

Government Support of Edtech Research & Development: *An International Overview*

Marianne Bakia

Federation of American Scientists <http://www.fas.org/learn>

Introduction

Educational policymakers have invested heavily in computer technologies for schools. The Organization of Economic Coordination and Development (OECD) estimates that approximately US\$16 billion was invested in information and computing technologies in 1999 (the most recent year this statistic was available), accounting for between 1 – 2% of overall education spending. Most of this investment was in hardware and networking infrastructure (OECD 1999). Understandably, governments, and schools, are beginning to ask serious questions about the return on this investment. What have schools gained? How can these resources be maximized? Answering these questions requires an investment in research and development, and the public sector should be supporting the endeavor since it will ultimately capture many of the gains that individual firms cannot.

The Need for Government Leadership

An extensive literature suggests that government investment in research and development activities is an important driver of innovation (Branscomb and Keller 1998 and Council of Economic Advisors 1995). Government support is particularly important for education research, including research on educational technology (see PCAST 1997). Private investment in these areas is expected to be sub-optimal for several reasons. The near-term market for education technology products is extremely uncertain, early-stage research is inherently risky, and few firms have been sufficiently profitable to finance activities that don't immediately and positively affect the "bottom line." The role of government is to balance the private-sector's short-term profit interests with a longer-term perspective. Further, given the positive spillover effects of education (lower recidivism rates, better health, higher wages), the public-sector stands poised to benefit from a high rate of return. Therefore, government investment in high-quality education research and the development of educational technologies is clearly justified.

Understanding Current Government Role

Given the importance of government investment in educational technology research and development (Edtech R&D), relatively little has been done to document, analyze or compare government Edtech R&D programs in the countries

around the world. The Learning Technology Project at the Federation of American Scientists conducted a Survey of International Investment in Educational Technology Research and Development, funded by the Spencer Foundation. (http://fas.org/learn/intl_rev/intlsurvey.pdf)

The study:

- identifies government-funded programs of research related to educational technology,
- analyzes investment characteristics,
- encourages international awareness of educational technology research efforts, and
- sets a baseline for future analysis of investment priorities and trends.

The project has documented research and development funding in the United States, Canada, Mexico, the European Commission, Ireland, South Africa, Korea, Singapore, Japan, and Australia.¹ An on-line searchable database is available in addition to individual country profiles at http://fas.org/learn/intl_rev/index.html.

In spite of the efforts made to be comprehensive, the information provided by the survey must be considered preliminary. No formal reporting requirements for educational technology research and development are in place in any country. Further, there is no agreement on how to define basic or applied research and much of what is called research is in fact used to help school systems acquire hardware and off-the-shelf software to demonstrate use of existing technology. In addition, response rates in some countries were considerably higher than in others, and in many cases we cannot state with certainty that we have identified every relevant program. Nevertheless, this is an important step in documenting worldwide activity that has thus far gone largely overlooked. We continue to collect information regarding 2000 and 2001 investments, and we encourage policymakers and researchers around the world to provide comment and additional information to ensure that the work presented here is as comprehensive as possible.

With these limitations in mind, the results offered here can serve several purposes. They can be used by policymakers to assess priorities and programs both across agencies within federal governments and across federal governments, and to

identify peers internationally who might be grappling with similar issues. The results should also be of interest to researchers interested in identifying peers, collaborators, and funding opportunities internationally.

The following table summarizes the total estimated investment in the research and development of educational technologies in each of the countries studied.

Table 1: Overview of International Investment

Country	Edtech R&D Investment, Fiscal Year 2000
United States	\$285,000,000
Canada	12,000,000
European Commission	65,000,000
South Africa	230,000
Korea	330,000
Japan	11,420,000
Australia	737,000

The United States is the largest investor in the study, although most of the investment (\$160 million) was invested for specialized training in the military. Only \$40 million was clearly designated specifically for educational technology research and development, and this was scattered across many programs in several agencies. By contrast, the European Commission plan was well-coordinated, multidisciplinary, and longer term. Korean representatives were rather explicit in suggesting that the government did not view research and development of educational technologies as a priority. Rather, the MOE has adopted off the shelf products and focused on implementation issues. With the exception of Korea, representatives from all countries indicated that their respective governments intended to invest more in educational technology research and development in the future.

Summary of Findings per Country

The United States of America

The United States (U.S.) is a special case in the educational technology research and development arena because of the scope, scale and continued commitment of the federal government to the use of educational technologies. Education in the United States is a large enterprise, accounting for more than a third of the global education and training market (Software Information Industry Association 2001). Public and private entities in the United States invested nearly \$800 billion dollars on education and training in FY2000, and technology-related investments were also sizeable. The Federal government alone invested over \$3 billion on technology for education in FY2000, including the e-rate program, and the private sector invested approximately \$2.5 billion.

Despite these sizable investments in activities related to educational technology in FY2000, the federal government only designated about \$196 million to the research and development of educational technologies, the vast majority funded by the Department of Defense. Examining many of these specific projects suggests a very unique focus of immediate interest only on the military. If military investments are excluded, the federal government only designated \$8 million to basic research, nothing to applied research, and about \$25 million to development, for a total of \$33 million designated to the research and development of educational technologies in FY2000. U.S. designated investments are scattered across four government departments or agencies, including the Department of Education, the National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), and Department of Defense.

Canada

Canada uses educational technologies actively, principally for distance education across Canada's vast, and often sparsely populated, terrain. However, the federal government in Canada has a very limited role in education. In fact, Canada does not have a centralized Ministry of Education charged with overseeing educational initiatives and funding education-related research. Instead, each of the ten provinces and three territories within Canada has at least one ministry of education whose responsibilities include developing and maintaining educational services and developing and overseeing distance learning programs. Therefore, most activity is being funded at the provincial rather than the federal level.

As in other countries the emphasis is on implementation, and Canada has placed particular emphasis on distance learning. Most programs support the achievement of structured, relevant web-based instruction and build upon existing models of web-based tools and late-stage development. Two departments in the Canadian federal government fund educational technology programs: Industry Canada and Human Resources Development Canada. In FY2000, the Office of Learning Technology (OLT) and Social Science and Humanities Research Council (SSHRC) maintained total budgets of \$10.7 million and \$84.9 million respectively for a total of \$95.6 million.

European Commission

European countries support the research and development of learning technologies with financial and intellectual leadership coming from the European Commission (EC). The EC is somewhat analogous to the executive branch of the United States federal government. Its general mission is to "embody and uphold the general interests of the European Union." The EC organizes its activities within multiple "directorates general," (DGs) which are specific either to a function (i.e. budgeting or external affairs) or policy area (i.e. agriculture,

education and culture, or environment). Several of these DGs touch on the research, development, or implementation of educational technologies, including: Education and Culture, Information Society, and Research, although the bulk of Edtech research and development activities have been managed by the Technology Program in the Information Society.

The EC has set out its research, technological development and demonstration (RTD) goals in a series of five-year "Framework Programs." The most recent, the Fifth Framework Program (FP5), covers the years 1998 - 2002. FP5 has a budget of about \$13.5 billion. The thrust is on solving social problems, with a focus on a limited number of research areas directly related to one of six thematic areas, which combine technological, industrial, economic, social and cultural aspects. The six thematic areas of FP5 are:

- Quality of Life and Management of Living Resources,
- User-Friendly Information Society,
- Competitive and Sustainable Growth,
- Energy, Environment and Sustainable Development - Euratom, and
- Increasing Human Research Potential and the Socio-Economic Knowledge Base.

Each thematic area is associated with several "Key Actions." FP5 has a total of 23 Key Actions. Key Actions are intended to mobilize the wide range of scientific and technical disciplines, both fundamental and applied, required to address specific problems. This has the effect of not only encouraging trans-disciplinary research but also bridging activities across programs and organizations. The third Key Action: Multimedia Content and Tools (KA3) is by far the largest funder of Edtech research and development, although other key actions also designate or allocate funds for this purpose.

South Africa

South Africa is committed to providing distance education via Information and Communication Technologies (ICTs) to meet its lifelong learning needs, and it has a considerable foundation already in place. It has the most advanced information technology infrastructure in southern Africa, which places it in an excellent position to take advantage of the latest educational technologies. For example, the Universities Network (UniNet), provides an Internet backbone that connects an estimated 500,000 students and staff at 21 universities and 15 technikons (Farrell, 1999). Further, South Africa has extensive experience providing distance learning with a variety of information technologies, including print, radio, and more recently computers. The University of South Africa (UNISA) (est. in 1875) is one of the earliest universities based on distance education strategies.

Although the emphasis has been on implementation, South Africa is also beginning to allocate resources to the research

and development of educational technologies. In FY2000, it is estimated that educational technology R&D funding totaled \$299,600. The primary funding agency for these initiatives is the Department of Arts, Culture, Science, and Technology.

Korea

As manifested in CYBER KOREA 21 policy initiative, Korea hopes to become one of the top ten nations in the world with the most advanced information infrastructure and industry. Government policy includes educational adoption of technologies as an important cornerstone of this initiative, although the research and development of educational technology applications is not included.

Since 1997, the Ministry of Education (MOE) has been pursuing a policy for adapting information and communication technologies in education systems for the primary school and university system. The MOE has conducted an aggressive campaign to build the information infrastructure, to develop the educational multimedia contents, and teacher training. The goals of the infrastructure policy were to:

- place at least one computer lab with multimedia PCs at every K-12 school,
- place at least one PC and a large monitor in every classroom,
- provide each teacher with a PC,
- have all PCs and servers connected into a campus network and a high-speed internet line.

Between 1997 and 2000, the MOE spent \$1.4 billion dollars on the building Korea's educational system's ICT infrastructure.

The MOE is very serious about integrating educational technologies in their school system, but does not believe it is necessary to invest heavily in educational technology R&D. Rather, the MOE feels comfortable using off-the-shelf technology currently in the market. Consequently, the MOE concentrates on utilizing the latest technologies currently available on the market, rather than investing heavily in educational technology R&D.

The Ministry of Information and Communication (MIC) funds the small amount of educational technology R&D funded by the government. In FY2000, \$330,000 was allocated to educational technology R&D projects related to multimedia content, developing tools, remote learning, and educational databases.

Japan

Japan was surprisingly slow in implementing educational technologies into the K-12 system in the 1990s, but the country is aggressively changing course. The Japanese gov-

ernment anticipates that all classrooms will have Internet access by 2005. There are also many projects that are designed to bring the latest multimedia technologies to schoolchildren. For example the "Regional Model Project for Advanced Educational - Networking" is planning to join 1076 schools in 30 districts via the latest high-speed telecommunications network. Additionally, the "Project Promoting Alignment between Schools for Using Multimedia" is going to provide the latest distance education applications to 600 schools.

Japanese investment in Edtech research and development is somewhat unique internationally, particularly because of the coherent and systematic approach by the National Institute of Media Education (NIME). NIME is one of three agencies supported by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) to conduct educational technology research and development. In FY2000, MEXT invested nearly \$7.5 million in education technology R&D through these three agencies.

Australia

Australia has a long and extensive history of integrating technology in education, particularly for distance education in rural, isolated communities. Under the guidance of the Department of Education, Science and Training (DEST), Australia has been developing innovative uses of ICTs in their distance education initiatives. DEST's main priorities are to implement the education and training policy of the Prime Minister, Parliament, and the Commonwealth community.

In FY2000, the Commonwealth of Australia spent approximately \$736,589 on educational technology research and development. Australian Commonwealth programs that support the research and development of educational technology are not managed by DEST, but are the responsibility of two primary agencies of the Australian Research Council (ARC), and the Australian National Training Authority (ANTA). Although funding allocations for educational technology research and development is not very great in Australia, it is expected that ARC will continue to increase its funding for ED TECH R&D in FY2001.

Bibliography

Branscomb, L. and Keller, J., eds. (1998). *Investing in Innovation*. Cambridge, MA: MIT Press.

Council of Economic Advisors. (November 1995). *Supporting Research and Development to Promote Economic Growth: The Federal Government's Role*. Washington, DC: Author.

Farrell, G.M. *The Development of Virtual Education: A global perspective*. The Commonwealth of Learning: Vancouver Canada
OECD (1999). *Education Policy Analysis*, Paris: Author.

President's Committee of Advisors on Science and Technology: Panel on Educational Technology (March 1997). *Report to the President on the Use of Technology to Strengthen K-12 Education in the United States*, New York: Author.

¹These countries were selected because a review of the academic literature and World Wide Web revealed evidence that these were the most active globally. Attempts were also made to collect data from Russia, China, New Zealand, and India, but these countries proved difficult to obtain necessary information about their programs and investment levels.

While the FY2000 numbers may appear low considering the considerable activity related to educational technologies in Australia, it is important to note that Australia has stepped up its activity in FY2001 with an innovative, new program.

The Commonwealth government is sponsoring a new initiative that focuses on the effective utilization of software-based learning technologies under the Backing Australia's Ability action plan, called the Le@rning Federation Schools Online Curriculum Content Initiative (SOCCI, see http://socci.edna.edu.au/suppliers/pdf/SOCCI_info.pdf). Beginning in 2001 and running until 2006, the SOCCI benefits from a \$17.6 million government effort, which includes matching funds from Commonwealth states. Total budget over the next five years is expected to climb to \$65 million. Under the management of the e-Learning section, the SOCCI's main objective is to generate high-quality, researched and evaluated, online curriculum content for Australia's schools. This collaborative and government coordinated program, expects to reduce potential duplication, increase cost efficiencies, and stimulate market and private investment in development.

Looking Forward

Despite the billions spent on implementing educational technologies, relatively little is spent on researching and developing how, when, where, with whom, and with what, these projects should be carried out. Perhaps as a result, and despite the extraordinary talents and dedication of the many teachers and software developers who have produced ingenious products that are already contributing to educational practices worldwide, a considerable gap separates the educational technology now in use from the incredible potential offered by these technologies. Efforts must be made within and across governments to standardize definitions of research and development and classifications of research and development, support high-risk, interdisciplinary research with potential for high public-payoff, and set long-term objectives akin to "a man on the moon" for education. With these and other supports in place, governments should examine closely opportunities to increase funding in this grossly neglected field.