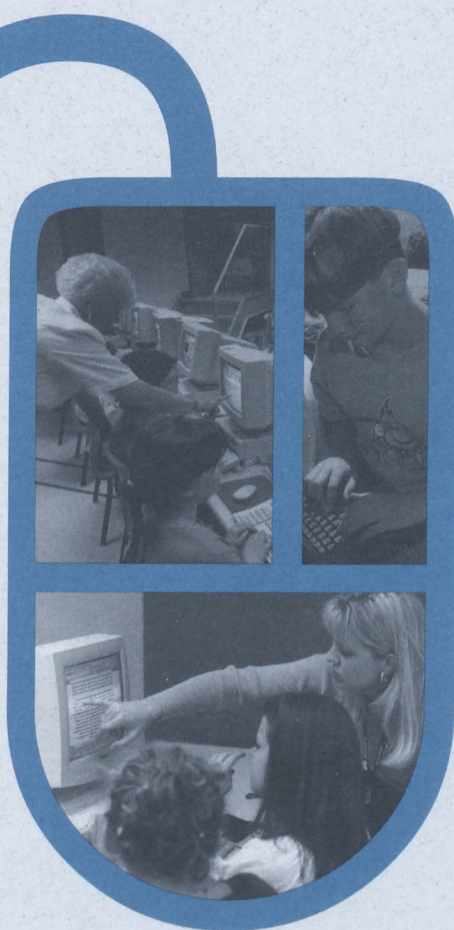


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Building Innovative Capacity in the Classroom

*Study prepared for Industry Canada
by The Conference Board of Canada*



The Conference Board of Canada

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Canada's SchoolNet GrassRoots Program

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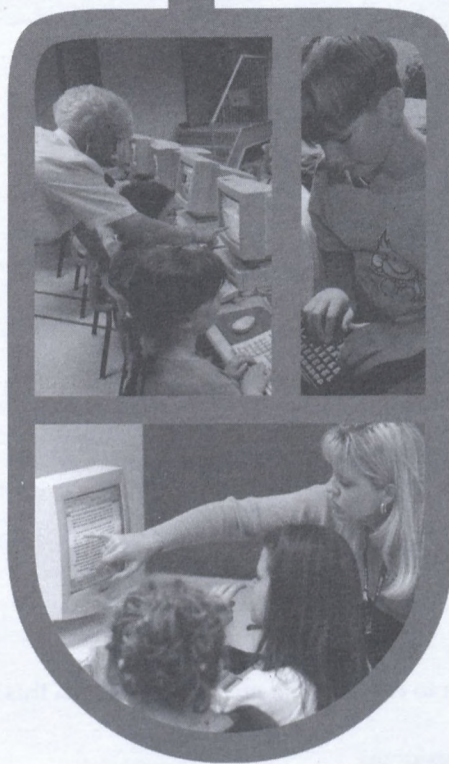


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This study was
made possible
through funding by
Industry Canada.

Building Students' ICT Skills

SCHOOLNET GRASSROOTS PROGRAM

Building Innovative Capacity in the Classroom

BY KURTIS KITAGAWA

March 2002

HIGHLIGHTS

Building innovative capacity depends on investing in people.

Industry Canada's SchoolNet GrassRoots Program offers funding to schools for the creation of innovative, Internet-based, collaborative projects.

GrassRoots projects develop the individual's innovative/entrepreneurial skills, attitudes and behaviours and also encourage collaboration at many levels.

The competencies arising from GrassRoots projects are easily transferred to the knowledge economy.



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About The Conference Board of Canada

The Conference Board of Canada is an independent, not-for-profit research organization with affiliates in the United States and Europe. Our mission is to help our members anticipate and respond to the increasingly changing global economy. We do this through the development and exchange of knowledge about organizational strategies and practices, emerging economic and social trends and key public policy issues. Since 1954, the Board has been committed to researching innovative practices, designing new strategies and providing our members with the most up-to-date information, analysis and expertise to help them excel in Canada and around the world.

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The Education and Lifelong Learning practice is a part of the Conference Board's Policy, Business and Society Division. Its mission is to help business, government and education leaders work collaboratively to promote the development of a learning society that prepares Canada's people for a changing world. The practice conducts research on issues of strategic concern to business, government and education; facilitates dialogue among business, government, education, community and labour leaders; and recognizes excellence in partnerships and programs that develop people in workplaces, education institutions and communities.

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Case Study

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EXECUTIVE SUMMARY

SCHOOLNET GRASSROOTS PROGRAM

Building Innovative Capacity in the Classroom

BY KURTIS KITAGAWA

March 2002

The purpose of this report, *SchoolNet GrassRoots Program: Building Innovative Capacity in the Classroom*, is to make the linkages between the Conference Board's findings in its case studies of four GrassRoots projects and the challenges and opportunities associated with equipping Canada for competitiveness and growth in the knowledge economy.

Industry Canada's SchoolNet GrassRoots Program offers funding to schools for the creation of innovative, Internet-based, collaborative learning projects that:

- are designed and implemented by teachers and students;
- are curriculum-relevant;
- foster the acquisition of academic, employability and computer skills in Canadian youth;
- integrate information and communications technology (ICT) into learning;
- build unique and relevant Canadian content on the Internet; and
- facilitate increased connectivity and training opportunities.

The Conference Board shows how students participating in GrassRoots projects are actively contributing - with the help of their teachers - to Canada's innovation agenda by developing the combination of generic employability and job-specific skills, i.e., problem-solving, teamwork and communications skills, and the know-how to leverage them in developing the innovative solutions that are crucial to equipping Canada for competitiveness and growth in the knowledge economy.

The present report adds value by providing a frame of reference for policy makers evaluating the impact and influence of the SchoolNet GrassRoots Program. Examples drawn from the four case studies illustrate that the skills students are learning are those that the innovation agenda emphasizes. SchoolNet GrassRoots is situated within a conceptual frame that the Conference Board has been developing in consultation

with its business, education and government partners for the past five years. In order to highlight this conceptual framework, material is drawn from a variety of Conference Board and other research documents, including the Conference Board's annual Innovation and Performance and Potential reports and the Report of the Federal Government's Expert Panel on Skills.

More specifically, this study shows how GrassRoots projects build in students the innovative/entrepreneurial skills, attitudes and behaviours that are key to ensuring Canada's competitiveness in the global economy. Information and communications technology skills such as keyboarding, research, editing and Web page design are immediately transferable across students' everyday experience. Moreover, process-oriented skills such as teamwork, problem solving, and verbal and written communication are core competencies (and therefore labour market capital) in the knowledge economy. And attitudes and behaviours such as initiative, drive and perseverance to get the job done are key levers in leading change. Taken together, this mix of skills, attitudes and behaviours, when combined with the relevant technical skill and knowledge sets, powers the knowledge economy.

This study also underlines the point that the skills and knowledge students develop while completing their GrassRoots projects are easily converted into innovative capacity in the knowledge economy. The habits students learn of transferring their skills, along with the institutional knowledge relative to developing and enhancing skills gained by the schools themselves, become the real dynamo of innovation as the GrassRoots process perpetuates itself in the subsequent activities of students and schools.

This report further reveals how GrassRoots projects enhance innovative capacity in the classroom by encouraging collaboration among teachers and between

schools, between teachers and students, and between students at different grade levels and in different geographical locations. The result of this collaboration is the growth of teaching and learning exchange networks, which are the pathways of the new "connected" culture.

Finally, this study emphasizes how GrassRoots projects are a living demonstration of entrepreneurial skills and culture in action. From the development of project proposals through the engagement of students in the work—in, for example, troubleshooting and problem solving in the execution—to communicating results and leveraging the learning resources created through the work, students cycle through the innovative/entrepreneurial process of thinking, managing and doing. Such skills are learned by doing,

and the immediate precedent of applying those abilities to the particular GrassRoots project at hand is already an indicator of innovative capacity that can be harnessed in subsequent activities.

The SchoolNet GrassRoots Program clearly contributes to building the human capital that drives the knowledge economy. It is a supportive, non-invasive complement to the delivery of curriculum in the classroom and, as such, helps students acquire the skills they need to make transitions to the world of work. GrassRoots projects make classroom computers come alive for students and engage them in innovative/entrepreneurial activities that engender the kinds of process skills and habits of thinking, managing and doing that they will apply in the knowledge economy.

SCHOOLNET GRASSROOTS PROGRAM: BUILDING INNOVATIVE CAPACITY IN THE CLASSROOM

About The Conference Board of Canada

For the past five years, the Conference Board has published *Performance and Potential*,¹ an annual research report that benchmarks our social and economic performance under dozens of indicators. Its objective is to find "Made in Canada" solutions and give insight into the underpinnings of our high quality of life and the choices we need to make to sustain that high quality. *Performance and Potential* issues a Call to Action, which contains the Conference Board's recommendations for improving Canada's socio-economic performance. The 2000–2001 *Performance and Potential* calls on business, education and government to make education and the development of a culture of lifelong learning a higher priority and encourages Canadians to grasp more firmly the levers of innovation that are the key to Canada's competitiveness and growth in the knowledge economy.

The Conference Board also produces an annual *Innovation Report*, which makes the connection between having and using a full complement of skills—including employability skills—and improving our innovative capacity. To succeed in the knowledge economy, Canadians need a combination of generic employability and job-specific skills, i.e., problem-solving, teamwork and communications skills, and the know-how to leverage them in developing innovative solutions.

¹ The most recent issue is *Performance and Potential 2000–2001: Seeking "Made in Canada" Solutions* (Ottawa: The Conference Board of Canada, 2000), ISBN 0-88763-479-6.

Introduction

Purpose of the Report

The purpose of this report, *SchoolNet GrassRoots Program: Building Innovative Capacity in the Classroom*, is to make the linkages between the Conference Board's findings in its case studies of four GrassRoots projects and the challenges and opportunities associated with equipping Canada for competitiveness and growth in the knowledge economy. More specifically, the Conference Board proposes to show how students participating in GrassRoots projects are actively contributing, with the help of their teachers, to Canada's innovation agenda. They are doing so by developing the combination of generic employability and job-specific skills, i.e., problem-solving, teamwork and communications skills, and the know-how to leverage them in developing the innovative solutions that are crucial to equipping Canada for competitiveness and growth in the knowledge economy.

Examples will be drawn from the four case studies to illustrate that the skills students are learning are those the innovation agenda emphasizes. The

conceptual framework in which the SchoolNet GrassRoots Program will be situated is one that the Conference Board has been developing in consultation with its business, education and government partners for the past five years. In order to build this conceptual framework, material will be drawn from a variety of Conference Board and other research documents. These include the Conference Board's *Performance and Potential* reports and its annual *Innovation Report*,¹ as well as the *Report of the Federal Government's Expert Panel on Skills*.

The present report adds value by providing a frame of reference for policy makers evaluating the impact and influence of the SchoolNet GrassRoots Program. It shows specifically how GrassRoots projects are empowering students to contribute actively to the knowledge economy. When they participate in GrassRoots projects, students build problem-solving, teamwork and communication skills and the know-how to leverage them in developing innovative solutions. These are among the innovative/entrepreneurial skills that are key to ensuring Canada's competitiveness.

NBEC Mission

We help business and education leaders work collaboratively to promote the development of a learning society that will prepare Canada's young people for a changing world.

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The GrassRoots case studies were written on the basis of in-depth face-to-face and telephone interviews with teachers, students, parents and school board personnel.

SchoolNet GrassRoots Program

Industry Canada's SchoolNet GrassRoots Program offers funding to schools for the creation of innovative, Internet-based, collaborative learning projects that:

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- foster the acquisition of academic, employability and computer skills in Canadian youth;
- integrate information and communications technology (ICT) into learning;
- build unique and relevant Canadian content on the Internet; and
- facilitate increased connectivity and training opportunities.

Background

In the fall of 2000, The Conference Board of Canada reviewed, in its ongoing case studies series, four projects funded by Industry Canada's GrassRoots Program. These projects represent initiatives of different levels of complexity undertaken by schools across Canada.

The case studies focus on initiatives from education, business and government that develop the employability skills of all Canadians, whether within the publicly funded education system, within the workplace, or participating in government programs that support labour market transitions for those outside the publicly funded education system and not currently employed. Conference Board case studies showcase effective practices in developing skills and provide independent analyses of the challenges, benefits and keys to success of skills development activities operated on a small or large scale. The case studies are reflective templates that can be used to replicate successful

programs and provide realistic commentary and observations on the "what fors" and "how tos" of developing the skills of Canadians in different environments. They also provide insight into the conditions under which different employability skills development programs may be replicated or adapted by others.

The GrassRoots case studies were written on the basis of in-depth face-to-face and telephone interviews with teachers, students, parents and school board personnel associated with the different projects. The studies focus on the:

- diversity of activities involved in implementing a project;
- particular information and communications technology (ICT) and other skills gained by students/teachers;
- impact on learning and teaching of the integration of ICT in the curriculum;
- innovations by teachers in integrating ICT-based learning in the classroom;
- student/teacher team structures used to complete a big project;
- student/teacher reflections on the Internet and its uses in education; and
- awards or recognition received for GrassRoots projects.

Canada's Innovation Agenda and the Knowledge Economy

In her recent Speech from the Throne, the Governor General, Her Excellency the Right Honourable Adrienne Clarkson, outlined the federal government's innovation agenda and its closely related skills and learning agenda. According to this, the government is committing itself to "building a world-leading economy driven by innovation, ideas and talent" by pursuing economic and social success together. One of the key elements of the government's plan is to invest "aggressively in the skills and talents of [Canadians]."²

In the GrassRoots projects reviewed by the Conference Board, students utilize the Internet to improve their skills. ►

Having a ready supply of skilled individuals is a key element in developing innovative capacity. ►

GrassRoots projects clearly support Canada's innovation agenda. ►

Actualizing innovative capacity enhances productivity, increases competitiveness, generates wealth/resources and helps to ensure quality of life. ►

This agenda is shared by The Conference Board of Canada. For example, the Board has stated that the knowledge economy is characterized by a "high velocity and complexity of change," in which the "human mind is the prime source of value creation" and where the "organization that thrives ... is the innovative one with a rate of learning that exceeds the rate of change in the surrounding competitive environment."³ The Board has further observed that, increasingly, the Internet is the most "valuable source of the information and knowledge [Canadian youth] need to improve their employability skills."⁴

In the GrassRoots projects reviewed by the Conference Board, students utilize the Internet to improve their skills. GrassRoots projects clearly support Canada's innovation agenda. In the following section of this report, the process by which economic value is extracted from knowledge (the definition of innovation endorsed by the Conference Board) is explored more systematically. This innovation process will then be used as a framework for analyzing the contributions GrassRoots projects make to Canada's innovation agenda.

Innovation: A Framework for Analysis

The innovation process can be summed up very simply. **The Conference Board defines innovation as the "process through which economic value is extracted from knowledge through the generation, development and implementation of ideas to produce new or improved products, processes and services."**⁵ Innovation is accomplished by people. Since people drive innovation on the basis of exercising and refining their skills, building the skills of individuals is a primary focus of the innovation process. Skills can be developed in any context, whether at home, at school, in the workplace or in the community.

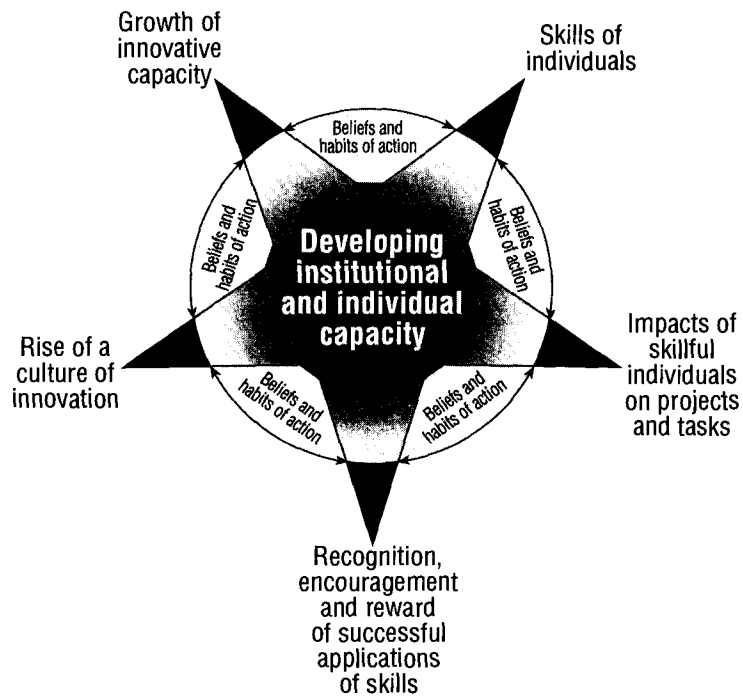
Having a ready supply of skilled individuals is a key element in developing innovative capacity. Particularly needed are people with the right mix of occupationally specific job skills and the generic skills, attitudes and behaviours identified by the Conference Board and others as required for success in any job in the knowledge economy. Attention to creating the policy environment and the institutional conditions at all levels (e.g., home, school, work, community) where skills development can most effectively take place is therefore central to building the skills of individuals. **It makes sense to speak of innovative capacity only when the political and institutional mechanisms are in place to assure a supply of skilled individuals who can drive the process of innovation.**

Once the structures are in place to support the development of people with the skills needed to drive innovation, individuals and organizations can consistently reap the benefits of having and actualizing innovative capacity. Leveraging that capacity can yield increased productivity, which in turn contributes to competitiveness and growth and the generation of wealth. All of this helps to ensure the quality of life of all Canadians.

Exhibit 1 shows the interconnectedness of a number of factors in developing human capital and building innovative capacity. Actualizing innovative capacity enhances productivity, increases competitiveness, generates wealth/resources and helps to ensure quality of life. But building innovative capacity depends fundamentally on investing in people.

In the following sections, each of these levers of innovation is developed more fully. In the final part of the report, examples drawn from the GrassRoots case studies will be situated within this framework according to the element of the innovation process they support.

Exhibit 1—Innovation: A Framework for Analysis



Source: The Conference Board of Canada.

What will emerge from this analysis is a portrait of GrassRoots as a contributor to Canada's innovation agenda.

Investing in People

The federal government's rationale for investing in the skills of individual Canadians is summed up neatly in Prime Minister Jean Chrétien's Address in his Reply to the Speech from the Throne: "In the new economy, the race goes to the quick—those who are first with new discoveries, first to market, first with better ways of doing things."⁶

Moreover, according to the Honourable Paul Martin, Minister of Finance for Canada, the quick are made, not born, and their development starts early. Thus, the beginning of their progress starts with basic education:

learning not only the "three Rs but also the three Cs of computation, calculation and communication" and having a "basic knowledge of the Web and how to navigate it, an understanding of its potential and how to exploit it, a grasp of its power and how to employ it."⁷

More detail on the skills Canadians need to compete in the global economy was given in *Stepping Up: Skills and Opportunities in the Knowledge Economy* (hereinafter referred to as the *Report of the Expert Panel on Skills*),⁸ the report of the Prime Minister's Advisory Council on Science and Technology, from October 1999.

According to the *Report of the Expert Panel on Skills*, the key to Canada's success in the global economy lies in building and sustaining a culture of

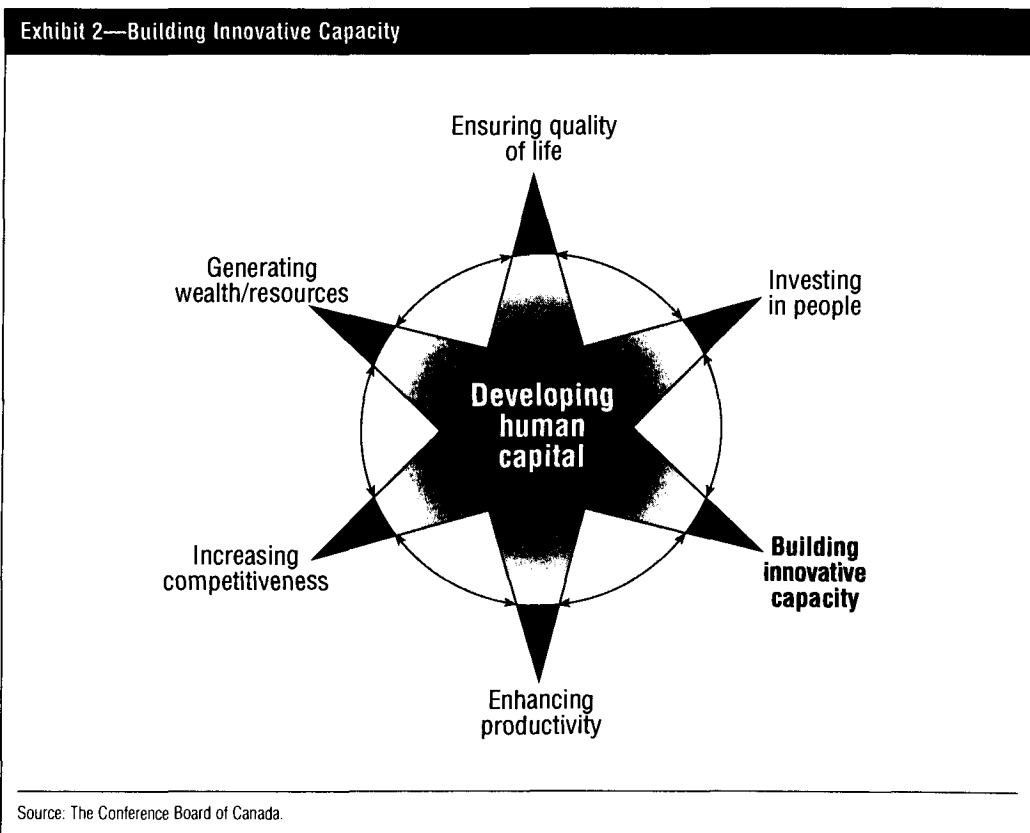
Patterns of behaviour such as innovative problem solving, teamwork and effective communication arise and take shape when people expect their words and actions to make a difference.

innovation/entrepreneurialism. This stands to reason, because it is human beings who add value through the application of their skills and knowledge in converting challenges into opportunities, investing in people, and building innovative capacity.

Moreover, human beings experience and participate in the economy—as they do in their daily lives—through the mediation of their beliefs and habits of action. Patterns of behaviour such as innovative problem solving, teamwork and effective communication arise and take shape when people expect their words and actions to make a difference, when they see the connection between what they do and how that affects the success of their projects and tasks. That sense of efficacy, or more simply of power, when consistently

recognized, encouraged and rewarded over time, creates expectations of future success that invite or motivate repeated applications of successful strategies and predictable performances. In other words, individuals' belief in their own power in relation to common purposes gives rise to a *culture*, or an intimation of the way things are done. A culture of innovation conveys the practical understanding that the application of such things as problem solving, communication and teamwork skills produces innovative results.

Exhibit 2 shows how the institutional employment and encouragement of the skills of individuals give rise to a culture of innovation that is driven at every stage by beliefs and habits of action centred on personal efficacy ("I can make a difference") and individual initiative.



► *The Report of the Expert Panel on Skills argues that entrepreneurial skills are among the components of innovative capacity.*

► *Innovative and entrepreneurial capacity is built on such basic skills as the ability to read, write, calculate and operate basic computer applications.*

Building this culture requires an integrated solution. It requires us to focus on encouraging the growth of the innovative and entrepreneurial capacity of our people as well as putting into place institutional or structural mechanisms that support the ongoing development of this capacity. The *Report of the Expert Panel on Skills* argues that among the components of innovative capacity are entrepreneurial skills. The Report focuses on finding ways not only of enhancing the entrepreneurial skills of individual Canadians but also of bolstering the institutional structures that support entrepreneurship.

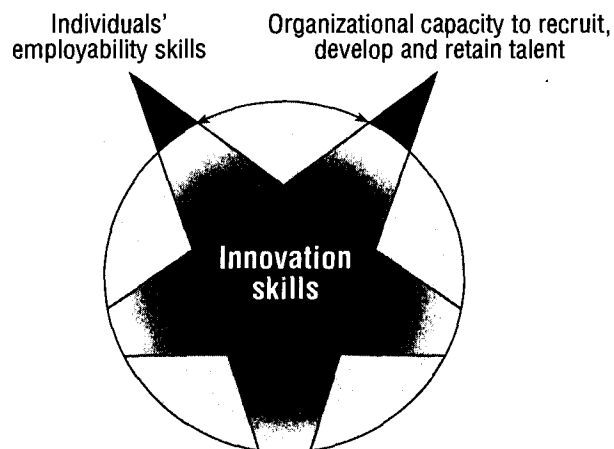
This vision is highlighted in The Conference Board of Canada's recently published *What to Do Before the Well Runs Dry: Managing Scarce Skills*.⁹ This report makes it clear that "employability skills" are the same skills that drive innovation. The report further argues that, from an organizational or business point of view, the basic employability competencies that help individuals succeed in the world of work are precisely those skills that organizations have to use to retain

and develop talent. This means that in order to build innovative capacity, companies need to build management's employability skills, encourage their use and build the infrastructure that supports the practise and exercise of these skills. This, in turn, will support the development of a culture of innovation and help Canadian business to retain talent.

Exhibit 3 underlines the point that the interests of organizations in recruiting, developing and retaining talent coincide with the interests of individuals in equipping themselves with employability skills. Both individuals and organizations need to have and use their skills to build innovative capacity in the economy.

Innovative and entrepreneurial capacity is built on solid grounding in such basic skills as the ability to read, write, calculate and operate basic computer applications. It is founded on the ability to think, analyze and solve problems, learn independently, exercise responsibility, adapt to a range of situations, communicate

Exhibit 3—The Skills Individuals Need to Get and Keep a Job Are the Same Skills Employers Need to Retain and Develop Talent



Source: The Conference Board of Canada.

► *The innovative and entrepreneurial capacity of shop floor and office workers - no less than that of middle managers, technicians, skilled tradespeople, executives and professionals - is crucial to competitiveness and growth.*

► *Conference Board research shows that well-roundedness - in the sense of combining technical with interpersonal skills - is precisely "what separates high-potential employees from the rest of the pack."*

► *Developing people is therefore key to building innovative capacity and competing globally.*

effectively, co-operate with others and work in teams. And its full potential is released only when drive, determination, enthusiasm and commitment animate these skills.

This combination of skills, attitudes and behaviours is not optional in the knowledge economy. Everyone's commitment is needed to drive innovation. The innovative and entrepreneurial capacity of shop floor and office workers—no less than that of middle managers, technicians, skilled tradespeople, executives and professionals—is crucial to competitiveness and growth. Clearly, individuals make their greatest contribution to innovation when they combine their technical, or job-related, occupational skills with the skills, attitudes and behaviours that enable them to work together, communicate and solve problems. Conference Board research shows that well-roundedness—in the sense of combining technical with interpersonal skills—is precisely "what separates high-potential employees from the rest of the pack."¹⁰

The Conference Board of Canada, in its *Employability Skills 2000+*, has elaborated on the skills, attitudes and behaviours that enable Canadians to work together, communicate and solve problems.¹¹ These skills, which can also be applied and used beyond the workplace in a range of daily activities, fall into three main categories: fundamental skills, personal management skills and teamwork skills.¹²

But while the mix of skills, attitudes and behaviours highlighted in *Employability Skills 2000+* are those most needed by Canadians, they are notoriously the most difficult to find. Even scarcer - especially in the fastest growing sectors of the economy (e.g., biotechnologies, information and communications

technologies)—are individuals who "combine strong technical abilities with essential skills (e.g., communications and teamwork) and management skills (e.g., cost control and budgeting). In all these sectors, executives reported that finding technically competent people who can work in teams, communicate effectively and apply their technical knowledge to real world business problems is a significant challenge."¹³

This sentiment is echoed in the Conference Board's own study of skills shortages that pose a serious threat to the competitiveness of Canadian industries. Executives from across high-growth sectors report that "many young candidates who possess the technical requirements for a position have "basic deficiencies in putting thoughts together in an organized fashion," or "are not quite ready interpersonally."¹⁴ Accordingly, in its *Performance and Potential 2000-2001*, the Conference Board calls on educational institutions to "become better at developing technical skills, improving science literacy, and helping to create positive attitudes to change, risk taking and lifelong learning."¹⁵

To summarize the story thus far, Canada's innovation agenda points to the importance of being innovative to competing in the knowledge economy. Innovation, in turn, depends on people having the right mix of skills. Developing people is therefore key to building innovative capacity and competing globally.

Building Innovative Capacity

Investing in people can take many forms, including the role educational institutions play in education and learning and the difference firms can make in training and skills development. The process of innovation requires government, business and education to attend

Innovation takes place at the organizational level and at the level of individuals. ►

Organizations support innovation internally when they recruit, retain, train and reward all of their employees with a view to increasing their practical ability to "take initiative, generate new ideas, take risks, embrace change and learn." ►

At the level of individuals, innovation takes place when people apply their skills to the process of extracting value from knowledge in terms of the development of products and/or the delivery of services. ►

Not surprisingly, the keys to operating successful and innovative GrassRoots projects are precisely the factors that contribute to innovation in the economy at large. ►

to developing and/or creating the conditions for individuals to develop skills and knowledge for participating in the new economy.

Innovation takes place at the organizational level and at the level of individuals. The two are connected, because it is individuals, ultimately, who drive innovation in their own organizations. On the level of firms, innovation takes place in an organizational context that supports the innovation process. It also requires collaborative opportunities that enhance organizational innovative capacity and a policy environment favourable to innovation.

At the level of individuals, innovation takes place when people apply their skills to the process of extracting value from knowledge in terms of the development of products and/or the delivery of services. Individuals are the ones who devise, modify and exploit innovative processes.

It is worth looking at the factors that contribute to successful innovation in the world of work, because these same factors come into play in GrassRoots projects where teachers and students build innovative capacity in the classroom.

Organizations support innovation internally when they recruit, retain, train and reward all of their employees with a view to increasing their "attitude assets," i.e., their practical ability to "take initiative, generate new ideas, take risks, embrace change and learn."¹⁶ This means that organizations have to provide an environment in which ideas and initiative are celebrated, healthy risk taking is encouraged, and learning and change are valued. Organizations are also successful innovators when they are functional and "relatively flat, capable of rapidly creating and disbanding teams from across the organization and of moving ideas and information quickly" and when their overarching operational management

practices (e.g., human resources, planning and budgeting) are aligned with corporate priorities on innovation.¹⁷

Organizations also create conditions favourable to innovation when they collaborate across corporate lines to share knowledge and risks, complement in-house competencies, and develop new skills.

Governments and educational institutions can also boost innovative capacity by creating a "publicly available pool of knowledge that is not necessarily industry specific" and by supporting education and public training programs that "develop skills that are essential for innovation."¹⁸

To sum up: building innovative capacity is a function of fostering conditions where risk taking is rewarded, creativity is promoted and the transfer of skills is encouraged. This report will show that GrassRoots projects help create the conditions necessary for these activities to take place. **The result is that GrassRoots projects are helping to build innovative capacity for the Canadian economy by building students' and teachers' skills in the classroom.** Not surprisingly, the keys to operating successful and innovative GrassRoots projects are precisely the factors that contribute to innovation in the economy at large.

Increasing Productivity, Contributing to Competitiveness and Growth, Ensuring Quality of Life

Investing in people and building innovative capacity are associated with enhanced productivity. Nearly 10 years ago, a multistakeholder Task Force on Challenges in Science, Technology and Related Skills sponsored by the federal government reported that the quality of people employed in a task "can make a tenfold difference in productivity."¹⁹

The Board found ►
that GrassRoots
projects are enormously
powerful vehicles for
engaging and focusing
teachers and students
in a shared learning
experience centred
on the use of information
and communications
technology to
accomplish curriculum
objectives.

Connectedness ►
emerges as a
whole new style
of teaching and
learning, not just
as an adjective
describing the
wiring of classrooms
to the World
Wide Web.

Enhanced productivity, in turn, contributes to Canada's competitiveness and growth in the global economy by making our higher value-added products and services available more cheaply in the marketplace and by inviting more foreign direct investment in the Canadian economy. The relative attractiveness of the resulting "Canadian brand" creates jobs, raises incomes and generates wealth. These things help Canadians maintain their standard of living and ensure their continued enjoyment of a high quality of life.

Summary: The Innovation Framework

The innovation framework presented in the preceding sections focuses on the importance of developing human capital as the key to building innovative capacity. Investing in developing the skills of individuals starts in motion a train of outcomes that leads to the rise of a culture of innovation and the growth of innovative capacity. The existence of this culture creates the necessary background conditions for individual and institutional innovative exertion. The purpose of investing in people is to empower them in the areas of problem solving, teamwork and communications, which convert an abstractly possible innovative potential into a concrete, dynamic innovative capacity.

This framework makes the connection between the skills individuals need in order to get and keep a job, on the one hand, and the skills employers need for recruiting, retaining and developing talent, on the other. Building the skills of individuals and developing institutional and individual capacity, in turn, have the effect of enhancing productivity, increasing competitiveness, generating wealth/increasing teaching and learning resources, and ensuring the quality of life of all Canadians.

GrassRoots Projects Situated Within the Innovation Framework

Synopsis

Having developed a framework for assessing contributions to Canada's innovation and skills and learning agenda, we now examine the SchoolNet GrassRoots Program as a key lever in building innovative capacity in the classroom. Wherever possible, insights and conclusions based on Conference Board research are illustrated with examples drawn from skills development activities reported in the Board's four case studies on projects completed under the SchoolNet GrassRoots Program.

In the most general terms, the Board found that GrassRoots projects are enormously powerful vehicles for engaging and focusing teachers and students in a shared learning experience centred on the use of information and communications technology to accomplish curriculum objectives. Time and again in interviews, teachers observed that **students involved in GrassRoots projects tend to take greater interest of their learning and, in consequence, tend to become more self-directed, independent learners.**

This has clear implications for the role of teachers, who must develop their relationship with their students: students who take a leadership role in their own education can be expected to consult more with their teachers. Students themselves tend to strengthen their relationships with one another as they collaborate in teams on their GrassRoots projects. In other words, to paraphrase author John Naisbett: "The higher tech you become, the higher touch you have to be."²⁰ Connectedness emerges as a whole new style of teaching and learning, not just as an adjective describing the wiring of classrooms to the World Wide Web.

GrassRoots projects ► are engaging for students who do not know the world without the mediation of technology. Students are hungry for learning that resonates with their experience outside of school and is relevant to their world.

Students "graduate" ► from being mere passive recipients of information into active learners who are engaged with the subjects they are studying and who design and drive processes that build their skills and knowledge and lead to the outcomes they and their teachers desire.

GrassRoots projects have had many other important impacts on, and outcomes for, students in particular. GrassRoots projects have been very effective in generating relevant learning experiences, promoting collaboration and across-curriculum connections, supporting student-owned and -operated learning, building a culture of mentoring and peer- and cross-tutoring, empowering active learners, refining teaching and learning practice, extending the use of computers, generating lasting learning products, enhancing students' and teachers' connectedness, and preparing students for transitions to the world of work. As the following analysis shows, all of these impacts and outcomes build the skills identified in the theoretical framework as being key to enhancing Canada's innovative capacity.

GrassRoots Invests in People

GrassRoots projects are engaging for students who do not know the world without the mediation of technology.²¹ Students are hungry for learning that resonates with their experience outside of school and is relevant to their world. Developing individual students' skills by engaging their passions motivates them to invest in their own skills development by taking ownership of their GrassRoots projects. With this motivational lever, students tend to drive their own learning and make connections across subject matter lines, applying skills and knowledge learned in one course to problems encountered in other subjects. In *La Boîte à Jeux*, for example, secondary students gained motivation and learned how to be resourceful and find technical solutions to problems they did not anticipate as they drove the process of adding value to elementary students' work.²²

In the course of operating their GrassRoots projects, teachers tend to

consult with one another across subject matter or disciplinary lines. The result of this sort of collaboration is that they better integrate their teaching and deliberately help students connect their learnings from one class with what they are called upon to do in other classroom learning situations. Opening these kinds of channels between teachers allows them to build students' skills and knowledge using a team approach that maximizes their collective capabilities and avoids unnecessary duplication of effort.

One is reminded here of GrassRoots activities undertaken in *Imagine the Challenge* at four Calgary schools. These activities, in different ways, cut across and integrate curricula in the following areas: social studies, science, technology, fine arts, language arts, physical education and mathematics. In one hands-on activity, students worked co-operatively to design, construct and cover a bridge made out of hundreds of objects of different shapes and sizes. This activity brought into play the students' geometry skills. In another activity, students used spreadsheets and graphs to plot their progress and that of an athlete in their different walking/running activities.²³ These kinds of across-curriculum connections are crucial to students, who build their innovative/entrepreneurial skills precisely when they connect knowledge acquired in one learning context to applications in other situations.

Investing in developing students' ICT skills therefore pays off in a variety of ways. Students "graduate" from being mere passive recipients of information into active learners who are engaged with the subjects they are studying and who design and drive processes that build their skills and knowledge and lead to the outcomes they and their teachers desire. In other words, GrassRoots projects encourage

Through their participation in GrassRoots projects, teachers coach students; students help teachers; and older students coach and assist younger students.

La Boîte à Jeux and Imagine the Challenge provide clear illustrations of how GrassRoots helps to develop the type of person the federal government's Expert Panel on Skills has identified as the key driver of the knowledge economy.

students to own, and as a number of teachers noted, *co-manage*, their education with their teachers, who provide curriculum continuity and planning support.

In this way, projects undertaken in tandem by elementary students, on the one hand, and middle and/or secondary students, on the other, were engaging and stimulating for students at both grade levels. Elementary students developed their own ideas, stories and activities while working towards French and mathematics curriculum outcomes. Secondary students then mentored the elementary students to develop, design and implement on-line educational games based on the elementary students' work.²⁴

La Boîte à Jeux and *Imagine the Challenge* provide clear illustrations of how GrassRoots helps to develop the type of person the federal government's Expert Panel on Skills has identified as the key driver of the knowledge economy. The *Report of the Expert Panel on Skills* emphasizes the importance of combining such essential skills as the ability to learn independently with key

"attitudes such as drive, determination, enthusiasm and commitment."²⁵

GrassRoots Builds Innovative Capacity

Investing in the development of students' skills builds innovative capacity in the classroom. Capacity, in contradistinction to potential, is a dynamic resource that students and teachers can and do draw upon at every point to enrich students' learning experiences.

The GrassRoots projects reviewed in the Conference Board's study show capacity being built in three significant ways. First, projects build students' and teachers' facility with collaborative, problem-based learning skills, which become a constantly available set of strategies on which they can draw. Second, GrassRoots projects expose students to a broad range of computer applications and thus add to their learning toolbox. Third, the projects enhance connectedness, which builds capacity by creating networks for exchanging information and expertise. It is worth exploring these three forms of capacity building in a little more detail.

1. Building Students' and Teachers' Facility with Collaborative, Problem-Based Learning Skills

Through their participation in GrassRoots projects, teachers coach students; students help teachers; and older students coach and assist younger students. In this way, GrassRoots projects help foster a culture of mentoring and peer- and cross-tutoring that augments and enhances the traditional culture of teaching and learning.

Teachers, and students as well, become guides on the side. Everyone develops collaborative, problem-based learning skills. This is a significant factor in building innovative capacity, whether in individuals, organizations or the economy at large, because problems that need to be solved in a workplace typically require collaboration. This, in turn, requires that individuals be able to make their own unique contributions and recognize those of others. Sometimes, technical problems that need to be dealt with involve interpersonal negotiation. Individuals need to learn how to assist and be coached in turn. Conference Board research underlines the importance of building teamwork and effective communication skills as vehicles for ensuring that technical expertise is fully utilized and not deflected by failures of personal expression or group function.²⁶

Through GrassRoots, students are extending their use of computers beyond the playing of games to conducting research, sharing information and publishing their work to an audience as big as the world.



For example, in *Imagine the Challenge*, having and using these process skills helped students understand the choices they were making and how they were treating other students in concrete situations in which they wanted to succeed.²⁷ Moreover, in *La Boîte à Jeux*, elementary teachers benefited from the feedback and technical support provided by their secondary students.²⁸ GrassRoots projects help to create a collaborative problem-based learning culture that structures teaching and learning activities.

2. Exposing Students to a Broad Range of Computer Applications

Innovative capacity is further enhanced when students use computers to complete school projects. Through GrassRoots, students are extending their use of computers beyond the playing of games to conducting research, sharing information and publishing their work to an audience as big as the world. *This Is Nova Scotia—From Individuals Out*, for example, shows that while the classroom may be where much learning takes place, it is not the only place where learning is shared. This GrassRoots project also demonstrates that computers are much more than vehicles for playing games; when connected with the Internet, they serve as tools for research and vehicles for interaction and collaboration.²⁹ This closely simulates what students will use computers for in the world of work.

The Conference Board's recent *Employability Skills 2000+* underlines the importance of being able to use computers, in a variety of applications, in virtually every part of the world of work. Research conducted when that document was prepared showed that it no longer makes sense to separate jobs requiring ICT skills from those that do not. So many workplace tasks are mediated by technology these days that jobs not requiring ICT skills are the exception, not the rule. By the same token, few jobs rely totally on technical skills (i.e., to the exclusion of teamwork and communication skills).

3. Enhancing Connectedness

A third way in which GrassRoots projects build innovative capacity relates to the various kinds of connectedness the projects enable and engender. When teachers and students carry out GrassRoots projects, they connect with one another in ways that empower individuals, build community capacity and lay the groundwork for a global community. GrassRoots projects enhance students' and teachers' connectedness in the knowledge economy in all of its various forms, including connections between physically present and long-distance project team members, connections between information sources, and connections between real-life events and the electronic recording of those events. Such high-touch/high-tech connectedness greatly expands teaching and learning horizons, because the whole world becomes a potential resource for gathering and interpreting data, sharing and processing information, increasing knowledge and building collaborative alliances, and generating useful and broadly applicable insights. **This is the stuff of innovation.**

Imagine the Challenge underlines the many ways community capacity is built through developing connectedness among teachers and students. Community capacity includes not only having "depth" in terms of ICT skills but also demonstrating self-confidence, expressing empathy with the situation of others, and taking responsibility for the things that are within one's power and that one can do.³⁰

To sum up: GrassRoots projects have helped to make connectedness a whole new style of teaching and learning, not just an adjective describing the wiring of classrooms

When teachers and students carry out GrassRoots projects, they connect with one another in ways that empower individuals, build community capacity and lay the groundwork for a global community.



GrassRoots projects develop individuals who see possibilities for using information and communications technology everywhere and seize any opportunity to apply their skills.

The skills (students) develop in the process (of doing a GrassRoots project) are the very soul of innovation, whose principal virtue, from the point of view of building capacity in the economy, is that it perpetuates itself on the basis of skills it engenders in individuals and institutions.

to the World Wide Web. Students learn innovative/entrepreneurial skills by enlarging their spheres of connectedness. They learn how to make their own unique contributions by building their ability to communicate effectively, solve problems and work in teams to deliver learning products on a just-in-time basis. The skills they develop in the process are the very soul of innovation, whose principal virtue, from the point of view of building capacity in the economy, is that it perpetuates itself on the basis of the skills it engenders in individuals and institutions. **GrassRoots grows human capital from the real grassroots in the form of Canada's youth.**

4. GrassRoots Generates Knowledge/Products

Conference Board research in the present study shows that GrassRoots projects not only build the skills of individual students but also develop capacity within their schools. In *Imagine the Challenge*, for example, when students reflected on their projects, they spoke of them as if they were still going on. This makes sense, because the learning products they developed (e.g., Web sites) are still available for use after the projects formally end, and teachers and students continue to apply their newly acquired or further refined skills to new projects. In short, GrassRoots projects develop individuals who see possibilities for using information and communications technology everywhere and seize any opportunity to apply their skills. These individuals are self-perpetuating ICT resources, who ensure that ICT is an ever-present possibility that they work to actualize whenever the occasion presents itself.

Teachers and students exploit the unique features and properties of information and communications technology to design and complete classroom-relevant activities, showcase their achievements and communicate their successes. This converts some of the tangible outcomes of education into living products that become dynamic quantities in the teaching and learning cycle for interested teachers and students everywhere. Accordingly, the use of computer technology "provides a tangible link between the world of education and the world of work."³¹ On the GrassRoots model, students and their teachers become entrepreneurial about teaching and learning, designing—and teaching and learning through—projects that not only help them accomplish their objectives in meeting curriculum outcomes but do so in a way that engages them and generates useful, value-added products.

Backyard Bird Feeding in Newfoundland, for example, underscored how integrating ICT skills into the delivery of curricula is most effectively achieved when such an initiative is operated on a business and/or entrepreneurial model that incorporates a strong marketing plan and leverages its assets appropriately. In other words, such initiatives work best when they are:

- coupled with a communication plan designed to showcase successes to school councils and school boards and celebrate achievements with students and their parents; and
- designed to be supported through time as a permanent learning resource for other teachers and students.³²

Backyard Bird Feeding in Newfoundland is a perfect illustration of the Conference Board's finding that innovation requires a full integration of thinking, managing and doing. The capacity to generate ideas needs to be attached to the process and planning skills that are required to manage and sustain projects and enterprises, and both of these need to be harnessed to a personal, organizational and institutional culture that takes

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In their GrassRoots projects, students do not just learn factual information about building and sustaining a culture of innovation/entrepreneurialism; they actively develop innovation/entrepreneurial skills precisely by building innovative/entrepreneurial capacity in the classroom.

usable products and services to market.³³ In their GrassRoots projects, students do not just learn factual information about building and sustaining a culture of innovation/entrepreneurialism; they actively develop innovation/entrepreneurial skills precisely by building innovative/entrepreneurial capacity in the classroom.

To summarize: **by participating in GrassRoots projects, students drive their own learning by developing real products (their GrassRoots projects) for real markets (e.g., current and future generations of students and teachers in other schools), which effectively simulate the performance skills and standards of the world of work.** This is the “practical relevance” of ICT, which makes learning engaging.³⁴ Having this knowledge and using these skills is essential to making successful school-to-work transitions, as well as contributing to and realizing one’s full potential in today’s world of work. ICT skills are crucial to meeting the challenges of building and leveraging innovative capacity in the knowledge economy, and students and teachers participating in GrassRoots projects are helping Canada meet those challenges and turn them into opportunities for competitiveness and growth.

For their part, teachers participating in GrassRoots projects reflect on what they have done. This is an important step in developing teachers’ pedagogical practice, because the learnings they derive from what they have done become, through the act of reflection, a resource they can apply in the future to integrate ICT skills development into the delivery of other curriculum objectives.

The ultimate beneficiaries of educators who actively reflect on and adjust their teaching practice are students, who make connections—learn—for themselves much more independently. In *Imagine the Challenge*, for example, students initiated and drove their own learning through the use of e-mail, the Internet, telephone and video technology. Significantly, students who participated in the *Imagine the Challenge* project also applied the self-confidence they gained and the risk-taking strategies they learned through GrassRoots to a variety of subjects such as mathematics, where they attempted answers even when they were not sure they were right.³⁵

The mechanism by which students benefit is easily described. Teachers participating in GrassRoots projects tend to provide their students with just-in-time, activity-based support. Students for whom such support is modelled build powerful support skills that help them later on in the workplace when they are called on to apply their knowledge in problem-solving situations requiring innovation.³⁶ Indeed, the knowledge economy is characterized by the rapid change of skills it requires, both of individuals and within organizations, to keep competitive. Retooling on a just-in-time basis as the key to capturing new opportunities, in turn, demands a workforce that can be reassembled on a moment’s notice to tackle a new problem or seize a new opportunity.

The GrassRoots projects studied by the Board present knowledge economy problems in microcosm (e.g., integrating ICT into the classroom, which has an immediate parallel in the challenge industry faces in developing e-learning systems in the workplace) and help students respond in innovative ways by building their skills. This finding from the GrassRoots case studies is also reported in an ongoing series of Conference Board case studies focusing on workplace education programs.³⁷

Perhaps the clearest demonstration of how GrassRoots projects build innovative capacity in the classroom lies in the way different projects—by sheer virtue of being so engaging to teachers and students alike—take on lives of their own that help sustain the

GrassRoots projects contribute directly to Canada's innovation agenda by developing a whole range of skills, attitudes and behaviours in students. ►

Such skills and knowledge as students develop while completing their GrassRoots projects are easily converted into innovative capacity in the knowledge economy. ►

projects while they are "on" and enable them to survive beyond the finish dates. GrassRoots projects tend to push students and teachers to go beyond set objectives in the interests of enriching their teaching and learning experiences and opening up future horizons for applying their newly acquired or developed skills and knowledge. Students and their teachers thereby gain an understanding of what in the business world are called "stretch goals," which encourage individuals to show initiative and take responsibility for making their own luck in a climate that demands innovation of everyone.³⁸

Conclusion

In this report, a framework for analyzing contributions to Canada's innovation agenda has been developed, and the ways in which specific GrassRoots projects have pushed that agenda forward have been examined in some detail.

More specifically, this study has shown that GrassRoots projects contribute directly to Canada's innovation agenda by developing a whole range of skills, attitudes and behaviours in students. Information and communications technology skills such as keyboarding, research, editing and Web page design are immediately transferable across students' everyday experience. Process-oriented skills such as teamwork, problem solving and verbal and written communication abilities are core competencies - and therefore labour market capital - in the knowledge economy. And attitudes and behaviours such as initiative, drive and perseverance to get the job done are key levers in leading change. Taken together, this mix of skills, attitudes and behaviours, when combined with the relevant technical skill and knowledge sets, powers the knowledge economy.

Such skills and knowledge as students develop while completing their GrassRoots projects are easily converted into innovative capacity in the knowledge economy. The habits students learn of transferring

their skills, and the institutional knowledge relative to developing and enhancing skills gained by the schools themselves, become the real dynamo of innovation, as the GrassRoots process perpetuates itself in the subsequent activities of students and schools.

GrassRoots projects also enhance innovative capacity in the classroom by encouraging collaboration among teachers and between schools, between teachers and students, and between students at different grade levels and in different geographical locations. The result of this collaboration is the growth of teaching and learning exchange networks, which are the pathways of the new "connected" culture.

Finally, **GrassRoots projects are a living demonstration of entrepreneurial skills and culture in action.** From the development of project proposals through the engagement of students in troubleshooting and problem solving in the execution phase to communicating results and leveraging the learning resources created through the work, students cycle through the innovative/entrepreneurial process of thinking, managing and doing. Such skills are learned by doing, and the immediate precedent of applying those abilities to a particular GrassRoots project is already an indicator of innovative capacity that can be harnessed in subsequent activities.

- 1 *1st Annual Innovation Report: Building the Future* (Ottawa: The Conference Board of Canada, 1999), ISBN 0-88763-456-7; *2nd Annual Innovation Report: Collaborating for Innovation* (Ottawa: The Conference Board of Canada, 2000), ISBN 0-88763-486-9.
- 2 To open the first session of the 37th Parliament of Canada, January 30, 2001 (http://www.sft-ddt.gc.ca/sftddt_e.htm)
- 3 *Performance and Potential 2000–2001*, p. 69.
- 4 *Performance and Potential 2000–2001*, pp. 10–11.
- 5 *Building the Future: 1st Annual Innovation Report*, p. 21.
- 6 January 31, 2001 (http://pm.gc.ca/default.asp?Language=E&page=newsroom&sub=speeches&doc=replystf_20010131_e.htm)
- 7 Speech to the Toronto Board of Trade, September 14, 2000.
- 8 *The Report of the Expert Panel on Skills* (Ottawa: Industry Canada, 2000), ISBN 0-662-64629-0, commissioned as a vehicle for providing advice on present and future skills issues as they relate to meeting the challenges of the knowledge economy.
- 9 See generally Stephen A. Murphy, *What to Do Before the Well Runs Dry: Managing Scarce Skills* (Ottawa: The Conference Board of Canada, 2000), ISBN 0-88763-465-6.
- 10 *What to Do Before the Well Runs Dry*, p. 14.
- 11 May 1, 2000.
- 12 *Fundamental Skills* are the skills needed as a base for further development. *Employability Skills 2000+* supposes that a person will be better prepared to progress in the world of work when he/she can communicate, manage information, use numbers and think and solve problems. *Personal Management Skills* are the personal skills, attitudes and behaviours that drive one's potential for growth. *Employability Skills 2000+* assumes that a person will be able to offer himself/herself greater possibilities for achievement when he/she can demonstrate positive attitudes and behaviours, be responsible, be adaptable, learn continuously and work safely. Teamwork Skills are the skills and attributes needed to contribute productively. *Employability Skills 2000+* is built on the assumption that a person will be better prepared to add value to the outcomes of a task, project or team when he/she can work with others and participate in projects and tasks.
- 13 *Report of the Expert Panel on Skills*, p. 2.
- 14 See *What to Do Before the Well Runs Dry*, p. 3.
- 15 *Ibid.*, p. 9.
- 16 *Building the Future: 1st Annual Innovation Report*, p. 22.
- 17 *Building the Future*, p. 23.
- 18 *Building the Future*, p. 24.
- 19 *Prosperity Through Innovation*, Challenge Paper, p. 3 in annex to Background Report.
- 20 Sean Fine, "Net Gain Accrues to Innovative Schools," *The Globe and Mail*, Friday, December 15, 2000 (<http://www.globetechnology.com/archive/gam/News/20001215/COSCUL.htm>) pp. 1-2.
- 21 See Conference Board Case Study 38, "Backyard Bird Feeding in Newfoundland," pp. 3, 5.
- 22 See Conference Board Case Study 37, p. 5.
- 23 See Conference Board Case Study 34, "Imagine the Challenge," p. 2.
- 24 See Conference Board Case Study 37, p. 2.
- 25 *Report of the Expert Panel on Skills*, p. 14.
- 26 See *What to Do Before the Well Runs Dry: Managing Scarce Skills*, pp. 3, 14.
- 27 See Conference Board Case Study 34, p. 3.
- 28 See Conference Board Case Study 37, pp. 3, 5.
- 29 See Conference Board Case Study 36, p. 6.
- 30 See Conference Board Case Study 34, pp. 4–5.
- 31 Jennifer Jenson, Brian Lewis and Richard Smith, "Is Policy Important? Technology Policy and Its Practices in K–12 Education in Canada" (an unpublished paper accepted at the American Education Association Conference 2001), p. 1.
- 32 See Conference Board Case Study 38, p. 6.
- 33 See Case Study 40, *Building and Sustaining a Culture of Innovation/Entrepreneurialism in Canada for Competitiveness and Growth* (March 2001), pp. 4–5.
- 34 See *What to Do Before the Well Runs Dry*, p. 15.
- 35 Teachers reported similar examples in *Backyard Bird Feeding in Newfoundland* and *This Is Nova Scotia*.
- 36 Compare *Report of the Expert Panel on Skills*, pp. 2, 14, 27.
- 37 See Case Studies 30 and 35, posted on the Board's Web site at: <http://www.conferenceboard.ca/cben/case.htm>
- 38 See Conference Board Case Study 34, "Imagine the Challenge," p. 5.

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*Enhancing Employability Skills: Innovative Partnerships,
Projects and Programs, 118-94 Report*

*Linking Teachers, Science, Technology and Research:
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