindsight".

Their widely disseminated, rigorous reports transformed official attitudes in the United States, and were a significant factor leading to the last 30 years of massive publicly funded support for fundamental research in that country, and by imitation, in Canada. Hence they are among the many accidental parents of RMA.

I first spoke about these ideas almost five years ago, when RMC conferred an honorary degree on Dr. Art McDonald, a distinguished physicist who is a key figure in the creation of the Sudbury Neutrino Observatory. At that time I not only alleged that his work and that of his colleagues was fundamentally transforming our understanding of matter, and of how the universe works, but I also went out on a limb and said that while I could not predict for that audience what the impact of his work would be on their professional lives, I thought it highly likely that some overwhelming practical consequences would be felt within their lifetimes. I still think that is true. I still believe that we must take the widest possible view of research if we are to sustain progress in the long term.

But since the title of my talk is "Myths and Realities in Education and Research: the problem of knowledge and judgement in democracies", I now need to link that hypothesis of breadth in research to a similar suite of issues in education, and to tie them to some concerns about democracy.

The word "Democracy" has been getting quite a workout lately, much of it resulting from the world's most powerful democracy proselytizing pretty hard for its particular variant. But while there are many forms of democracy, some more direct than others, some more secular than others, some with broader franchises than others, with widely varying constitutional frameworks and checks and balances, they <u>all</u> are forms of collective decision making.

Democratic forms don't always produce the right decision, and they frequently fail to take timely decisions, but at least we're masters of our own fate, and we do continue to hope that the choices made by the majority have a reasonable chance of being good decisions for the great majority. And they probably will be, if that majority has a clue.

It is hugely popular to fret about the health of democracy. Not too surprising, as we observe low voter turnouts, cynicism about political choices, and oversimplification or outright misrepresentation of important issues of public policy by both representatives and media.

Meanwhile, the issues get more difficult. All politics may be local, but the last century of scientific and social change has guaranteed that the problems to be solved are neither local nor simple. Indeed, even the issues highlighted in a single election usually span most of human knowledge, including both the scientific and technological disciplines and the humanities and social sciences.

It is all the more frightening then, that it has become fashionable to know a great deal about a single field, but quite unfashionable to have a solid basic grounding in many. How did this fashion come into being?

Since the end of World War II, North Americans have witnessed an explosion in higher education. Once the province of a privileged few who were either wealthy or especially talented and determined, university attendance steadily grew to the present state of

affairs, in which it has become a near-normal expectation for those who finish high school well.

Along the way it went through phases. In the 1950's, degrees were few enough that possession of one, regardless of field of study, was usually a ticket to a better than average economic future. But during the 1960's we saw the first signs of a clear shift towards a noxious mythology that holds sway in many quarters today. It appeals particularly to folk who describe themselves as "pragmatic".

This odd dysfunctional mythology rests on five false assumptions made by governments, and by many parents and students about the taxonomy and purpose of higher education:

1. A specialized technical, commercial or professional education which provides immediate access to a good job is the main reason for going on to higher education.

2. Such education is more desirable than a less marketable one, but is also inherently more difficult. Fortunately, since it is preferred, the competition to get into it is fiercer, and so the entry standard is appropriately high.

3. For those who feel especially driven towards one of the other less practical disciplines, intense specialization in it may be acceptable, as one can always work as a teacher and scholar in that discipline, in which case the rest of society will support you, albeit grudgingly.

4. A liberal education consists of a buffet style selection of the humanities and social sciences. It is good for something, in that it makes you a well-rounded person so you can enjoy the world around you more and think beautiful thoughts during your leisure time.

5. Since a liberal education is not good for getting a job, it is good choice only for the slightly less energetic children of the well to do whose families can afford to support those beautiful thoughts. Others, however, may pursue a liberal education while still finding themselves, provided that they then move on.

The holder of a so-called liberal education is therefore viewed as rather a dilettante, and the primacy of specialized, professional education as the real higher education is reinforced.

One small but delicious irony about that most coveted specialized program, medicine, is apparent when one recalls that, despite the association of medicine with great European universities of the 16th and 17th centuries, in North America, medicine made its way into the universities and respectability largely after 1900 (or post Flexner) and engineering in the UK more recently still.

But the myth of the impractical, beautiful, self-indulgent liberal education is persuasive only to those who know little of the past and think little about the future.

In the Middle Ages, the pillars of liberal education were the subjects of the trivium and the quadrivium. The trivium of three logical and linguistic disciplines, which were grammar, logic (usually called dialectic) and rhetoric, formed the basic platform, sort of the BA of medieval times. The quadrivium of four mathematical disciplines, which were arithmetic, music, geometry and astronomy was the advanced program, more or less the MA of its day. These more advanced subjects were not viewed from a theoretical perspective at all, but rather were taken as descriptive of and explaining the actual world.

There was an eighth core subject implied but not stated, and that was the second language requirement, a concept familiar to Canadians. In the Middle Ages, that second language was Latin, as all instruction, spoken and written, was given in Latin. University students were required to speak Latin when not in class as well, with penalties for failing to do so. Of course, the Latin of the later Middle Ages developed vocabulary and phrasings unknown to the Roman Empire as it struggled to keep pace with progress, just as language does today.

These were the "liberal arts"; they were so heavily laced with mathematics that it makes one chuckle to think of the occasional modern student who flees to the mistaken modern notion of the liberal arts because of a fear of math. The trivium and the quadrivium were called the liberal arts because they were viewed as the minimum suite of subjects necessary for "liberi" – "free men". This is an important concept, that there is a broad educational requirement for those who would be free, and that there is a way of defining what that reasonable minimum might be.

We speak easily of living in a free society, but have given little thought to what the citizenry of a free society need to know to meet their obligations. Indeed, society is so free that individuals are free to know nothing, while still having an equal vote and an equal say in our affairs of state.

So what risks do we run by accepting the primacy of specialized, professional education? In some ways we don't know, as we haven't run the experiment all that long. The scientist was also a natural philosopher and often an artist not only in Leonardo Da Vinci's time, but right up to the dawn of the 20th century. Until that point, we placed a very high value on knowing a reasonable amount about almost everything. The idea of the Renaissance man or woman as the epitome of education did not end with the Renaissance, but it may have died on the battlefields of the First World War.

Now it may be that we will be lucky, and can just barely muddle through as a free society with a citizenry that largely hasn't a clue, except in a narrow domain. After all, the World Health Organization survived Mel Lastman's surprise at its existence, and Stockwell Day was ultimately unsuccessful in reversing the flow of the Niagara River. And while most Canadians still do not understand the first language of most Quebeckers, the fraction that does is clearly on the rise.

Furthermore, people like to learn broadly, and will do so on their own, given half a chance. They take pride in knowing something that others may not, and the popularity of

the television show “Jeopardy” is not just because of one slightly jug-eared wildly successful contestant, but because an enormous fraction of the viewers try to beat the contestants to the answers. Somehow, viscerally, knowledge matters.

This natural desire to know things, right down to the smallest detail, is enormously valuable in a democracy, a society committed to collective forms of decision-making. For any collective decision-making process to produce good decisions, many of those participating need to have a reasonable grasp of the facts of the matter at issue, and at least some of those who are knowledgeable need to have access to the tools used to communicate with and persuade others.

But, despite the communications revolution, in some ways the flow of real information in Canada on questions of public policy is drying up. This is a grave threat to any functioning democracy. And it’s related to some disturbing trends in dissemination of news in Canada.

There are multiple causes for the remarkable dumbing-down of the media in Canada over the past 40 years. Some of the obvious reasons are the need to compress complex issues into 10—30 second sound bites and the narcissism of portions of the media who report incessantly on themselves. But the less obvious cause is our failure to provide a liberal education designed to foster good judgement. Most journalists are neither literate nor numerate, and do us the huge discourtesy of assuming we aren’t either.

Interestingly, one crucial flaw also relates to market size. As critical as we are of US media, one can find some thoroughly brainy specialized commentary in the US. This is because it is a huge market, so that through syndication a journalist actually can make a living understanding issues in economics, or science, or geopolitics. But not here: in Canada, you are the science reporter the week after you were the society reporter, and the week before you are the constitutional issues reporter. Generalist journalists know that they haven’t the time to learn enough to deal with the full complexity of the issues, so they fall back on the double-barrelled stock in trade of any articulate journeyman, human interest and scandal. Hence all Canadian news is covered as human interest or scandal.

Furthermore, major studies have shown that when they do reflect the real complexities, their editors dumb it down or declare the story not interesting. The ill-informed editor is a well-documented Canadian paradox.

The situation is exacerbated by a fad taught in our journalism schools, which I call the “interior decorator” style of journalism. Have you noticed of late that the key facts are not at the beginning of the article? You need to read at least two thirds through it to find out what has happened or who was charged with what. The first part of the article is all about the feelings of the reporter or the relatives or bystanders, or about the general setting of the story. This forces you to read the continuation, on page 11, so that you will appreciate the true effort of the writer, or at least see the advertisements on that page.

Or perhaps you recall years ago that when one of our leaders gave an important speech, the Globe and Mail would print it. That would never happen today. Too grey and forbidding to have all that text. Better to interpose an egotistical columnist, who will emote upon what he or she thinks you (the public) would have thought of the speech, if you had ever gotten to hear it or read it. What ever happened to the concept of "newspaper of record"?

Or contrast the CBC television news with the BBC equivalent, which is full of hard news. The CBC version is half filled with the opinions of reporters and pollsters, which is the high point, because during the other half they show scenic postcard views or stick microphones under the noses of whatever slack-jawed gum-chewing vagrant they can find on the street to ask them what they think about dollarization or arms control or equalization payments.

If perchance they should stray to a science or medicine story, please don't expect anything better. Drugs, diseases, and chemical compounds will be alluded to without actually giving their names (unless they are already widely known) and scientific papers will be cited without actually giving a précis of the published findings. You can just imagine a story on nuclear power generation, as they would assume a moderator should be chairing a panel of talking heads, and enrichment would be somehow related to "Adscam".

But if the media give new depth to the word "shallow", what about our leading politicians? I've known many of them, and certainly some are genuinely impressive.

Just imagine an election campaign debate in which unelected journalists didn't participate, and didn't interrupt our representatives every 30 or 60 seconds. Imagine the people we might elect debating each other in long enough blocks to be coherent, and on subjects which they think we might wish to hear about before judging their fitness to govern. Contemplate the possibility of political discourse not pushed through microcephalic filter of some ill-educated but firm-jawed stage prop of a newsreader.

We might get political discourse appropriate for a free people, and, by chance, some listeners would have the "liberal" education to assess it properly.

At RMC, however, we knew we could not leave liberal education to chance. H. G. Wells described the history of humankind as "a race between education and catastrophe". Nowhere is this truer than for the modern profession of arms.

On the one hand, the public in the developed world have come to view any significant failure of judgement within the profession of arms as a genuine catastrophe. We would be profoundly unwise to dismiss this as merely anti-military bias and an appetite for scandal. While those factors may amplify that perception, the perception itself is inextricably tied to the increasing importance of human rights issues in both domestic and foreign policy throughout the developed world.

On the other hand, the remarkable acceleration of technological change and the growth of knowledge have the potential to be a vast multiplier of the effectiveness of numerically small forces. This is part of RMA, the Revolution in Military Affairs. But it also amplifies the need for complexity of thought and maturity of judgement to avert catastrophe, and drives that requirement further down the chain of command than ever before. Complexity of thought and maturity of judgement are the product of strong education, and its application to the interpretation of experience. Indeed, while experience is important, experience without education is a form of tourism.
(By that I mean that it has the passive characteristics of tourism without prior education. Such tourists are not expected to transform the settings through which they pass. And they are always surprised.)

So coping with RMA, transformed forces and the "three block war" is almost impossible without advanced education.

Traditionally, of course, in the CF, some education was viewed as a "nice to have", but training was viewed as the real antidote to catastrophe. Today, when a young officer may be called upon to be a skilled leader, a technical expert, a diplomat, a warrior, and even an interpreter and an aid expert, all at once, there is no question that good training is not enough. Skills are not enough. The job calls for judgement, that odd distillate of education, the thing which is left when the memorized facts have either fled or been smoothed into a point of view, the thing that cannot be taught directly, but which must be learned. Without the mature judgement which flows from education, we fall back on reflexes, which are damned fine things for handling known challenges, but which are manifestly unreliable when faced with new ones. And there will be new ones.

From November 1997 until June 1998 a small committee chaired by Gen Ramsey Withers studied RMC and planned for its future. At that time I was Vice-Principal at Queen's, and as one of the members of that committee, I never imagined that I'd be the one to have to implement the recommendations in the report I co-authored. One of those recommendations was for a vastly altered core curriculum. This core is a suite of subjects deemed essential for officership in the 21st century.

The list was not arrived at in the customary university fashion, which is to say by assembling the collective biases of the committee members. Instead, and in the grand military tradition of rigor tinged with bureaucracy, we returned to the then current version of the Officer General Specification (OGS), and tried to determine from the list of required competences what studies would get us there.

Once the Minister had approved the recommendations of the Withers Report, the Board of Governors of RMC struck a committee to rewrite the undergraduate curriculum to comply with the requirement to enhance the core curriculum. While still at Queen's, I chaired that Core Curriculum Committee of RMC and drafted the revised undergraduate curriculum, which the Board approved in March of 1999. The report did not argue for one size fits all. It mandated a common suit of core minimum competences, but not everyone would use the same courses to get there. The minimum math competence, for

example might be a year long course in Arts Division, but might be met halfway through the first math courses for science and engineering. A common minimum, but different slopes for different folks. Similarly, the Canadian history course was twice as full for Arts as it was for engineers. The one for engineers was the minimum, and Arts students probably needed even more for the follow on aspects of their program.

The new undergraduate core curriculum was implemented for first year in September 1999. The first class that got all four years of that curriculum graduated in May 2003. Already the Chief of the Defence Staff and other senior officers tell us it is making a difference. Under this curriculum all officer-cadets meet minimum standards in those core subjects viewed as essential for officership, specifically: ethics, psychology, leadership, Canadian history, Canadian civics, politics, law, military history, international affairs, cross-cultural relations, mathematics, logic, information technology, physics, chemistry, English and French. On top of that, they do their specialized component, whether it is electrical engineering, French literature, economics or whatever.

Of course, it makes the academic portion of an RMC degree a bit long, but it has been always thus. An honours arts or science degree at RMC has 5-17% more course credits than at a good civilian university, and an engineering degree about 10% more course credits. But this is unavoidable if the needed breadth is going to be there, while still getting the specialization that society has come to expect. What is interesting, however, is that the students can do it, even while meeting the substantial demands of the required bilingual, sports and military components of the program.

You may note that, from time to time, we are criticized by the uninformed for not providing a liberal education. And our graduates are not dilettantes because they got exposed to greater breadth. Sometimes I wonder if the pressures for narrowness in the typical modern university don't come from the scoring system for faculty rewards. Promotion criteria for professors and the kudos of the learned societies are sometimes distorted to specially reward narrowness. I note with distaste that some literature departments only count the writing of criticism as real research, while creative writing, no matter how widely disseminated and how erudite, counts for nothing. How ironic that Professor X could get no credit for writing a work that Professor Y could get promoted for analyzing. At RMC I have insisted upon a wider definition of scholarship. My own personal experience leads me to doubt the practice of only recognizing the narrow focus. I've had research support from all three of the federal granting councils in my life, so that would brand me a dilettante in the eyes of some colleagues.

The RMC core curriculum is the modern equivalent of the trivium and the quadrivium, so much so that, for example, the minimum physics requirement can be met with the ever-popular course on the physics of music. We didn't get there from nostalgia or from someone's pipe dream. We did not get captured by a philosopher with a hankering for the Middle Ages. We got there by working backwards from what we needed on the ground in the Balkans or Afghanistan, on ships engaged in blockade, and in air operations around the globe. Strange as it seems, the subjects needed to be truly free are pretty much the same ones needed to defend freedom in an ethical manner.

Liberal education works. It is not just the humanities and social sciences. It is not just to think beautiful thoughts. It is not just for the idle rich. It is not second-class education. It is what helps people make good choices. And it is the collective making of those good choices that will determine our collective future, and our persistence as a free people. So in effect, it is what makes us free, and it is what keeps us free.