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Chairman Présidente

Notes for an Address

to the

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Economic Council
of Canada

Conseil économique
du Canada

I am grateful for the opportunity to take part in this very timely discussion.

The Economic Council of Canada has turned its attention frequently to the subject of education. In fact, we are now in the late stages of a study of education to be published next Spring. In this overview presentation, I will be drawing on some of the results of that work and also on the results of the International Mathematics and Science Studies, which Council researchers have standardized to make the comparisons with other countries valid.

I will look at what those studies tell us about Canadian education. I will then discuss the implications of these findings for the Canadian economy and set out some questions for your workshops. I should say at the outset that the education system has strengths as well as weaknesses. The topic you have asked me to address today leads me to focus on the weaknesses in achievement and in participation of women. I will have to use another forum to give more attention to our areas of strength.

The link between education and economic success is talked about so much that we may have convinced ourselves it is clearly recognized. I am not at all sure it is. Old attitudes do not collapse abruptly, they do a slow fade. It was not all that long ago that there was still a significant role for workers without much education and training. Now, we have a hard time finding jobs for people who are poorly educated, and we know that these people face a lifetime of economic insecurity -- low incomes, frequent spells of unemployment, and limited chances of ever owning their own home.

My guess is that many Canadians are confused. On the one hand, the academic stream in the schools with its goal of reaching postsecondary education seems the best way to go. On the other hand, many students fail to meet the academic requirements and either drop out or finish high school with no real skills.

When you look at the track record of modern industrialized nations, you find a strong relationship between economic success and innovative use of technology. Competitiveness is built upon the knowledge and skills of employers and employees.

In this kind of environment, obviously, a competitive Canada means a Canada with an educated, well-trained work force.

Education is a cumulative process. The end products are the scientists, engineers, technicians and other skilled people emerging to take their places in Canadian businesses, schools, hospitals and offices. But their success reaches back through secondary institutions to kindergarten and nursery school and even further to early childhood experiences. You can't get good scientists, if the children in Grade 3 did not learn fractions.

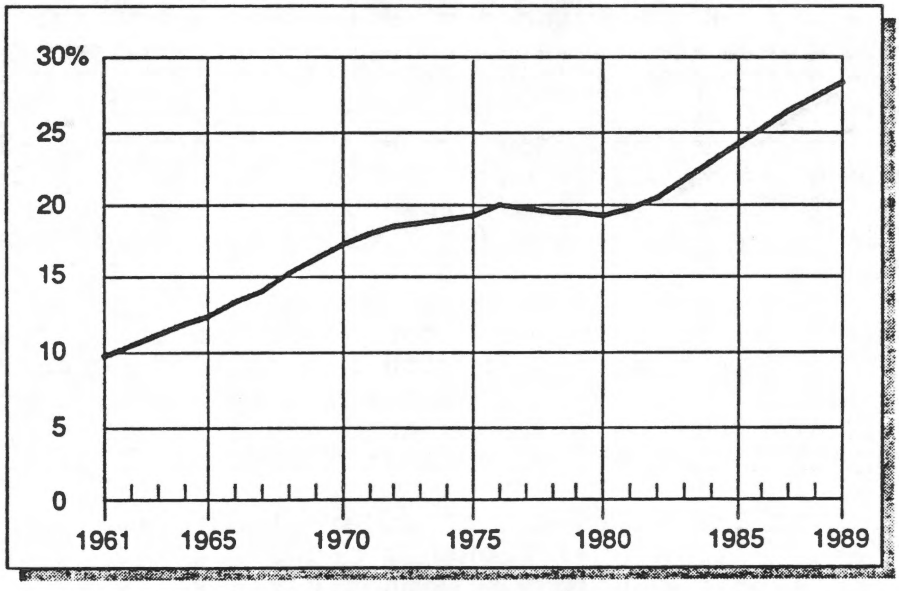
So, do we have the scientific brainpower to meet the challenge?

Currently in Canada, the ratio of scientists and engineers to the total work force falls well behind the economic superpowers like the United States, Japan and Germany. We also fall behind countries closer to our own profile, such as Sweden. A lot of people are worried that we will not have the type of brain power and the skills we will need.

Let's begin our analysis with the postsecondary stages, and work our way back to high school.

Chart 1

Full-time postsecondary enrolment as a percentage of the 18-24 age group

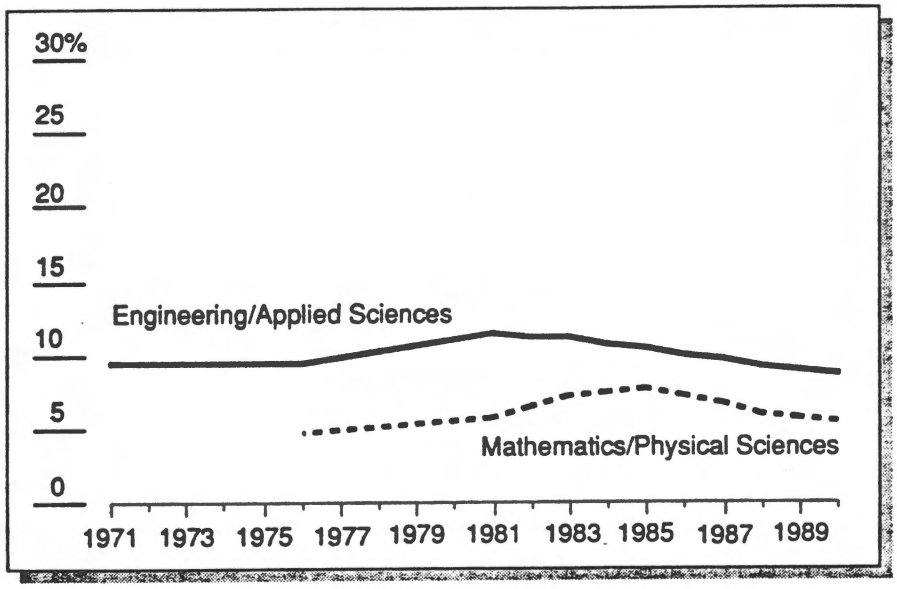


Source Based on data from Statistics Canada, cat. 81-229.

These figures show enrolment in postsecondary education in Canada. Looked at in isolation, it is an encouraging picture. The proportion of 18-24 year-olds enroled in postsecondary programs has been rising rapidly since the late 1960s. In 1989, it had reached 28 per cent and the latest figures, just released, put it at 29 per cent.

Chart 2

Enrolment in Mathematics, Science, and Engineering as a Percentage of Total Undergraduate Enrolment, Canada, 1971-90



Source Based on data from Statistics Canada, cat. 81-204.

However these are boxcar figures. When we start breaking them down, the picture becomes less bright.

As we see here, enrolment in engineering and applied sciences reached a plateau in the mid-1980s. Since then, there has been a marked decline, from 11 per cent in 1980 to about 9 per cent recently.

The percentage enroled in mathematics and physical sciences peaked at about 8 per cent in 1984, and since declined to 5.5 per cent (in 1989-90).

There is an exception in one discipline -- biology, in which there was a slight increase in enrolments.

These are disturbing trends, to say the least. When we look in more detail, we find that overall, women's share of enrolment in engineering and applied sciences has been rising -- from very low levels, to about 15 per cent in 1989-90 -- but in part, this reflects a drop in enrolment by men.

And, while women's enrolment in math and physical sciences is comparatively much higher -- over 25 per cent at the bachelor's level -- it has been stagnant in the 1980s. In biology, however, the pattern is reversed. Enrolments for both sexes have been increasing. And the proportion of female enrolments is higher.

Still, there is clear evidence of sex stereotyping. It shows up vividly in the data on degrees granted.

Chart 3

WOMEN'S DEGREE ATTAINMENT BY FIELD OF STUDY,
(Bachelor and First Professional University Degrees)

	Percentage of total earned by women	
Field of study	1970-71	1988-89
	(Per cent)	
Household science	99.4	94.7
Nursing	97.0	96.1
Social Work	54.9	80.2
Pharmacy	38.3	63.6
Physical Sciences	19.4	27.9
Medicine	14.7	41.8
Engineering	1.2	11.0

Source Estimates by the Economic Council of Canada.

Significant gains have been made since 1970, for instance, in the share of medical degrees earned by women.

But only relatively small gains have been made in women's share of engineering and physical science degrees. And by far the majority of degrees earned in social work, nursing, and household science are earned by women.

Projections of supply and demand for engineers show that if current trends continue unchanged, there will be a serious shortage of engineers in Canada by the end of this decade.

The problem of declining enrolment in technical fields is compounded by demographics. The baby boom has bust. The 18 to 24 year old age group will continue to decrease, as a percentage of the total population, and that will have a dramatic impact on the number of young people entering the labour force.

In short, we have no human resources to waste. We cannot afford cultural or other barriers that deter people from these careers. And we certainly need to do more in the way of identifying and cultivating the relevant talents in the schools themselves.

Let's turn now to the secondary level.

Here, we must acknowledge that we are not in the best possible position to cultivate the talent in our high schools. For some years now, Canada and many other OECD countries have experienced a shortage of high school science, math, and technology teachers. The falling enrolments I just described can only aggravate the problem. A common response is that teachers with less-than-adequate qualifications are pressed into service to teach science and math. Also, too often, technology courses simply are not offered in many high schools.

Chart 4

EFFECTIVE MATH COVERAGE
(Final Year of Secondary School, Various Countries, 1981)

	Percentage in school		Percentage taking math	Effective coverage	
	(%)	(Rank)	(%)	(%)	(Rank)
Canada (British Columbia)	82	2	38	30	1
Canada (Ontario 12)	74	3	41	30	1
Canada (Ontario 13)	33	4	55	19	2
England and Wales	17	6	35	6	5
Japan	92	1	13	12	3
New Zealand	17	6	67	11	4
Sweden	24	5	50	12	3
United States	82	2	15	12	3

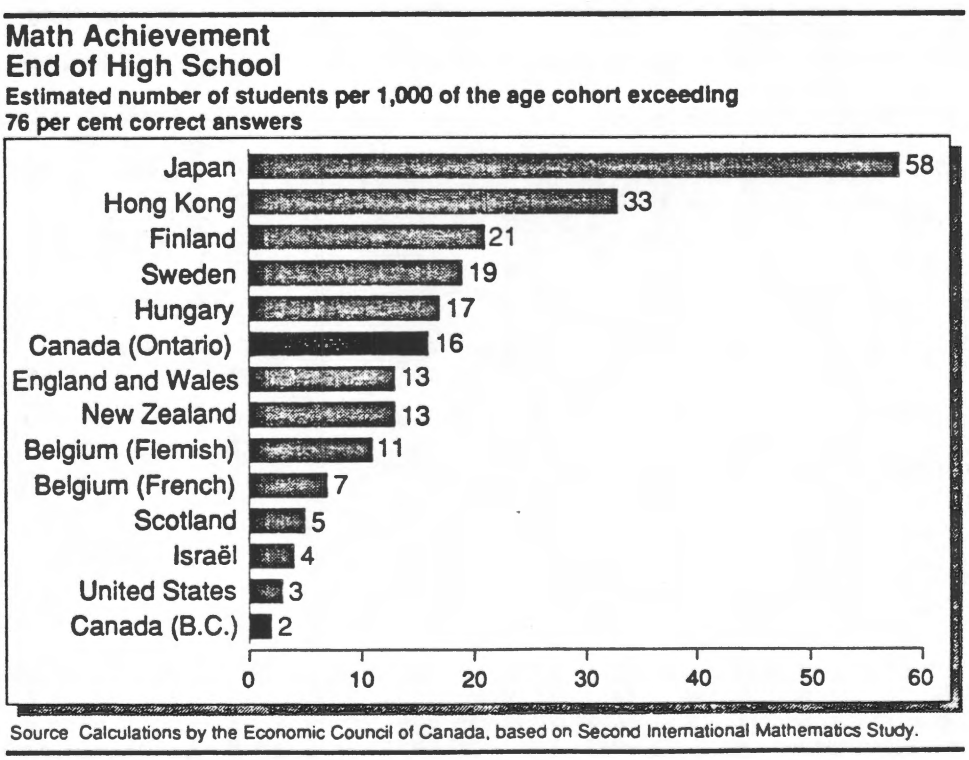
Source David Robitaille, "Canadian Participation in the Second International Mathematics Study", Working Paper No. 6, Economic Council of Canada, 1990.

This chart is based on the Second International Mathematics Study. It shows the proportion of the school age population which is exposed to math education -- not their achievement. Only two Canadian provinces participated in the 1981 study: B.C. and Ontario -- though I should note that the coordinating centre for the Third International Study is located in the Faculty of Education at UBC. All provinces have expressed an interest in participating.

On the left we see the percentage of students still attending school in the final year of high school. You will see that Canada comes out well -- one rung on the ladder below Japan, on the same rung as the United States. But let's be careful about simplistic interpretations. Differences in the system account for some of the lower scores in other countries. Students streamed into vocational schools are excluded, for example.

Next we see the percentage of students taking math. Then we calculate the per cent of the high school age population being exposed to math. On the right, we see Canada scores relatively high -- at the very top in fact.

Chart 5



But the next slide shows that we are only in the middle of the pack on achievement, if we go by the Ontario results. (B.C. came out low on that study partly because there was no calculus in the curriculum. This has since been changed.)

Chart 6

EFFECTIVE SCIENCE COVERAGE
(Final Year of Secondary School, Various Countries, Early 1980s)

		Chemistry			Physics		
	Percentage in school	Percentage taking course	Effective coverage	Rank	Percentage taking course	Effective coverage	Rank
	(%)	(%)	(%)		(%)	(%)	
Australia	39	12	5	5	11	4	5
Canada (English)	71	25	18	2	19	13	2
Canada (French)	67*	37	25	1	35	23	1
England	20	5	1	8	6	1	8
Hong Kong	20	14	3	6	14	3	6
Hungary	18*	1	0	9	4	1	8
Italy	52	2	1	8	19	10	3
Japan	63	16	10	3	11	7	4
Norway	40	15	6	4	24	10	3
Singapore	17	5	1	8	7	1	8
Sweden	15*	15	2	7	15	2	7
United States	90	1	1	8	1	1	8

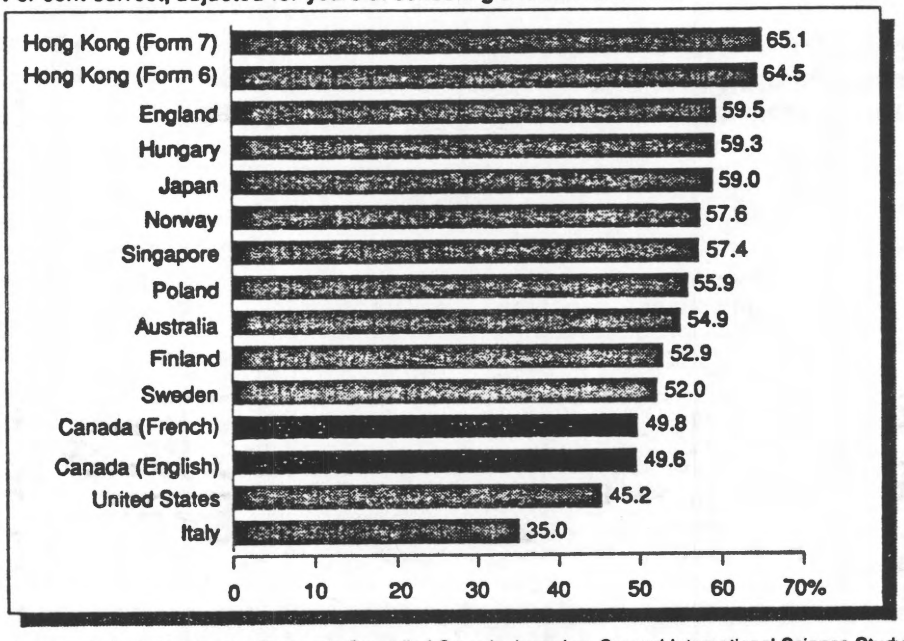
* Excludes students in vocational or similar streams which were not sampled.

Source Robert Crocker, "Science Achievement in Canadian Schools", Working Paper No. 7, Economic Council of Canada.

Let's look now at science coverage. Canada again ranks at the top in terms of the proportion of high school students who are actually taking courses in chemistry and physics.

Chart 7

Science Achievement
End of High School, Science Specialists, 1983-86
Per cent correct, adjusted for years of schooling and retention rate

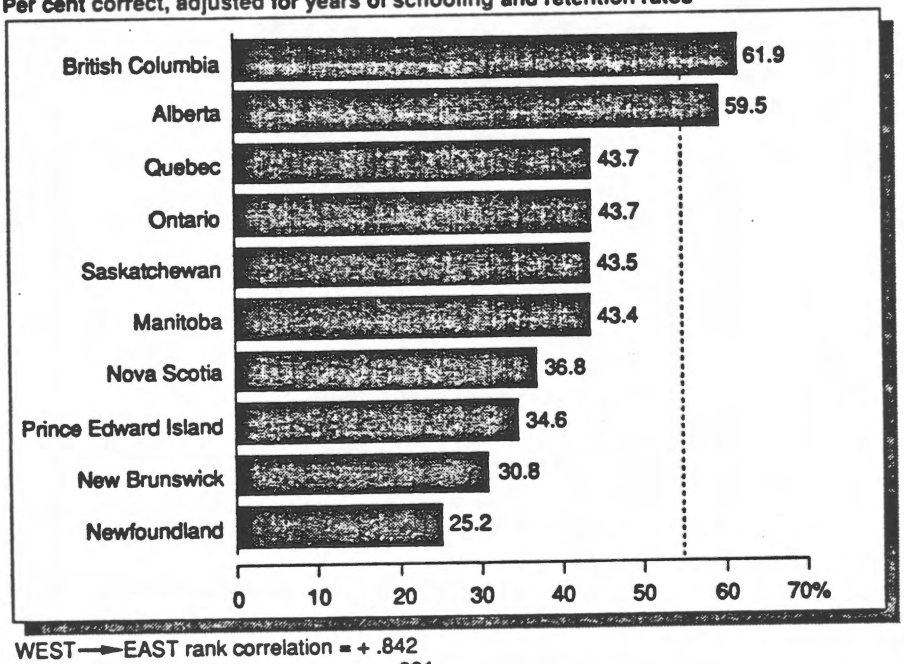


SOURCE Calculations by the Economic Council of Canada, based on Second International Science Study.

But again the results are disappointing. Even when we adjust the international study results for years of schooling (end of high school in Quebec, for example, is Grade 11) and retention rates, Canadian students rank near the bottom.

Chart 8

Science Achievement, by Province
End of High School, Science Specialists, 1983-86
Per cent correct, adjusted for years of schooling and retention rates



WEST⟶EAST rank correlation = + .842
p < .001

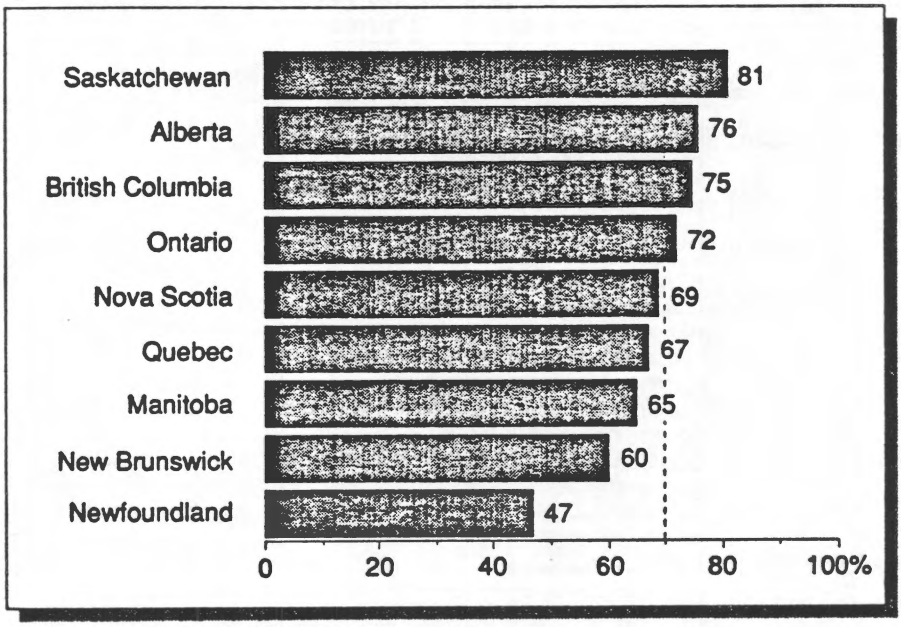
International mean of 15 industrialised countries = 54.5 per cent.

SOURCE Calculations of Economic Council of Canada based on Second International Science Study.

As part of the work being done by the Council, we have focused on interprovincial comparisons. On a number of indicators, including the science study, we have found a puzzling tendency for the western provinces to perform better than the eastern ones. Note that eight provinces fall below the international average on the science study. We are struggling to explain this east-west tilt and I would be fascinated if any of you could offer any insights.

Chart 9

Literacy Skills Used in Daily Activities, Youth
Aged 16-24, Reading Level 4,* 1989



West ⟶ East correlation = .8 $p < .02$
Canadian average = 70 per cent.
*Canadians at this level meet most everyday reading demands.
SOURCE Based on Statistics Canada Survey of Literacy Skills, 1989.

Now I want you to look at a much broader measure of achievement -- the literacy and numeracy of Canadian youth aged 16 to 24. These findings derive from a survey made by Statistics Canada in 1989.

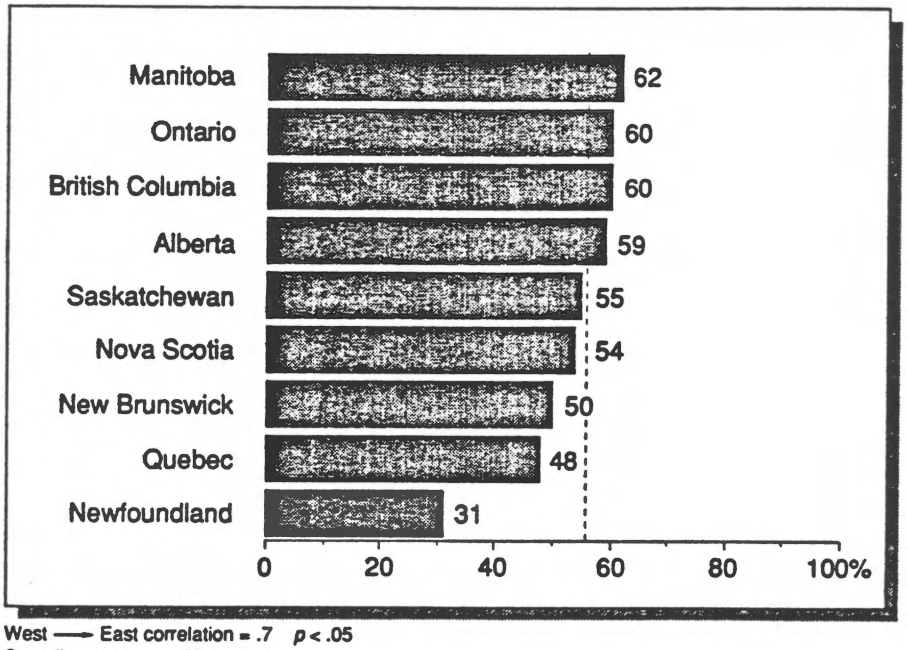
Literacy in these terms means being able to read and write well enough to cope with the demands of everyday life: reading simple newspaper articles, or a classified ad, or filling out a bank slip, for example.

The results are appalling.

More than 28 per cent of young people could not meet most everyday reading demands. This, after at least nine years of schooling.

Chart 10

Numeracy Skills Used in Daily Activities, Youth
Aged 16-24, Numeracy Skill Level 3,* 1989



West ⟶ East correlation = .7 $p < .05$
Canadian average = 56 per cent.
*Canadians at this level can deal with material requiring them to perform simple numerical operations which enable them to meet most everyday demands.
SOURCE Based on Statistics Canada Survey of Numeracy Skills, 1989.

The results on numeracy were even worse. Over 40 per cent of young Canadians failed to meet everyday needs, like adding up an order from a catalogue and calculating a 10 per cent shipping charge.

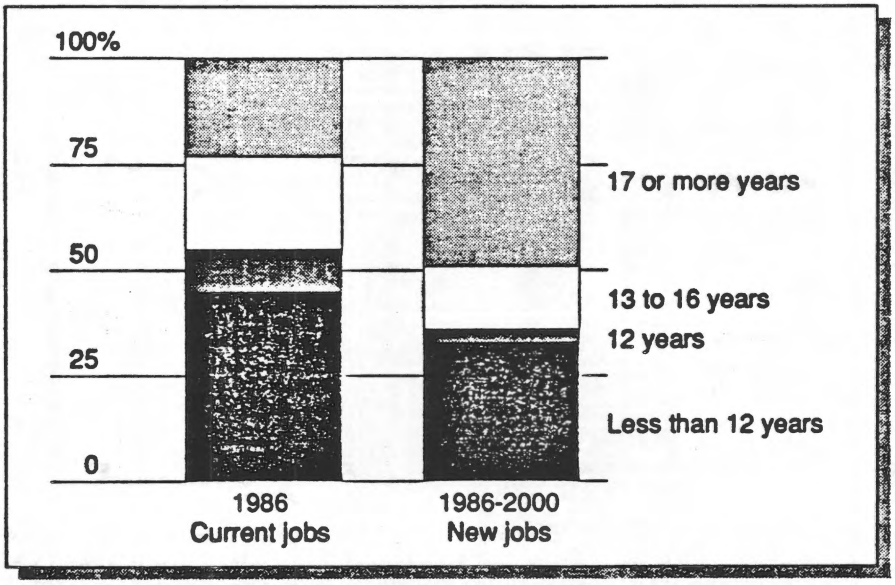
This wasn't a matter of defects in educational systems of the past, showing up in older people. Nor was it attributable to diminished capacity in aged people. We are talking here about people aged 16 to 24: all recent products of the current school system -- we have excluded from our calculations those born abroad.

Note, again, that in the literacy and numeracy scores we see the pattern of declining performance from west to east.

Let's stand back now -- and with the aid of one more chart -- compare what we're getting with what we need.

Chart 11

Rising Skill Requirements



Source CEIC, Success in the Works, A Profile of Canada's Emerging Workforce.

This chart is based on projections made by CEIC. They indicate that, in percentage terms, the proportion of jobs requiring 17 or more years of education will double in the 1990s. Conversely, there will be far fewer jobs requiring less education than that.

Here we are in a period in which the future, not only of individual Canadians, but the nation collectively, demands a higher level of scientific, engineering and technical competence. At this very time, the lines on the graphs are going in exactly the wrong direction:

- declining postsecondary enrolments in these disciplines;
- mediocre performance in secondary schools;
- totally inadequate rates in literacy and numeracy; and,
- underutilization of women.

I think this is the point at which we ask ourselves: what are we doing wrong? Today, I am asking the questions. Within six months, the Council will be making recommendations.

Could there be a problem of inadequate incentives? There are two sides to this coin.

Our research shows that the future incomes people can expect to earn in science, mathematics and engineering are low relative to the incomes for people with other qualifications -- doctors, lawyers and dentists, for example. Is this the real value we place on science and engineering?

Another side of incentive is the hope factor. I don't think you need research to deduce that young people do not have the reasons for optimism that people growing up in the 50s and 60s were able to bring to the job market. High unemployment among young people does not make a good climate for ambitious planning. Why bother to take the hardest courses, if you expect to be unemployed?

The topic of this forum is "awareness". Is awareness the problem? Is it the solution?

It depends on how we define terms.

Do we mean awareness of the kind that persuades a reasonably high share of secondary school students to sign up for math and science? If so, going by the figures I've just presented, we have plenty of that. What is missing is follow through -- high achievement and a strong commitment to a career in math, science and engineering. What can awareness contribute on that front?

Achievement and commitment grow out of a nation's popular culture, its goals and values. Role models and parental support are important, for example. The achievement levels of some of the top-ranking countries reflect a remarkable devotion to excellence. The North American attitude is more diffuse -- less demanding.

If we hope to change the classroom scores we are going to have to work on more than the schools.

There is no point getting youngsters turned on to science and technology if we are not at the same time building a capacity to deliver good education in these programs. We need higher enrolments yes, at both the secondary and postsecondary levels. But we also need good instructors, a good curriculum and a labour market that can challenge these people once they have completed their studies.

Don't forget that achievement and commitment are generated in part by the knowledge that there really are quality educational and career opportunities out there. At the same time, the career opportunities are influenced, at least in part, by the supply of

trained people. One of the first questions a company president asks before making an investment is whether the skills will be available.

Another question: Do the media have an important role to play in increasing science and technology awareness among all Canadians? Most Canadians are unable to name a single Canadian scientist -- living or dead -- or a single Canadian scientific achievement.

That betrays a woeful lack of awareness. Perhaps we lack pride in what we do well.

A final question: Why is achievement lower in eastern Canada than in the West?

In summary, Canada is falling short -- it is caught in an impasse. Because we are short of the new skills we need, it is hard to create them. To break out of that impasse we need new ways of doing things.

One new idea that is gaining momentum is cooperative arrangements between employers and schools. Employers who are engaged in partnerships with high schools are helping to achieve several goals simultaneously. They are building awareness. They are creating incentives. They are stimulating teachers and providing better equipment. But most important, they are illuminating the link between school and work. This last factor in particular could make important changes in the rates of participation and the level of commitment of young people today. But I do not pretend that this one idea is the solution to the impasse. We need more ideas that give out the right signals.

There are some signs of awareness and action at the policy level -- the goals proposed in the Speech from the Throne, for example, and new programs to encourage young women to enter science and math. But we have a big job ahead of us.

I hope that your workshops this morning will come up with some more ideas that can help us create a better future for these young people, and for the country.