



Canadian Labour Market and Skills Researcher Network

Working Paper No. 83

The Role of Education in Technology Use and Adoption: Evidence from the Canadian Workplace and Employee Survey

W. Craig Riddell
University of British Columbia

Xueda Song
York University

October 2011

CLSRN is funded by the Social Sciences and Humanities Research Council of Canada (SSHRC) under its Strategic Knowledge Clusters Program. Research activities of CLSRN are carried out with support of Human Resources and Skills Development Canada (HRSDC). All opinions are those of the authors and do not reflect the views of HRSDC or the SSHRC.

The Role of Education in Technology Use and Adoption: Evidence from the Canadian Workplace and Employee Survey*

W. Craig Riddell
Department of Economics
University of British Columbia
craig.riddell@ubc.ca

Xueda Song
Department of Economics
York University
xsong@yorku.ca

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Abstract

Adoption of innovations by firms and workers is an important part of the process of technological change. Many prior studies find that highly educated workers tend to adopt new technologies faster than those with less education. Such positive correlations between the level of education and the rate of technology adoption, however, do not necessarily reflect the true causal effect of education on technology adoption. Relying on data from the Workplace and Employee Survey, this study assesses the causal effects of education on technology use and adoption by using instrumental variables for schooling derived from Canadian compulsory school attendance laws. We find that education increases the probability of using computers in the job and that employees with more education have longer work experiences in using computers than those with less education. However, education does not influence the use of computer-controlled and computer-assisted devices or other technological devices such as cash registers and sales terminals. Our estimates are consistent with the view that formal education increases the use of technologies that require or enable workers to carry out higher order tasks, but not those that routinize workplace tasks.

JEL Classification: I20, O33

Key words: Technology use and adoption, education, causal effects,
compulsory schooling laws, heterogeneity in technology

* We thank both the British Columbia Interuniversity Research Data Centre and Toronto Region-Statistics Canada Research Data Centre for access to the data. In particular, we thank Yves Decady and Lee Grenon at Statistics Canada for excellent statistical and data support. We also thank the SSHRC for research support. Earlier versions were presented at the International Conference for Panel Data Analyses, Seoul, Korea, and meetings of the Society of Labor Economists and the European Association of Labour Economics. Thanks are extended to participants for their helpful comments and suggestions.

Executive Summary

The creation and diffusion of new and more advanced knowledge and technologies has long been recognized as a major contributor to productivity and economic growth. As developed countries shift more toward economic activities that are knowledge-based, information, technology, and learning play an increasingly important role. The adoption of new technologies by firms and workers constitutes an important part of the process of technological diffusion and advancement. Thus, investigation of employer and employee characteristics that influence decisions to adopt new technologies is an important area of research.

Relying on data from the Canadian Workplace and Employee Survey (WES) (1999-2005), this study assesses the causal effects of workers' educational attainment on their use and adoption of new technologies. A key methodological challenge to our research is that the positive correlations between education and technology use and adoption that we expect to observe are likely to be confounded by the endogeneity of education, and thus do not necessarily reflect the true causal effects of education. In particular, positive associations between education and technology use and adoption could arise because of unobserved factors that are correlated with both variables. For example, individuals with higher innate ability and stronger motivation may be more likely to be early adopters of new technologies at the workplace and also more likely to acquire more schooling. In these circumstances standard regression methods, such as ordinary least squares (OLS) estimation, yield biased estimates of the true causal link between education and technology use and adoption.

To overcome the endogeneity of education problem, we make use of historical changes in compulsory schooling laws in Canada to create instrumental variables for assessing the causal effects of education on technology use and adoption. Moreover, we partially control for the unobserved ability of individual workers by controlling for the average observed skills of coworkers in the same firm and same occupation in our empirical analyses, which is possible due to the linked employer-employee feature of WES.

We find that employees with more education are more likely to use computers on the job. Graduating from high school increases the probability of using a computer in the workplace by 37 percentage points and an additional year of schooling increases such probability by 7 percentage points, impacts that are large in size and statistically significant. We also find that employees with more education possess longer work experiences in using a computer. Specifically, graduating from high school increases computer use experience by 6.2 years and an additional year of schooling increases computer use experience by 1.2 years. Employees with more education are not only more likely to use

computers on the job at a point in time, but also start to use computers earlier in their working lives.

The impact of education on technology use in the workplace, however, differs by the type of technology. Our IV estimates indicate that education does not exert causal effects on the use of computer-controlled and computer-assisted devices or other technological devices such as cash registers and sales terminals. In the context of the current “information and communication technology” era, these results are consistent with the view that education increases the use of technologies that require or enable workers to carry out higher order tasks, whereas schooling does not affect the use of technologies that routinize workplace tasks. Our finding is also consistent with findings from previous studies that technology is heterogeneous.

We also find evidence of heterogeneity in the impacts of education on computer use and computer use experience in the workplace. Impacts of additional schooling are largest in the range of 9 to 13 years of schooling, and somewhat lower above 13 years. The presence of heterogeneous effects helps to reconcile differences between OLS and IV estimates.

Overall, our results provide empirical support for the hypothesis that there exists a causal link between education and certain measures of technology use and adoption. Findings from this study not only shed light on the role of education in technology use and adoption, but also contribute to the literature on the non-market impacts of education. To the extent that education increases the probability of technology use and adoption, the private and social benefits of education may be understated by standard outcome measures (e.g., individual earnings). This will especially be the case if an individual employee’s education and the associated technology use also influence employer and coworker outcomes. In contrast, studies of the non-market effects of education often focus on outcomes such as health and longevity, impacts that are experienced by the individual receiving the education.

Further, this study contributes to the literature on the relationship between education and economic growth by providing empirical evidence that supports education as an effective means to enhance technology adoption and diffusion and hence technological advancement and productivity growth. It thus illuminates one specific channel through which education may enhance economic growth.