PERSPECTIVES ON LABOUR AND INCOME

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NAVIGATION BUTTONS

Computers in the workplace (1)

Graham S. Lowe

Spectacular advances in microelectronic technologies are transforming the workplace. Over the past decade, the effects of technological change on employment opportunities, job content and work rewards have been widely discussed. Indeed, the debate has polarized around positive and negative perspectives. (2) The positive image of an emerging postindustrial society emphasizes the personal and social advantages of work in hightechnology and informationintensive service industries: jobs will be more challenging and rewarding, offering employees more control over where, when and how they work. Critics, however, raise serious doubts. Will more efficient technologies mean fewer jobs? Will automation de-skill work and reduce the overall quality of working life? And if there are benefits from automation, who will be the winners?

Unfortunately, with the exception of research by the Economic Council of Canada, few national studies have examined the extent and impact of technological changes in the workplace. (3) Thus it is difficult to evaluate these competing positions on new technologies. This article injects some new evidence into the debate using data from the General Social Survey (GSS) of February 1989.

Specifically, the GSS illuminates three issues in workplace automation. First, it documents which employees are most likely to use mainframe computers, personal computers, and word processors. This captures office automation, which accounted for the majority of workplace technological innovations in the last decade. (4) However, the survey did not examine the use of new industrial technologies such as robots, computer numerically controlled machines, computerassisted manufacturing, or automated material handling systems. Second, shifting to a broader focus on computers and automated technology, the GSS addresses how their introduction affected the employed labour force during the 1984 to 1989 period. And third, the survey briefly touches upon the issue of job loss resulting from the introduction of new technology, broadly defined.

Computers on the job

Our starting point is the distribution of informationprocessing technology. Those employed at the time of

the survey in February 1989 were asked, "Do you use computers such as mainframes, personal computers or word processors in your job?" Onethird, 4.3 million individuals, answered yes. Onthejob computer use varied considerably by province. Use was lowest in the Atlantic provinces, Saskatchewan and Quebec and highest in Ontario, Alberta and British Columbia. This trend runs parallel to the patterns of computer skills and home computer ownership. (5)

Computerized work also varied markedly by age (Table 1). Teenagers who had left school and were in the labour force had the lowest level of computer use (13%). In contrast, over 40% of the baby-boom cohort (ages 25 to 44) used computers at work.

VIEW ▶ Table 1 **Use of mainframes, personal computers, and word processors on the job, by age and sex, 1989**

Source: General Social Survey

As well, women reported a higher level of computer use. Over 37% of women used computers in their work, compared with about 30% of men. (In contrast, in the adult population, slightly more men than women reported knowing how to use a computer.) However, this difference results from women in the labour force being concentrated in office jobs where automation is well under way.

Education is also a factor in determining who does or does not use a computer at work. The higher one's level of education, the greater the likelihood of working with a computer. About 55% of those with university degrees used computers at work, compared with only 12% of individuals with less than high school (Table 2).

VIEW ▶ Table 2 **Use of mainframes, personal computers, and word processors on the job, by education and sex, 1989**

Source: General Social Survey

Variations in computer use by occupation

The strong relationship between education and onthejob computer use largely reflects occupational

differences. Two whitecollar occupations had extensive computer use (Table 3). Specifically, over threequarters of individuals in science and engineering and 52% of managers and administrators used computers. Only one other occupation, clerical, had a comparably high use level (55%). Employees least likely to use computers were in service and primary occupations (both around 10%).

VIEW ▶ Table 3 **Use of mainframes, personal computers, and word processors on the job, by occupation and sex, 1989**

Source: General Social Survey

In the three most computerized occupations, women were heavier users than men. But this pattern was not consistent across all occupations. In teaching and social sciences, for example, substantially higher proportions of men used computers.

Using a more detailed classification scheme, we find nine occupations in which 60% or more of employees reported using computers (Table 4). This identifies what the Economic Council of Canada refers to as hightech occupations C jobs requiring either an indepth knowledge of the principles and applications of technology or having a high technology content. (6) At this level of detail, over 90% of individuals in two occupations C mathematics, statistics, systems analysis and related fields; and office machine and electronic data processing equipment operators C worked with computers.

VIEW ▶ Table 4 **Occupations with 60% or more employees using mainframes, personal computers, or word processors, by sex, 1989**

Source: General Social Survey

These nine hightech occupations are clearly different, though, in educational requirements, earnings potential, and advancement opportunities. The juxtaposition of highstatus (largely male) and lowstatus (mainly female) occupations is quite apparent. Alongside managers, administrators, engineers, architects and scientists we find clerical and sales workers. Indeed, computer use is most extensive at both ends of the whitecollar occupational hierarchy.

Variations in computer use by industry

The belowaverage computer use in the primary industries, manufacturing, and construction mirrors the occupational trends noted. Within the goodsproducing sector of the economy, computers were most common in manufacturing. It must be kept in mind, however, that the 1989 GSS focused on the information processing technology usually found in offices. As such, the GSS did not tap the full extent of automation in the goodsproducing sector of the economy.

Clearly, the service sector led the way in the use of computers on the job. This is not surprising, given findings from the Economic Council of Canada's study (7) and the wording of the GSS question on technology use, which was slanted towards service sector applications. Three out of four financial industry employees (535,000 individuals) worked with computers. Close to half the employees in business services and public administration also used computers. The relatively high rate of computer use in the transportation and communication industry reflects the reliance of communications firms on sophisticated technologies. Given the huge volumes of information processed by these firms, each one requires large numbers of clerks (about 80% of whom are women), numerically the largest single occupational group of computer users.

Employment characteristics, working conditions and computer use

The occupational and industrial distribution of mainframe computers, personal computers, and word processors gives only a broad outline of computer-use patterns. To fill in the details, we must examine the characteristics of jobs associated with computer use.

Employee seniority had little bearing on computer use. Employees in permanent jobs were much more likely to use computers than workers in temporary, casual or seasonal work. Relatively few selfemployed individuals used computers. Proportionately more fulltime employees than parttime employees used computers. Large firms had far more employees using computers than small firms.

As already mentioned, managers and administrators are in the hightech group of occupations. The 1989 GSS asked two questions to further probe computer use among managers and supervisors. Employed respondents were asked: "Which of the following best describes the work you do? Is it managerial, supervisory or neither?" Respondents who indicated that their work was managerial were then asked: "Would you say that you are in a top-, upper-, middle- or lower-management position?" Managerial and supervisory employees were more likely to use computers than their subordinates. However, within management ranks, individuals at middle or lower levels were bigger users than those further up the hierarchy.

To summarize: secure, fulltime jobs; supervisory or lower- and middle-management positions; and jobs

in large organizations had significantly higher than average rates of computer use. This amplifies the Economic Council of Canada's recent distinction between "good jobs" and "bad jobs" in the service economy showing that good jobs are also more computer based. (8) As further evidence, individuals making progress in their careers, by virtue of having been promoted in the previous five years, also had well above average rates of computer use.

VIEW ▶ Chart **Selected characteristics of employees using computers* on the job. 1989.**

Source: General Social Survey

** Mainframes, personal computers, word processors.*

VIEW ▶ Chart **Computer* use on the job, 1989.**

Source: General Social Survey

** Mainframes, personal computers, word processors.*

If satisfying, challenging and rewarding jobs are also more computerized than jobs lacking these characteristics, then automation may be contributing to the polarization of employment rewards, which many analysts attribute to recent economic restructuring. (9)

The 1989 GSS also asked employees to evaluate specific aspects of their jobs. On the whole, these selfreported evaluations suggest that employees using computers do have better jobs. Specifically, greater proportions of computer users agreed strongly or somewhat that their positions required a high level of skill, provided a lot of decisionmaking freedom, paid well, and offered good promotion or career prospects. Similarly, these same employees were far less likely than nonusers to perform repetitive work. The only job characteristic that did not seem to vary by computer use was having pleasant physical surroundings. Differences in job satisfaction between users and nonusers, while minor, also followed this same general pattern.

These results, while not overwhelming, suggest that within the labour force as a whole using a mainframe computer, personal computer, or word processor is associated with other job characteristics indicative of somewhat more challenging and rewarding work. However, this generalization should not overshadow the considerable diversity in job rewards within the group of hightech occupations identified above.

Hours of onthejob computer use

Computer users spent an average of 16.2 hours weekly on their machines (Table 5). Women spent slightly more hours using computers than men, reflecting their predominance in clerical and other office jobs that are extensively automated. Across occupations, average weekly hours ranged from a low of between 8 and 9 in social sciences, teaching, and primary occupations to over 20 in science and engineering, and clerical occupations. The latter occupations also had large majorities of employees using computers. In terms of industry, agriculture had very low weekly hours (about 5), compared with a high of 21 in business services. In the labour force generally, nearly half the computer users operated their machines 11 hours or less weekly; almost two-fifths used them 20 hours or more.

VIEW ▶ Table 5 **Average weekly hours of mainframe, personal computer, or word processor use on the job, by occupation and sex, 1989**

Source: General Social Survey

Five occupations reported a weekly average of 20 or more hours of computer use. Mathematics, statistics, systems analysis and related occupations typically required about 31 hours of computer use weekly. Following a close second were office machine and EDP operators, at 29 hours a week. Other jobs with 20 or more hours of use in a week were all within the clerical category.

Undoubtedly many mathematicians, statisticians and systems analysts, as well EDP equipment operators and other clerical workers, are heavily dependent on computers. However, the 1989 GSS does not reveal how workers in different occupations defined computer use when answering the question: "How many hours per week do you normally use (computer) equipment?" Further research into this issue will likely reveal significant differences in how, for example, the work time of systems analysts and data entry clerks is actually spent "on a computer".

Impact of computers or automated technology on work

The 1989 GSS also examined the impact of technological change on work. Individuals employed at the time of the survey were asked: "In the last five years, how much has your work been affected by the introduction of computers or automated technology? Would you say ... Greatly? Somewhat? Hardly? Not at all?" It is important to note the wider focus here on computers or automated technology, compared

with the narrower definition of technology used to document computer use.

Less than onethird (about 3.6 million individuals) reported that their work had been greatly affected. Another 15% (or 1.9 million) said it had been somewhat affected. About 14% experienced a few effects, but the largest group C roughly 42% of all employees, just under 5.3 million individuals C encountered no effects at all (Table 6).

VIEW ▶ Table 6 **Impact of introduction of computers or automated technology, 1989**

Source: General Social Survey

There are several notable provincial variations in the impact of computers and automation. Those employees who were affected greatly or somewhat, more likely lived in Alberta, Nova Scotia or British Columbia. Employees in New Brunswick, Quebec and Newfoundland had the highest proportions reporting that their work had not been affected at all by the introduction of computers or automation in the previous five years.

Looking at the impact on major occupational groups, managerial and professional employees encountered the greatest changes because of technology in the previous five years, followed by clerical, sales, and service workers. The impact was least in bluecollar occupations. In the managerial and professional category, a substantially higher proportion of males than females (45% and 29%, respectively) reported that their work had been greatly affected by computers or automation. This no doubt reflects the male domination of management, science and engineering occupations, all of which have experienced rapid technological changes.

A more detailed analysis found six occupations in which over 70% of employees reported no effects of automation. Three of these were lowerlevel personal service jobs. The other three occupations were in the goodsproducing sector: jobs in wood, rubber and plastics manufacturing, which probably underwent automation before the 1980s; clothing production, which remains labour intensive and low technology; and food and beverage processing.

In contrast, the six occupations experiencing the greatest impact were those previously identified as having very high levels of computer use. The one exception is university teaching. On the whole, these high use levels are likely associated with the recent introduction of new technologies.

VIEW Chart **Perceived impact of computers or automation on skill level in last five years*.**

Source: General Social Survey

** Employees affected by automation.*

Employees currently using computers were far more likely than non-users to have experienced the impact of automation in the preceding five years. Among computer users, 63% had been greatly affected by the introduction of computers or automated technology. Interestingly, an almost identical proportion (61%) of employees not using computers reported no effects of technological change. Only 1 in 10 of nonusers said they had been greatly affected. The most obvious explanation for this is that the question on computer use was restricted to basic office technologies, whereas the impact of computers was measured in more general terms by including automated technology.

Impact on job skills

A key issue in debates about the impact of technological change is skill requirements. Analysts offering a critical perspective on technology claim it tends to lower skill levels. (10) Yet, a growing body of research refutes such technological determinism, arguing that technology has the potential to upgrade skill requirements, depending on how work is reorganized. (11)

Employees reporting that their work had been affected by technological change were asked about its impact on work skills. Twothirds said that computers and automation had resulted in increased skills. Almost none reported a decrease, while 29% experienced no effect.

In terms of occupations, mathematics, statistics, and systems analysis; physical and life science jobs; along with two clerical groups (office machine and EDP operators, stenographers and typists) experienced the greatest increases in skill levels. Over 50% of employees in these occupations reported an increase. Not only do these employees use computers extensively, but the process of technological innovation has also generally upgraded their skills.

Using three broad occupational groups C managerial and professional; clerical, sales, and service; and bluecollar C provides some evidence of sex differences in the effects of automation on skills. In particular, women in clerical jobs experienced a greater increase in skill requirements than men.

On the whole, employees who experienced skill upgrading due to automation tended to be relatively well educated. They were also concentrated in the baby-boom age cohort. Among men, those aged 35 to 44 were more likely to report skill increases, while among women the greatest skill improvements were reported in the 25 to 34 age group.

Threequarters of onthejob computer users reported increased skill requirements. But so did just over half of those not currently using computers. This discrepancy may have resulted from the wording of the questions on computer use and impact. Another possibility is that these individuals may have used computers at some point in the previous five years and associated skill increases with this. Equally plausible, the reorganization of work units that sometimes accompanies automation may have indirectly increased skill requirements for some employees. (12)

Nor should we rule out the possibility of a positive bias towards new technology. Canadians are receptive to technology, so it may be that when automation occurs in a workplace, even those not directly affected will tend to view the changes in a positive light. Obviously, all these hypotheses demand further investigation.

Impact on job security

Fewer than 1 in 5 employees affected by technological change had benefited from increased job security due to automation. In fact, over two-thirds encountered no change. Only 1 in 10 reported decreased job security. However, bluecollar workers were somewhat more likely to have experienced a decrease in job security due to automation than employees in managerial and professional, or clerical, sales, and service occupations.

Before jumping to the conclusion that automation in Canadian workplaces during the second half of the 1980s had little effect on job security, we must point out that only employed individuals answered these questions. Thus, anyone who had lost a job because of technological change and was not employed at the time of the survey was not included. Still, the employed showed little concern about new technologies undermining job security.

Impact on intrinsic interest

The impact of automation on the intrinsic interest of work, as with skill, was positive overall. Fully 60% of the employees affected by automation reported that it had made their duties more interesting. Almost none reported the opposite. Individuals in managerial and professional occupations were somewhat more likely to say that their work had become more interesting; bluecollar workers were least likely.

Comparing men and women, in the managerial and professional occupations a higher proportion of men reported increased intrinsic interest. But the reverse held true for clerical, sales, and service jobs. This follows the pattern observed for skill increases.

VIEW ▶ Chart **Job perceptions of employees, 1989.**

Source: General Social Survey

** Mainframes, personal computers, word processors.*

Technological change and job loss

The survey also touched briefly on the issue of technologically induced job loss. While the results are generally informative, they point to the need for a more comprehensive investigation.

Anyone who had lost a job during the 1984 to 1989 period was asked the reason. Of the 2.4 million workers who had lost jobs, less than 1% cited the introduction of new technology. But the causes of job loss are often numerous and complex, so some workers may not have known all the factors responsible. Still, the impact of new technology seems minor.

Another 948,000 workers (7.5% of those employed at the time of the survey) expected to be laid off or to lose their jobs in the next year. Of these, only 79,000 thought this would be a result of the introduction of computers or automated technology. In the Canadian labour force, then, fears about being future victims of advancing technology were negligible, at least in early 1989.

This is not to downplay any negative personal consequences for those 79,000 individuals who anticipated technological redundancy. Indeed, this number is equivalent to dozens of Canada's largest factories, stores or offices closing their doors for good. Viewed from this perspective, these findings do not contradict the negative impact on employment levels found in case studies of technological change in specific firms. (13)

Discussion

One in three employees uses a mainframe computer, personal computer, or word processor for an average of about 16 hours a week. Proportionally more women than men are computer users. Better educated workers, and those in the baby boom generation, also have levels of computer use above the labour force average.

In venturing any conclusions from the 1989 GSS, we must remember the limitations imposed by the different definitions of automation used and the latitude possible in respondents' interpretations of the various questions.

The profile of computer users includes a combination of employment conditions and specific job characteristics typically associated with "good jobs". (14) Corroborating this positive image of automation is the finding that the most technologically intensive jobs are at the upper levels of the occupational

hierarchy. But lowerlevel whitecollar jobs, especially in the predominantly female clerical occupations, also appear to have reaped some benefits from automation. This is especially true regarding increased skill requirements and intrinsic interest.

More research is required, however, to explore how computerized work is associated with various job rewards and opportunities. Additional information on how workers perceive technological change is also needed. Most contentious is the issue of skill. For example, automation may appear to workers to be upgrading skills because of the need to learn new things, even though objective measures of job skills before and after technological change may point to a decline. (15)

In 1985, the Economic Council of Canada estimated that 13% of the work force used new automated technologies directly in their work. (16) On this basis, the 1989 GSS documents a remarkable increase in computer use in the second half of the 1980s.

In short, the experiences of employed Canadians with the recent and rapid introduction of new technologies in the workplace do not fit the gloomy scenarios of widespread de-skilling and job loss. However, given the concentration of computers in a relatively small number of "good" jobs, it is entirely possible that technological change is increasing the polarization between good and bad jobs in the labour market.

Workplace automation also has an important human capital dimension. About half of adult Canadians can operate a computer, with the vast majority of these users able to do more than just play computer games. (17) Is this relatively extensive computer literacy being utilized in the workplace? The answer is no. Only about 55% of individuals in the labour force who have the ability actually use computers at work. Clearly, not all jobs can be computerized. Even so, a broader utilization of untapped human resources could accelerate the pace of the microelectronics revolution. And based on 1989 GSS evidence, this advancing automation has the potential to upgrade the content of jobs.

1989 General Social Survey (GSS) questions on computers in the workplace

- "Do you use computers such as mainframes, personal computers or word processors in your job?"
- "In the last five years, how much has your work been affected by the introduction of computers or automated technology? Would you say... Greatly? Somewhat? Hardly? Not at all?
  If respondent answered "Greatly" or "Somewhat":
  "In the last five years:
  – has the level of skill required to perform your work increased, decreased, or stayed the same...
  – has the job security increased, decreased or stayed the same...

– has your work become more interesting, less interesting, or stayed the same as a result of introduction of computers or automated technology?"

- If respondent lost a job between January 1984 and December 1989: "Why did this happen (mark all that apply): An employer going out of business? A plant closing? The introduction of new technology? Reduction of staff? Seasonal job? Shortage of work? Other?"
- "Do you think it is likely you will lose your job or be laid off in the next year?" IF YES: "Do you think this will be because of the introduction of computers or automated technology?"

Notes

Note 1
This article is based on chapter 5, "Computers in the workplace" from G.S. Lowe, *Education, work, computers, and retirement: challenges for the 1990s* (Summer 1991).

Note 2
Compare, for example, C.B. Handy, *The future of work: a guide to a changing society* (1984); S. Zuboff, *In the age of the smart machine: the future of work and power* (1988); L. Hirschhorn, *Beyond mechanization: work and technology in a postindustrial age* (1984) with R. Howard, *Brave new workplace* (1985); B. Garson, *The electronic sweatshop: how computers are transforming the office of the future into the factory of the past* (1988); C.C. Rochell and C. Spellman, *Dreams betrayed: working in the technological age* (1987).

Note 3
See G. Betcherman and K. McMullen, *Working with technology: a survey of automation in Canada* (1986); Economic Council of Canada, *Innovation and jobs in Canada: a research report* (1987).

Note 4
Betcherman and McMullen, op. cit., p.17, report that in the 1980 to 1985 period 65% of all automation in their sample of Canadian firms was in the office. The GSS examines this kind of automation.

Note 5
See G.S. Lowe, *Canadian Social Trends* (Winter 1990).

Note 6
Economic Council of Canada, *Innovation and jobs in Canada: a research report*, p. 39.

Note 7
Betcherman and McMullen, loc. cit.

Note 8
Economic Council of Canada, *Good jobs, bad jobs: employment in the service economy: a statement* (1990).

Note 9
On the polarization thesis see: J. Myles, *The Canadian Review of Sociology and Anthropology* (1988); J. Myles, G. Picot and T. Wannell, *The Labour Force* (1988); N. Leckie, *The declining middle and technological change: trends in the distribution of employment income in Canada, 1971-84* (1988).

Note 10
The clearest expression of this position is H. Braverman,*Labor and monopoly capital: the degradation of work in the twentieth century* (1974). For a critical assessment of the de-skilling debate see P. Attewell, *Work and Occupations* (1987).

Note 11
See, for example, Hirschhorn, loc. cit.

Note 12
However, available evidence suggests that innovative organizational changes likely to have an upgrading effect on skills typically do not accompany automation in Canadian firms. See K. Newton,*New Technology, Work and Employment* (1989).

Note 13
See, for example, D. Robertson and J. Wareham, *Technological change in the auto industry: CAW technology project* (1987).

Note 14
Economic Council of Canada, *Good jobs, bad jobs: employment in the service economy: a statement* (1990).

Note 15
M. Wallace, *Work and Occupations* (1989).

Note 16
K. Newton, op. cit., p.42.

Note 17

G. Lowe, loc. cit.

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Author

Graham Lowe is with the Department of Sociology at the University of Alberta.

Source

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Table 1

Use of mainframes, personal computers, and word processors on the job, by age and sex, 1989

	Proportion of employees		
	Male	Female	Total
	%		
All age groups	**30.8**	**37.6**	**33.8**
15 19	12.3	13.0	12.6
20 24	23.8	35.2	29.4
25 34	35.8	45.8	40.2
35 44	39.2	44.3	41.4
45 54	29.3	33.9	31.3
55 64	21.0	24.9	22.5

Source: General Social Survey

Table 2

Use of mainframes, personal computers, and word processors on the job, by education and sex, 1989

	Proportion of employees		
	Male	Female	Total
	%		
University degree	57.8	49.7	54.5
Postsecondary diploma	38.5	41.2	39.8
High school diploma	29.2	45.2	37.2
Less than high school diploma	10.3	15.8	12.4

Source: General Social Survey

Table 3

Use of mainframes, personal computers, and word processors on the job, by occupation and sex, 1989

	Proportion in occupation		
	Male	Female	Total
	%		
All occupations	**30.8**	**37.6**	**33.8**
Managerial/administrative	50.3	54.7	51.9
Science/engineering	76.5	81.9	77.6
Social sciences	42.0	33.5	38.0
Teaching	58.6	36.5	45.2
Medicine/health	27.0	20.4	22.0
Artistic/literary	40.7	33.0	36.7
Clerical	35.9	60.5	55.3
Sales	33.6	33.7	33.7
Service	16.6	5.0	9.8
Primary	11.7	-	10.3
Manufacturing/processing	15.7	-	13.4
Construction/transportation	10.5	33.6	13.3

Source: General Social Survey

Table 4

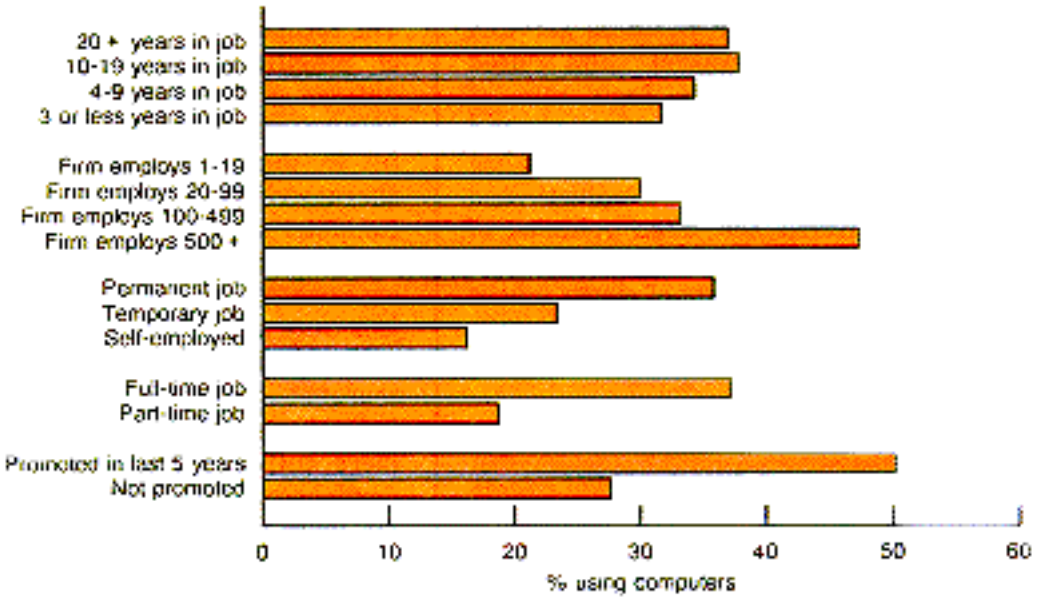
Occupations with 60% or more employees using mainframes, personal computers, or word processors, by sex, 1989

	Proportion of employees		
	Male	Female	Total
	%		
Mathematics, statistics, systems analysis and related	97.7	93.3	96.2
Office machine and EDP operators	86.4	95.5	93.3
Management, administration and related	79.0	70.0	74.8
Architects/engineers	71.1	69.0	71.0
Stenographers/typists	65.6	70.6	70.6
Sales (services and other non commodity sales)	56.1	77.5	65.7
Physical and life sciences	64.4	71.3	65.9
Architecture- and engineering- related	64.9	60.0	64.2
Library/filing/correspondence and related clerks	43.1	67.2	60.4

Source: General Social Survey

Selected characteristics of employees using computers* on the job, 1989

Permanent, full-time employees in large firms were most likely to use computers on the job.

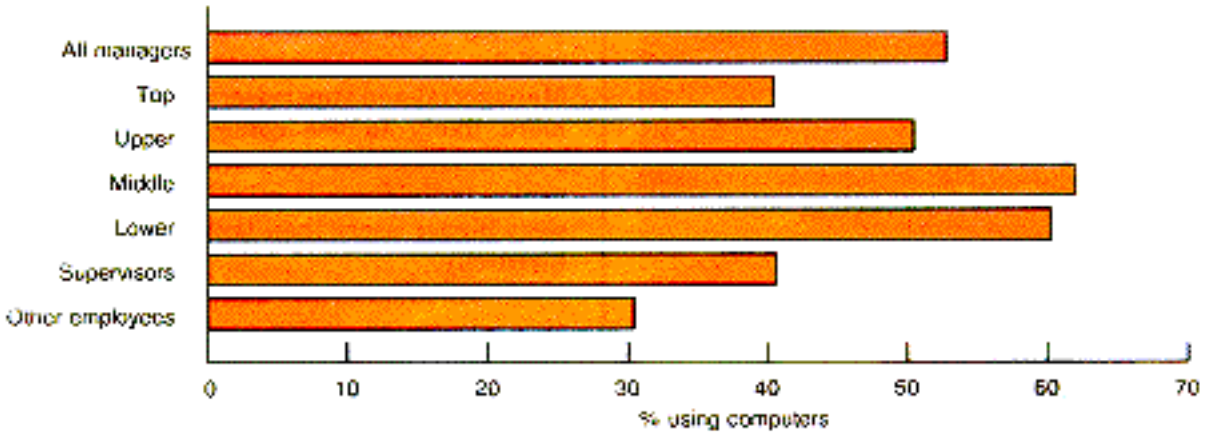


Source: *General Social Survey*

** Mainframes, personal computers, word processors*

Computer* use on the job, 1989

Middle- and lower-level managers had the highest rates of computer usage.



Source. *General Social Survey*

*Mainframes, personal computers, word processors

Table 5

Average weekly hours of mainframe, personal computer, or word processor use on the job, by occupation and sex, 1989

	Male	Female	Total
	hours		
All occupations	**14.5**	**18.0**	**16.2**
Managerial/administrative	13.4	16.7	14.6
Science/engineering	22.5	23.8	22.8
Social sciences	8.0	8.8	8.3
Teaching	10.3	6.6	8.5
Medicine/health	10.7	13.4	12.6
Artistic/literary	17.3	19.7	18.4
Clerical	21.0	20.9	20.9
Sales	12.3	14.9	13.6
Service	10.0	18.0	12.2
Primary	9.2	-	8.9
Manufacturing/processing	11.5	-	13.2
Construction/transportation	10.6	-	13.3

Source: General Social Survey

Table 6

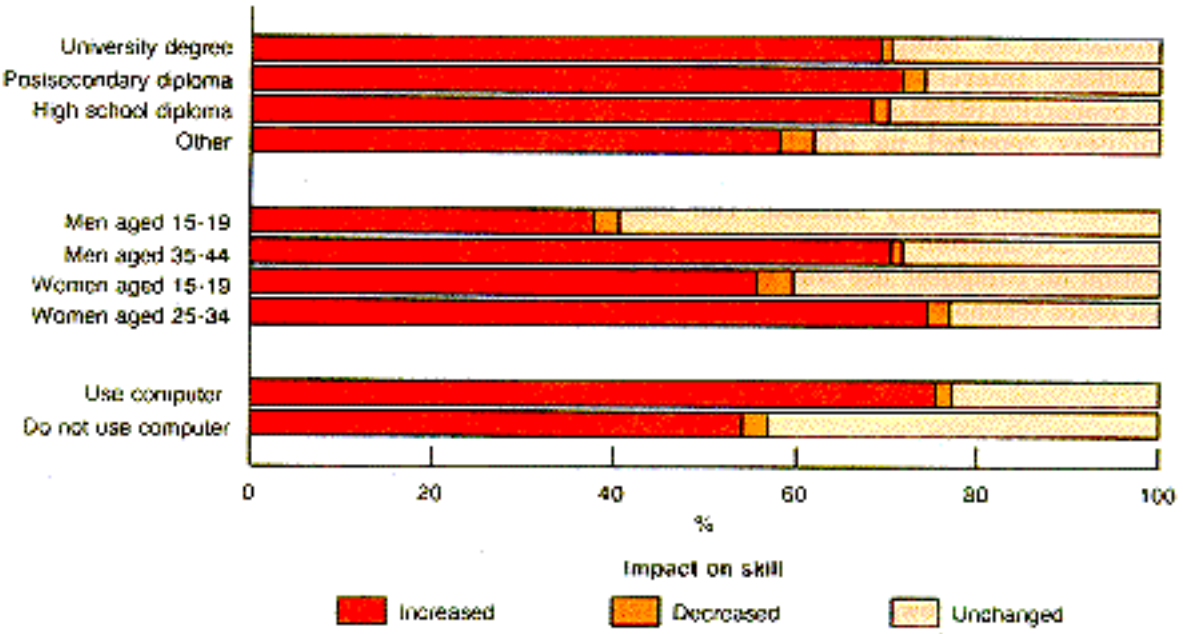
Impact of introduction of computers or automated technology, 1989

	Employees reporting that their work had been:			
	greatly affected	somewhat affected	hardly affected	not at all affected
	%			
Canada	**28.0**	**14.9**	**14.4**	**41.9**
Newfoundland	17.6	18.1	17.6	46.5
Prince Edward Island	-	-	-	-
Nova Scotia	29.5	18.9	14.4	36.6
New Brunswick	21.4	13.7	12.7	51.5
Quebec	26.2	9.4	16.1	47.6
Ontario	29.1	14.9	11.9	43.2
Manitoba	25.4	19.6	15.3	39.4
Saskatchewan	24.6	18.7	21.7	34.0
Alberta	31.2	21.0	16.6	31.1
British Columbia	30.5	16.9	15.3	36.0

Source: General Social Survey

Perceived impact of computers or automation on skill level in last five years*

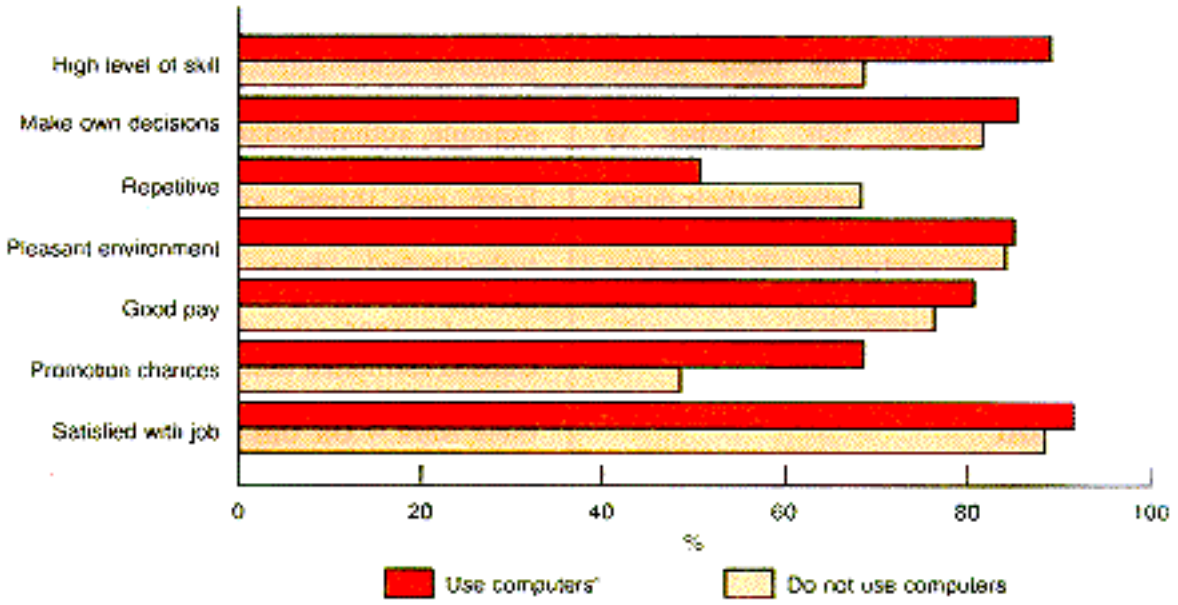
Even non-users reported increased skill levels because of the introduction of computers.



Source: General Social Survey, 1989
** Employees affected by automation.*

Job perceptions of employees, 1989

Computer users tended to view their jobs more positively than non-users.



Source: General Social Survey

** Mainframes, personal computers, word processors*