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ARGUMENTS DO NOT JUSTIFY PRESENT POLICIES TOWARDS GRADUATE EDUCATION

One can very justly argue that Canada, as a developing nation, cannot have too many educated people; that all Ph. D's will, in fact, find employment whether it be in teaching at junior colleges, high schools or even in "sales"; that we should not interfere with the rights of individuals to determine the career of their choice. While we would entirely agree with each of these statements, they do not justify our present policies toward graduate education. This can be seen from the following rather simplistic considerations.

The production of a Ph. D implies a high cost on the part of society as well as on the part of the individual. The financial cost to society can be roughly estimated as follows: *The total expenditures of Canadian universities for the academic year 1970-71 are estimated to be \$1.78 billion (current expenditures \$1.2 billion and capital expenditures \$580 million). It was further estimated by MacDonald that "research and research training" accounted for 55 percent of total university expenditures so that for 1969-70 the total cost of "research and research training" is about \$980 million. If one divides this number by the number of Ph. D's graduating in 1969-70 (estimated to be 1,700 for all disciplines), one arrives at an astronomical figure of \$575,000.* The cost of producing a Ph. D is, of course, much lower than this because there are other benefits derived from "research and research training" in universities, notably the intrinsic value of the research itself, benefits to undergraduate education, and masters degree graduates. However, even if only one-quarter of the cost is allocated to Ph. D training, one arrives at a cost of nearly \$200,000 per Ph. D. It would seem that a somewhat different allocation of our education dollar, far from producing fewer highly educated people, might well produce more well-educated people and these in areas more appropriate to the needs of Canada. Nor can we accept that this would represent an infringement of the personal freedom of students. The present policy of providing funds for graduate education in selected areas of learning has had the effect of producing a tremendous growth in these areas. The policy which favoured the postgraduate level, and which favoured the physical sciences, was not considered to be an infringement of personal freedom. A deficit policy perhaps favouring a different level of education and or a different discipline would no doubt be equally effective without coercion.

OFF COMMENTARY

This report has prompted other Science Council staff members to comment on the veracity and interpretation of its statistics and conclusions. See Table V page 6.

There is a good deal of confusion about the likely output of science and engineering Ph. D's. The Bonneau Report and the Economic Council of Canada (in its Staff Study No. 20) differ in their output estimates. (The E.C.C. projections are based on the assumption that the percentage of the 23-year-old population earning Ph. D's will increase from 0.26 in 1966 to 0.60 in 1976.)

On the other hand, the sum of estimates by university department heads is considerably

Year	
1968	800
1969	1,020
1970	1,280
1971	1,460
1972	1,850

Year	New Positions in R&D	
	No Attrition	4 percent attrition
1969	665	975
1970	570	905
1971	490	850
1972	490	870

	1964	1965	1966	1967	1968
Total emigration of scientists to U.S.	293	289	246	--	--
Total immigration of scientists to Canada	556	856	1,001	--	--
Net immigration of scientists	263	567	855	677	--
Vacancies for non-Canadian science and engineering Ph.D's in Canada.	--	400	420	490	260

	1969	1970	1971	1972
Total new employment positions per year	990	860	850	940
Effective new employment positions per year (discipline matching coefficient equal to 0.8)	790	860	680	750
Output of Ph.D's per year *	630	900	1,300	1,780
Surplus of Ph.D's per year	-160	210	620	1,030
Cumulative surplus of Ph.D's	-160	50	570	1,700

* Assuming 400 additional PDF positions created per year, declining to 100 additional per year in 1972.

higher than the Bonneau figures. Oscar Levine, whose data form the basis of the Bonneau Report, has applied severe correction factors to take university optimism into account, and regards the Bonneau figures as underestimates rather than overestimates.

There are on file the names of 906 science and engineering Ph. D's who graduated in 1968.

Federal expenditure on university research is falling off quite rapidly, and we may soon expect the Ph. D output to increase at only 10 percent per year. It is as likely, however, that new postdoctoral fellowship positions (of which we have assumed, at worst, 100 per year) will suffer in the first wave of university economies.

It is difficult to document the assertion that the Ph. D output of Canadian universities is a measure of the supply in Canada. It is true that 50 percent of all predoctoral students (and 30 percent of all Ph. D's granted) in Canadian universities are foreign. Perhaps half of these either return to their country of origin or for other reasons are not contenders in the Canadian employment market. Accurate information is needed on this point: there are large numbers (2,263 in 1968) of foreign students pursuing doctoral studies in science and engineering, with a potentially significant impact on the Ph. D supply.

At least 15,000 Canadians are currently studying abroad; it is estimated that one-half of them are graduate students. The recent drop in employment opportunities in the U.S. and the U.K. (in which most of the students are located) may be expected to increase the proportion of these students returning to Canada to seek employment.

In 1967 (the most recent year for which information is available) 691 Canadian-born scientists and engineers left Canada and were admitted as immigrants to the U.S. An additional 870 non-Canadian scientists and engineers, resident one year or more in Canada, also entered the U.S. as immigrants. The departure of these people presumably created a substantial number of employment vacancies in Canada. This mechanism is expected to become considerably less effective in view of the domestic oversupply in the U.S. In fact, it is not unlikely that a proportion of these experienced scientists will now return to Canada.

In the same year, 1,200 Canadian-born "temporary" U.S. residents (mainly students and postdoctoral fellows) changed their status to permanent immigrants. This phenomenon, too, may be expected to decline.

The dangers of overreaction have been stressed by several commentators. Measures have been suggested to iron out the present imbalance without prejudicing the long-term issues; they include

Cut-back in support for earlier stages of Ph. D work in certain programs.

Increase in the number of postdoctoral fellowships to provide a "holding tank."

Institution of Intermediate and Major Programs with considerable funding by the Federal Government.

Encouragement of substitution of M.A.'s and B.Sc.'s by Ph. D's in junior colleges, high schools and other non-R & D employment sectors.

Year	Bonneau	E.C.C.
1968	800	660
1969	1,020	770
1970	1,280	880
1971	1,460	980

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