Issue 1.0

Social Innovation in Education

In this issue:

"Driving Social Innovation in Education"

DRIVING SOCIAL INNOVATION IN EDUCATION

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FOREWORD FROM HP

Because information is the most valuable resource of the 21st century, HP believes education holds the key to creating individual opportunity, driving social progress and improving quality of life.

Despite the efforts of governments, nonprofit organizations and the private sector, educational systems and teaching methods have not adequately adapted to meet the complex, interdependent and rapidly evolving challenges of our time. What's urgently needed is a new approach to teaching and learning, one designed to expand human capacity to respond to, manage and ultimately shape accelerating forces of global change. This is the mission of the HP Office of Global Social Innovation (OGSI).

While we believe information technology is vital to this new approach, HP OGSI's strategy focuses on empowering people to develop, implement and share innovative solutions rather than simply equipping classrooms with computers and providing access to the Internet. Technology is a tremendous tool for unleashing human potential. It opens up new ways of communicating and sharing ideas. It accelerates understanding, deepens insight and sparks innovation. But radical change at the scale needed to address global challenges is possible only when individuals have the knowledge and skills to use technology to their greatest advantage.

Our strategy goes beyond developing curricula and delivering training that revolve around technology. HP is focused on helping the world harness the power of information to change the equation for people, businesses and the world.

That's why our education initiatives include developing open and extensible learning systems; building cross-cultural networks of innovators and entrepreneurs; facilitating the inspiration, exchange and recombination of ideas; and fostering cross-disciplinary communities of educators and experts. We recognize that HP alone does not have the solutions to the challenges education faces; our most effective role is championing and empowering a broader community invested in using technology to transform how the world teaches and learns.

In assuming this role, HP OGSI believes we can make the greatest impact by emphasizing two areas: science, technology, engineering and math (STEM) education; and entrepreneurship training.

These areas provide the foundation for discovery and innovation, making STEM education essential to fueling economic growth as well as taking on many of the world's endemic social and environmental challenges. Our collective future depends on education systems developing deep and highly skilled generations of scientists and engineers.

Similarly, the world needs more entrepreneurs. They start and run the small businesses that are the engine of the global economy. Microenterprises are also hotbeds of innovation. They are a vital source of groundbreaking ideas, and a catalyst for changes that affect how larger companies and even industries work. By helping recent graduates, aspiring entrepreneurs and small business owners develop essential business and IT skills, we can change millions of lives worldwide.

To carry out our education strategy, HP OGSI manages three flagship programs:

- The **HP Catalyst Initiative** sponsors networked consortia to explore new approaches to improving science, technology and math education.
- The **HP EdTech Innovators Award** identifies, supports and showcases innovators who are making groundbreaking use of technology in their classrooms.
- The **HP Learning Initiative for Entrepreneurs** provides training and tools on how to harness the potential of IT to expand small businesses.

In addition to reflecting our core values and longstanding commitment to global citizenship, HP's focus on education and entrepreneurship is strategic to our business, both today and over the long term. Innovation is the lifeblood of our company and of our customers and partners. By promoting education—and especially STEM education—and fostering the success of young entrepreneurs, HP is helping develop the next generation of innovators, business leaders and skilled workers.

HP OGSI's strategy is informed by the insights and analysis presented in this paper. We have commissioned Futurelab, a UK organization dedicated to transforming teaching and learning through the use of innovative practice and technology, to investigate significant economic, technological, demographic and societal trends and to examine education's response to these trends.

EXECUTIVE SUMMARY

HP's Office of Global Social Innovation (OGSI) commissioned this paper from Futurelab, a UK organization dedicated to transforming teaching and learning through the use of innovative practice and technology. Futurelab's work is contributing to HP's renewal of its social innovation strategy.

Global trends and education's response
This paper first reviews the global demographic, economic, social and technological trends that set the context for social innovation and education.

It then explores how education—particularly science, technology, engineering and math (STEM) education—is responding to meet these significant challenges, and describes the work that remains to be done.

In our analysis, we address the following areas:

- **Curriculum** Educational institutions must restructure curricula to align with the skills, knowledge and competencies integral to today's knowledge economy.
- **Assessment** Because student assessment often drives classroom practices, it can be an effective tool to ensure curricula changes are being made successfully.
- **Use of technology** Information and communications technologies are not being used to their full effect by many educational institutions. As a result, learners often have widely different experiences in accessing and using technology between home and school, reflecting a persistent digital divide.

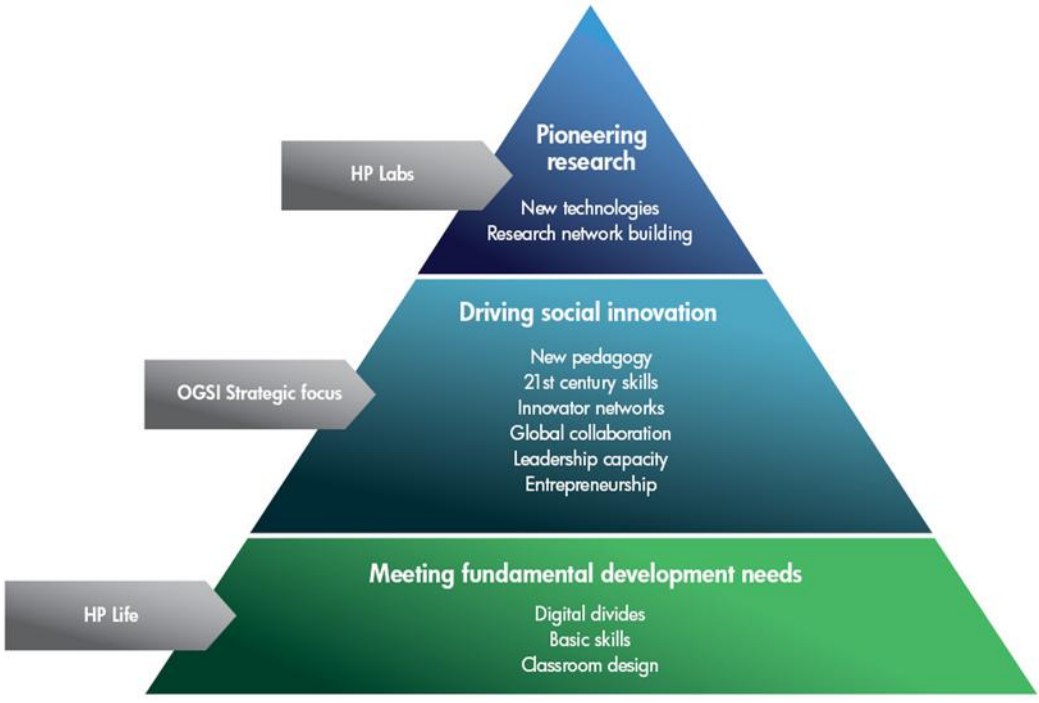
Specific opportunities
Our analysis offers a powerful case for innovating and reinventing education to drive greater social innovation and entrepreneurship. We describe the following opportunities:

- Address the digital divide by improving access to technology.
- Address the second digital divide by improving technology skills and the capacity to make sound judgments about when and how to use technology for learning.
- Improve technology's impact on teaching and learning by developing new pedagogies.
- Develop education's capacity to adopt and benefit from innovative practice through technology (e.g., address the challenges of educating rapidly growing populations, tackle changing skills requirements and facilitate lifelong learning.
- Support continued exploration, discovery, ingenuity and innovation in the use of technology for learning, by nurturing and supporting innovators and leading practitioners.
- Apply technology to education systems to support development of 21st-century skills.
- Use technology to facilitate collaboration between experts and between institutions.
- Address cost issues of technology through efficient approaches such as cloud computing.

HP's social innovation program
In the final section of the paper, we examine how HP OGSI is helping influence and spark change to transform education, and conclude with recommendations to enhance and extend its work.

HP OGSI's strategic focus is illustrated below in Exhibit 1, and its programs are described in more detail in the paragraphs that follow.

Exhibit 1



HP Labs
HP Labs addresses the challenges of pioneering research, innovating and developing new technologies and working with the wider research community.

HP Catalyst Initiative
HP is funding a global network of five consortia of education experts and supporting organizations to explore what the future of STEM education can look like. Each consortium will receive more than US$1 million in technology, cash and professional support. HP plans to help build a future where students use their technical and creative ingenuity in innovative ways to address urgent social challenges in their communities and around the world.

HP EdTech Innovators Award
HP is supporting and showcasing educators who are using technology in groundbreaking ways inside and outside the classroom. In 2010, a maximum of ten institutions will each be awarded an HP technology grant valued at approximately US$40,000. The winners will be invited to participate in a social network of educators, giving them increased access to support, training and other resources to help grantees develop and share their ideas beyond the award.

HP Learning Initiative for Entrepreneurs (HP LIFE)
HP LIFE is a global program for training students, aspiring entrepreneurs and small business owners to harness the power of IT to establish and grow their business. HP LIFE builds on our successful GET-IT, HELP and MAP education and training programs. Bringing them together under one umbrella program will help HP meet its goal of reaching 500,000

students by the end of 2010. HP LIFE combines face-to-face training and online tools to address the educational needs of students, regardless of their backgrounds, locations or circumstances.

1. Key trends and challenges

1.1. Introduction

The world is changing, largely due to human activity. Rapid population growth, increasing climate instability, dwindling energy and water supplies, and rising poverty[1] are already impacting billions of lives today—and are poised to impact countless more in the future.

At the same time, information and communications technologies have dramatically recast how we understand and experience the world. Modern technologies, paired with human ingenuity, have redefined how we live, work, communicate and learn, making the once unimaginable routinely possible.

Indeed, extraordinary advances are constantly redrawing the boundaries of STEM. Yet humanity still struggles with primordial conflicts that shape our priorities and define our relationships with each other and the environment.

Education must be at the core of society's response to these powerful forces. Our collective progress depends on each of us applying knowledge and skills, particularly scientific knowledge and skills, to address these formative and far-reaching issues. It is critical that we develop a pervasive culture of innovation, not only inside schools, colleges and universities but also within and across communities of students and educators, to drive positive social, economic and technological change.

This section addresses the following questions:

- What are the major trends influencing education globally?
- How is education adapting to meet these challenges?
- What are the areas of opportunity?

1.2. What are the major trends influencing education globally?

Following are the principal trends we explore in this report:

- **Economic** Globalization and a highly integrated and competitive world market increase the need for skills in creativity, entrepreneurship and innovation.
- **Technological** Exponential growth in the production and storage of digital knowledge and information, and development of new forms of communication bring new challenges for learners to navigate and manage information.

[1] T. Friedman (2008). *Hot, Flat, and Crowded: Why We Need a Green Revolution—and How It Can Renew America.*

- **Demographic** Falling birthrates and aging populations within OECD countries make lifelong learning ever more valuable. Population growth in the world's poorer regions taxes governments' capacity to provide an education for young people.
- **Social** Changing relationships between the individual, the state and society raise the need for young people to be educated to become responsible, active citizens. Complex family relationships create a demand for education to support a wider range of personal circumstances.

1.2.1. Economic trends

Since 1990, trade between economies has risen from 38 percent to more than 52 percent, meaning more trade now takes place between countries than within them.[2]Advances in technology, cheaper modes of transportation and removal of trade barriers have all contributed to this shift.[3]

The impacts of such globalization have been profound. Hundreds of millions of workers are now competing in an international marketplace. Companies regularly reorganize and shift their operations and manufacturing to take advantage of local economic and demographic conditions. Countries are pressured to invest in infrastructure and innovation to maintain their economic standing, even in the wake of the global downturn.

The shifting economic landscape also raises large challenges for education systems the world over. More than ever, education systems must nurture in students the creativity that feeds innovation, the entrepreneurial skills needed to compete in a global marketplace, and the vision to see beyond local, regional and national boundaries.

1.2.2. Technology trends

Information and communications technology is becoming ever faster, cheaper and ubiquitous. The effect has been rapid and wholesale changes in how the world communicates, which has spawned an array of new media, modes of communication and social behaviors. In turn, these advancements have led to explosive growth of digital information, accompanied by complex issues related to data storage and security.[4]

Measures such as the Economist Intelligence Unit's e-readiness rankings[5] track continuing growth in connectivity, with countries such as Denmark, Sweden and the Netherlands leading the way. At the same time, it reports that emerging markets continue to set the pace in connecting people to mobile phone networks. The ten largest mobile operators in the Middle East and Africa now add over 12 million new customers every quarter; new Nigerian mobile subscribers in 2008 accounted for nearly 20 percent of the annual figure for that entire region.

The Economist Intelligence Unit's e-readiness report also points to some technology challenges ahead for all countries. Widespread Internet use is motivating telecoms carriers and content providers to obtain more information to generate sales from their customers, raising questions about personal privacy. According to the report: "The delicate social

[2] Guardian Education, Innovation in Education conference, November 2009.
[3] OECD CERI (2008). *Trends Shaping Education*.
[4] Ibid
[5] The Economist Intelligence Unit Ltd (2009). "E-readiness rankings 2009–The usage imperative," 2009.

contract between digital consumers and the operators of digital channels will be tested in coming years, as intensified revenue pressure increases service providers' use of the Internet for intrusions that are both annoying (e.g., inbound advertising) and that could infringe on privacy ("deep-packet" inspection systems)."[6]

In addition, the report observes "the environmental impact of ICT usage is also likely to remain a concern for governments as long as climate change and carbon reduction remain high on the global agenda. As the digitally connected world watches more videos and transfers more files, it consumes more energy. The expansion of one of the global economy's most essential resources—information—is having an unintended knock-on effect on other precious resources. The interplay between these two resource ecosystems underscores once again the reality that e-readiness is not fostered in a digital vacuum, but rather in a complex web of social, cultural, economic and political factors, ultimately driven by the usage imperative."

According to recent estimates, the digital universe now exceeds 800,000 petabytes—800 thousand million gigabytes—an increase of 62 percent over 2009. More than 70 percent of that data is user generated, meaning it represents all the e-mail and text messages, photos and videos, online commerce, and other digital information individuals create and share in aggregate.[7]

These statistics reflect a growing global appetite for participating and sharing media rather than simply consuming it. Facebook reached 500 million registered users in July 2010, making it the biggest information network on the Internet just six years after its launch.[8] Meanwhile, Twitter's growth is reflected in the numbers of tweets per day. In 2007 that figure was 5,000, and in 2008 it was 300,000. By the end of 2009, the number of tweets had reached 35 million per day, and it hit 50 million in 2010, or 600 tweets per second.[9]

Facebook and Twitter are just two notable examples among many, including YouTube and Flickr. Other less popular niche sites are also having a big impact. For example, FanFiction[10] allows users to "publish" additional chapters and stories associated with their favorite books. As of May 2010, there were 455,735 additional contributions to the Harry Potter stories.

Technology trends augur significant challenges as well as opportunities for education. We must prepare learners of all ages with the skills that will enable them to make the most of ubiquitous technology. We also need to consider how the ready availability of information changes traditional models of learning and suggests a different balance between the development of skills and accumulation of knowledge. Individuals have extraordinary opportunities to access information and manage their own learning, to communicate with peers and mentors, and to innovate, create and share new materials. Learners must have the opportunity to harness and apply these new resources.[11]

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[6] Ibid

[7] http://gigaom.files.wordpress.com/2010/05/2010-digital-universe-iview_5-4-10.pdf

[8] "Facebook to hit 500 million users, but meteoric rise has come with growing pains," *The Washington Post*, July 19, 2010.

[9] "Twitter users send 50 million tweets a day," Computerworld, February 23, 2010.

[10] http://www.fanfiction.net/book/

[11] K. Facer (2009). Educational*, social and technological futures: A report from the Beyond Current Horizons Programme*. Futurelab: Bristol, United Kingdom; Claxton, G. (2002). *Building Learning Power: Helping Young People Become Better Learners*, www.tloshop.co.uk

1.2.3. Demographic trends

The demographics of regional and national populations are changing substantially. Researchers note shifting ratios between young and old people, between dependants and those who care for them, and between the employed and retired. For example, birth rates are falling in OECD countries. Between 1960 and 2003, birth rates fell from more than 3 percent to about 1.7 percent. In some countries this drop was even more marked; for example, in Korea the birthrate fell from 6 percent to just over 1 percent in that period.

Such shifts in demographics have led to falling school rolls and a greater burden on fewer working-age people to create more wealth to support an aging population. The OECD reports that the "old age dependency ratio" will double by 2050, likely pushing up retirement ages. Current figures suggest that in Europe only about 40 percent of 55–64 year olds are employed, placing an additional burden on society's younger, economically active citizens. These changes underscore how lifelong learning has become more important, whether people work longer or retire.

Outside the OECD and in the world as a whole, the population is growing. The present world population of 6.4 billion is forecast to grow to 8.9 billion by 2050,[12] with much of that growth coming in the world's poorer regions. Currently 51 percent of the combined populations of developing and least-developed countries are reported to be below the age of 25.

Given the speed and distribution of global population growth, simply providing basic education for most of the world's children and young people will prove a major challenge. On the occasion of World Teacher' Day 2009, UNESCO declared that "a global total of 10.3 million teachers should be recruited between 2007 and 2015 just to meet the Millennium Development Goal of universal primary education."[13]

Yet finding teachers may be particularly difficult in countries where life expectancy is low and the challenges facing the education sector are greatest. For example, UNESCO[14] reports that in many regions, particularly sub-Saharan Africa and Asia, HIV and AIDS take a huge toll on the teacher workforce, creating teacher shortages and absenteeism. Teachers may face the need to support orphans, or children tending sick family members. Educator support is an essential component of the education sector response to that pandemic.

These challenges are disproportionately distributed. While more than 20 countries and territories, including Macau, Singapore and Japan, boast a life expectancy of over 80 years, 14 countries have life expectancy rates of less than 50 years, including Zambia and Angola, which have life expectancies at birth of less than 40 years.[15]

1.2.4. Societal trends

Relationships between individuals, the state and society are also changing. For some, this has meant less hierarchical relationships. In others, the interests of markets have grown in influence. Some governments have sought to change the balance of responsibilities from the government to citizens. At the same time, voter participation has tended to decline while

[12] OECD CERI (2008). *Trends Shaping Education.*
[13] http://www.unesco.org/en/teacher-education/advocacy/world-teachers-day/
[14] http://www.unesco.org/en/teacher-education/hiv-and-aids/
[15] https://www.cia.gov/library/publications/the-world-factbook/rankorder/2102rank.html

engagement on specific issues has risen—a phenomenon possibly driven by increasing online activity.[16]

The OECD observes that responsible, active citizenship is one of the fundamental purposes of an educational system.[17] Increasingly, individuals will need to have the knowledge and skills to make decisions that were once the responsibility of the state—in matters such as healthcare, pensions, higher education financing and schooling.

Relationships within family units are also changing. Children are growing up in an increasingly complex range of living arrangements. At the same time, there is growing recognition of the importance of family and home life on learning. Education will need to support learners in a much more diverse range of circumstances.

1.3. How is education adapting to meet the challenges set by these trends?

These trends represent an array of significant challenges. Education is responding, but there remains much to address. This chapter explores the following areas:

- **Curriculum** Educational institutions must restructure the curriculum to take account of the skills, knowledge and competencies that have become associated with the 21st-century knowledge economy. Data from the OECD's PISA[18] indicates room for improvement in developing students' advanced skills[19] in all education systems.
- **Assessment** The approach to student assessment—what skills and knowledge are measured, how they are measured and how frequently—tends to drive classroom practice. This is why assessment can be an effective lever to ensure curriculum changes are being implemented. The University of Melbourne is leading work to develop a framework of priority skills together with approaches to assess them. These skills fall into four areas: ways of working, ways of thinking, tools for working and living in the world.
- **Use of technology** Learners' experiences with technology are often very different inside and outside the classroom, which creates a broad set of challenges. On one hand, many schools are not taking full advantage of technology to help instructors teach and students learn. On the other, students in many areas of the world lack access to technology at home, making it difficult to develop and reinforce core skills. But pockets of innovation exist, pointing to possible solutions. For example, the Horizon K–12 Report 2010[20] identifies promising future trends in technology and forecasts the adoption of cloud computing and collaborative environments in K–12, and greater use of mobile computing and shared content in postsecondary education.

1.3.1. Curriculum

Advocates for education's transformation often call for fundamental restructuring of curricula to better develop the skills, knowledge and competencies integral to the knowledge economy. These skills rely on higher-order thinking that includes creativity, multimodal communication, collaborative problem solving and meta-cognitive strategies that are critical to success in the knowledge economy.

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[16] Futurelab (2009). "Beyond Current Horizons," paper by Summative Report on Identity Communities and Citizenship by Professor Helen Haste, Harvard Graduate School of Education and University of Bath.
[17] OECD CERI (2008). *Trends Shaping Education.*
[18] http://www.pisa.oecd.org
[19] As cited in OECD (2007). PISA 2006: Science Competencies for Tomorrow's World Executive Summary. Available at http://www.pisa.oecd.org/dataoecd/15/13/39725224.pdf.
[20] L. Johnson, R. Smith, A. Levine, and K. Haywood (2010). *The 2010 Horizon Report: K-12 Edition.* Austin, Texas: The New Media Consortium: Sponsored by HP and CoSN.

Many countries recognize that education in science, technology, engineering and mathematics is key to social progress and economic competitiveness. Yet persistent challenges remain in providing challenging, authentic, engaging and relevant learning that can fulfill the potential of students and enable STEM teachers to be successful.

The OECD's PISA[24] is a regularly administered test for 15-year-olds in nearly 60 countries. PISA is one of the first standardized tests designed to measure not only student knowledge in literacy, math and science, but also to assess how students apply their knowledge and skills to analyze, reason and communicate effectively as they solve problems. The assessment also measures each participant's ability to continue learning throughout life. Student achievement in PISA demonstrates that there is room for improvement in developing students' advanced skills in all education systems. PISA's results show that:

- On average, only 1.3 percent of 15-year-olds reached Level 6 of the PISA 2006 science scale, the highest proficiency level.
- On average, 19.2 percent of students were classified as achieving below Level 2, with 5.2 percent below Level 1. Level 2 on the science scale is where students begin to demonstrate the science competencies that will enable them to participate actively in life situations related to science and technology.
- Despite increased spending, most countries saw no change in reading performance since the PISA 2000, with many large "knowledge economy" countries seeing a considerable decrease in performance.[21]

1.3.2. Assessment

Acknowledging the need to build 21st-century skills prompts the question of how these skills should be assessed. Assessment can play a critical role in changing educational practices, as it establishes baselines for performance and helps define success. As such, assessment can influence classroom practices, such as teaching strategies and allocation of time dedicated to elements of the curriculum.

Assessment & Teaching of 21st Century Skills,[22] an international project led by the University of Melbourne, identified the ten high-priority skills listed in Exhibit 2 below and is researching associated assessment approaches.

Exhibit 2: High-priority skills: assessment and teaching of 21st-century skills

Ways of thinking	Creativity and innovation
	Critical thinking, problem solving, decision making
	Learning to learn, meta-cognition
Ways of working	Communication
	Collaboration (teamwork)

[21] For full results, see OECD (2007). *PISA 2006: Science Competencies for Tomorrow's World: Volume 1: Analysis.*

[22] http://atc21s.org/default.aspx, (2010) University of Melbourne, sponsored by Intel, Cisco and Microsoft.

Tools for working	Information literacy
	Information and communications technology literacy
Living in the world	Citizenship—local and global
	Life and career
	Personal & social responsibility—including cultural awareness and competence

Denmark provides an example of the issues educational systems may encounter in shifting assessment approaches to meet new conditions and behaviors brought about by technology. In summer 2010, a pilot project there will give secondary school students access to the Internet during their end-of-year examinations. The project brings into relief a key question: Should student success be a measure of information recall or a measure of critical thinking and problem-solving skills? Given widespread access to the Internet and the proliferation of mobile devices, it is likely that searching for and validating information, and then analyzing and synthesizing it into a cogent argument will become a more reliable indicator of a student's long-term success.

In reflecting on the pilot project in Denmark, it is worth examining how the Internet is quickly becoming an accepted part of student assessment. In this case, perhaps the true innovations are in the broadening expectation of personal responsibility and in the trusting relationships within education and between its stakeholders.

1.3.3. Use of technology

For many students, their interaction with digital technologies in educational institutions does not match their experiences at home or in their communities. This is true both in terms of the types of technology they use and in the time they spend using technology. As Marc Prensky[23] observed, "I constantly remind educators that, while in the past kids grew up in the dark intellectually and our role (and value) as teachers was to enlighten them, in the twenty-first century our kids grow up in the light, connected to the world by television, mobile phones and the Internet long before they ever go to school."

The 2006 OECD publication "Are New Millennium Learners Making the Grade?—Technology Use and Educational Performance in PISA" focuses on student experiences at school. These are the publication's main findings:

- Virtually all students in OECD countries are familiar with computers, with less than 1 percent of 15-year-olds suggesting they had never used a computer.
- The frequency of computer use at home is not matched in school. While more than 80 percent of 15-year-olds used computers at home, the majority did not use computers in school.
- Low computer-to-student ratios are a continuing issue in expanding the use of technology for learning.

[23] Joint Information Systems Committee (2007). "In their own words – exploring the learner's perspective on e-learning."

- Digital media are increasingly used as education resources, but there are significant disparities in the extent to which this happens in different countries.
- Students' primary personal use of computers tends to be related to the Internet or to entertainment. Students use their computers:
  - For e-mail or "chatting" (69 percent)
  - To look up information about people, things or ideas on the Internet (61 percent)
  - To download music (58 percent)
  - To play games (54 percent)
  - To download software (41 percent)
  - To collaborate with a group or team (37 percent)

A Pew Research study[24] of American teenagers suggests that cell phone texting has become the preferred channel of basic communication between teens and their friends. Cell phone calling is a close second, with some 75 percent of 12- to 17-year-olds now owning a phone (up from 45 percent in 2004). The gulf between education and the rapidly changing world outside seems to be widening.

There is an increasing body of evidence that information and communications technology (ICT) has a positive impact on educational performance, which should increase momentum behind the adoption and use of technology in education. For example, the OECD New Millennium Learners report cited above found a link between computer usage and higher educational performance.

In addition, in 2008 the Institute of Fiscal Studies analyzed data from the DCSF Longitudinal Survey of Young People in England, which showed that the availability of a computer at home is significantly associated with higher test scores. The association amounts to the equivalent of two GCSE grades in a single subject.

The report also identified a second type of digital divide, between those who have the core competencies and skills to benefit from computer use and those who do not. These differences are closely linked to students' economic, cultural and social standing. The Horizon K–12 Report[25] reinforces this view of a second digital divide, observing that "the digital divide, once seen as a factor of wealth, is now seen as a factor of education; those who have the opportunity to learn technology skills are in a better position to obtain and make use of technology than those who do not."

While the general advance in the use of technology in education may appear not to keep pace with the world outside, the Horizon K–12 Report 2010 identifies pockets of more advanced practices. The report states that "Technology is increasingly a means for empowering students, a method for communication and socializing, and a ubiquitous, transparent part of their lives. …Once seen as an isolating influence, technology is now recognized as a primary way to stay in touch with and take control of one's own learning. Multi-sensory, ubiquitous and interdisciplinary, technology is integrated into nearly everything we do. It gives students a public voice and a means to reach beyond the classroom for interaction and exploration."

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[24] A. Lenhart, R. Ling, S. Campbell and K. Purcell (April 2010). "Teens and Mobile Phones—text messaging explodes as teens embrace it as the centerpiece of their communication strategies with friends." Pew Education Research.

[25] L. Johnson, R. Smith, A. Levine, and K. Haywood (2010). *The 2010 Horizon Report: K-12 Edition*. Austin, Texas: The New Media Consortium: Sponsored by HP and CoSN.

Horizon reports are produced annually and review trends in technology adoption in education. The latest of these reports in 2010[26] suggests technology adoption trends outlined in Exhibit 3 below. They provide examples of the areas where leaders and innovators have begun to use technologies in advance of their wider adoption.

[26] L. Johnson, A. Levine, R. Smith and S. Stone (2010). *The 2010 Horizon Report.* Austin, Texas: The New Media Consortium.

Exhibit 3: Future trends in the adoption of technology in education

	Time to adoption		
	1 year or less	**2–3 years**	**4–5 years**
K–12 education	Cloud computing	Game-based learning	Augmented reality
	Collaborative environments	Mobiles	Flexible displays
Postsecondary education	Mobile computing	Electronic books	Gesture-based computing
	Open content	Simple augmented reality	Visual data analysis

For example, the Laboratory for Continuous Mathematical Education in St. Petersburg, Russia,[27] which is supported by an HP Innovations in Education grant, is using cloud computing to connect students and scientific researchers, giving students exposure to professional research practices while they build their own technical skills. Similarly, the Cloud-Computing Infrastructure and Technology for Education[28] program from Massachusetts Institute of Technology's Climate Modeling Initiative is using cloud computing resources to perform scientific research both in university laboratories and in K–12 classrooms. Such access to research tools gives students of all ages opportunities to investigate and engage with relevant and current issues.

1.4. What areas of opportunity arise from the trends and challenges?

These social, economic and technology trends lay the groundwork fora compellingcase for innovating and reinventing education. Following are specific opportunities to address:

- Addressing the digital divide by providing personal devices to improve access to technology
- Addressing the second digital divide by improving technology skills, which improves learners' capacity to make sound judgments about using technology for learning
- Improving technology's impact on teaching and learning by developing innovative pedagogies that reflect society's changing relationship with information and communications technologies
- Applying technology to expand innovative approaches to the development and adoption of 21st-century skills within education
- Working with developing technologies such as cloud computing to address technology cost and access issues in education
- Developing teacher capacity to use technology to improve their teaching through continuous professional development in technology and through further integration of technology into initial teacher training
- Developing multimedia resources to support teaching and learning
- Development of relatively new technologies such as augmented reality and nanotechnology to research and investigate their potential influence on teaching and learning

[27] http://www.lcmespb.ru/

[28] http://www-paoc.mit.edu/cmi/technologies/ cloudcomputing.htm

2. Social innovation and education

2.1. Innovation and entrepreneurship as key drivers in social change

Government intervention and market forces alone are not enough to solve vast and intractable global challenges confronting society today, such as climate change and aging populations. The necessary catalysts for social change are innovation and entrepreneurship.

Entrepreneurship empowers people, at all levels of society, to determine their own destiny. For example, new approaches to supporting entrepreneurialism, such as microcredit services, (e.g., Grameen Bank—microcredit; Jamii Bora—microfinance and family improvement; BASIX India—microfinance and technical support) have enabled individuals at extreme levels of poverty to start small businesses and improve their lives.

A recent report of the World Economic Forum quotes its founder and executive chairman, Klaus Schwab, describing entrepreneurship as "the engine fueling innovation, employment generation and economic growth." Schwab underscored that "entrepreneurship and education are two extraordinary opportunities that need to be leveraged and interconnected if we are to develop the human capital required for building the societies of the future." [29]

The same report states that "now more than ever, we need innovation, new solutions, creative approaches and new ways of operating. We are in uncharted territory and need people in all sectors and at all ages who can 'think out of the box' to identify and pursue opportunities in new and paradigm-changing ways." It observes that most initiatives have been at the local, regional or national level, but current momentum makes now the time to intensify efforts and address entrepreneurship education in a comprehensive manner at a global level.

2.1.1. The power of technology to change the world

Technology is a disruptive force that can trigger global change. Innovations in ICT are fundamentally altering how people live, work and play. Specifically, the Internet creates new channels to market and generates entrepreneurial opportunities by allowing people to share ideas and collaborate without being part of a formal organizational structure.

For example, consider the impact of mobile telephony. It supports social connections, enables the timely sharing of information (for example, about prices, or transport delays), and has opened up significant economic possibilities for millions by permitting the "un-banked" to transfer money and execute other transactions at affordable rates.[30]

These advances in technology have repercussions throughout the world's systems and challenge traditional approaches to the organization and practice of teaching and learning.

2.1.2. Social innovation

A recent Young Foundation report defines social innovations as new ideas (products, services and models) that simultaneously meet social needs and create new social

29 *Educating the next wave of entrepreneurs* (2009). World Economic Forum.
30 http://psdblog.worldbank.org/psdblog/2006/06/mobile_banking_.html

relationships or collaborations. In other words**, they are innovations that are both good for society and enhance society's capacity to act.**[31]

This definition expresses two themes. The first is the role of technology in enabling collaborations through the spread of ICT networks and social networking tools. The second is the growing importance of culture and values and an emphasis on the individual and relationships rather than systems and structures.

2.2. Innovation and education

The relationship between innovation and education is important and complex. First, innovation has an important place in transforming education. And second, education plays a significant role in preparing students to become entrepreneurs and social innovators. These two aspects are explored in more detail below.

2.2.1. Role of innovation in transforming education and how it can be accelerated

The scale of the challenge

Creating the conditions to transform educational systems begins with the recognition that we must reinvent the ways in which the world learns. Technology and the involvement of a wider community can facilitate very different approaches. Exhibit 4 looks at where, how and when learning takes place.

Exhibit 4: Changing approaches to education for school-aged children

Learning Feature	Past	Future
Where learning takes place	Mainly in schools	In schools (including studio schools, learning villages and open campuses), cultural centers, businesses, homes, virtual centers and other places across the city
Who children learn from	Teachers	Teachers, parents, other skilled adults, peers and social networks
Learning mode	Instruction	Interaction, collaboration More learning by doing and discovery
When	In school terms and hours	Continuous, at different times that better suit individual learning
Assessment	At conclusion of instruction Focus on cognitive skills	During learning process More peer-to-peer evaluation and self-evaluation against learning plans More focus on non-cognitive skills
How	In classrooms	More real-world computing

[31] R. Murray, J. Caulier-Grice, G. Mulgan (2010). *The Open Book of Social Innovation,* Young Foundation.

	from books, whiteboards	Schools as productive units
Funding	To schools and school boards	More to support student learning and networks
Standards/measures	Top down	More bottom-up targets and self-evaluation

Source: Charles Leadbeater, (2008). What's Next —21 Ideas for 21st Century Learning, The Innovation Unit.

Specific challenges underscore the need to transform education. For example, the U.S. Department of Education has targeted increased participation in higher education. Its Office of Education Technology reports we must "raise the proportion of college graduates from where it now stands (39 percent) so that 60 percent of our population holds a 2-year or 4-year degree."[32] Other challenges include the need for more STEM graduates, the need to develop entrepreneurial skills and the need for greater collaboration in learning.

Additionally, longer life spans and the tightening integration of technology into every aspect of our lives, mean we must go beyond formal education to promote lifelong learning so individuals can continually deepen their knowledge and broaden their skills.

The structure of education impedes innovation

Education's current structure can interfere with its capacity to innovate. Too often, education professionals in schools, colleges and universities are isolated or compartmentalized within their classroom, department or institution. Accountability policies tend to restrict innovation and encourage a conservative approach to learning, rather than one of exploration and discovery.

Innovation (the new and different) and systems (the status quo) are typically at odds, with the tendency towards inertia favoring entrenched systems. When an innovation is forced to conform to a system, it is often weakened or can even morph into something it wasn't intended to be. Skeptics of technology's ability to transform education use this point to support their case.[33]

This is why education systems themselves must be fundamentally reinvented. Many so-called new approaches to schools and education systems are not truly new. Take, for example, the charter school movement in the U.S. and sponsored academies in the UK. Yet even the most successful of these efforts still remain on the periphery of mainstream education. [34]

Redesigning education systems to reinforce innovation

Generating and sustaining change requires not only creating innovations that yield new outcomes, but creating systems that support those outcomes. In other words, for change to

[32] Office of Education Technology, U.S. Department of Education (March 5, 2010). "DRAFT Education Technology Plan: Transforming American Education; Learning Powered by Technology."

[33] See Seymour Papert's article "Why school reform is impossible" in The Journal of the Learning Sciences (1997, Vol 6, Num4, p. 417-427) and Tinkering Towards Utopia: A Century of Public School Reform by David Tyack and Larry Cuban.

[34] For tools on structuring policies and systems for desired outcomes, see *Transforming the Systems of Public Education* by J. Groff (2009).

take hold, a system must be designed and managed to reinforce innovation rather than hinder it.

Below are examples in education that illustrate this principle:

- **The Lumiar Institute**, a nonprofit organization with innovative ideas on using technology to leverage learning, created a learning platform called Mosaic that allows teachers to plan personalized learning for their students. The Lumiar schools were built to implement Mosaic, and when the Lumiar Institute began designing schools that would use this tool, they rethought all traditional educational components—such as how lessons are facilitated. At Lumiar schools, teachers (called tutors) facilitate the learning process with students, while content experts come in to direct specific learning modules.
- **Quest to Learn** is a school (grades 6–12) opened in New York City in September 2009 where students learn by using new technology. Lessons are structured like games, and students use computer programs and in-class simulation to understand material. The curriculum is interdisciplinary.
- **Kunskapsskolan** was founded in 1999 and runs 30 schools in Sweden. Rather than use a one-size-fits-all approach, every student works at their own pace, following a long-term learning and attainment plan agreed that the student, the student's personal tutor and parents agree on. The learning plan is designed to ensure that every student achieves the very best results that he or she is capable of. Technology plays a significant role in enabling this approach and supporting communication with parents.
- At the **RSA Academy** in the UK, all the components of the school have been redesigned to support the aims of its core innovation, the Opening Minds curriculum. Opening Minds is built on a framework of competencies for the 21st century developed by the Royal Society for the Arts (RSA) through extensive discussion and collaborative exploration. After several years of testing and refining the curriculum in over 200 schools, the RSA advanced this innovation by building a school entirely around it, which has led to an impressive improvement in results.[35]

Leveraging technology's potential for "disruptive innovation"

The power of technology rests in its ability to continually improve upon—and often displace—current products and services to better meet the needs of users.[36]

An example is "**Hole in the Wall,**" a computer in a common area of a slum in India where local children are able to explore the web and use other computer applications. An experiment of Sugata Mitra, professor of educational technology at the School of Education, Communication and Language Sciences at Newcastle University, UK, Hole in the Wall has expanded to 500 locations across India. This simple idea has exposed thousands of children to new technologies and self-organized learning, and engaged then in other forms of learning as well.[37]

The evidence of children's ability to teach themselves has shaped Mitra's more recent work in Newcastle. He is exploring the potential for children to learn from adults other than

[35] The RSA Academy in Tipton received its best ever set of GCSE results—showing a marked improvement in standards since the school became an academy in September 2008. The number of students who gained at least five A* to C grades jumped from 63 percent in 2008 to 73 percent in 2009, with a particularly significant increase in the sciences: 80 percent in 2009 compared with 30 percent in 2008.

[36] For more on disruptive innovations, see *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns* by Clay Christensen, Curtis Johnson and Michael Horn (2008).

[37] For more examples of different types of disruptive innovations, particularly across the developing world, see Charles Leadbeater and Annika Wong's paper, *Learning from the Extremes* (2009).

teachers; for example, by encouraging grandmothers to work with children to enrich their education. This builds upon the view that there is a largely untapped pool of people who are willing to help children learn an hour or so a week with no remuneration. If implemented broadly using technology, this concept could lead to alternative schooling through a cloud-based network connecting volunteer educators and students on the Internet.

Another example of the disruptive power of technology is **Lektion**, a resource-sharing website in Sweden for teachers. This site was started by three teachers in 2001 and, with over 217,000[38] registered users, is now used by a majority of Swedish teachers to share interactive learning resources. The site is free to use and funded by advertising.[39] Lektion has been successful in facilitating the use of digital learning resources in the classroom, and improving teacher confidence and practices.

Approaches to accelerate innovation within education

Research indicates that the key enablers of innovation within an institution are leadership, a clear vision that all support, shared responsibility for leadership, and a culture supportive of managed risk taking.[40] Practitioner networks are crucial to spreading ideas, so programs to support educational leaders and networks of practitioners could accelerate innovation. The paragraphs below explore the importance of leadership and practitioner networks.

Leadership

Transforming education to engage lifelong learners will require radical—not incremental—change. Encouraging and supporting disruptive social and educational entrepreneurs will be an important strategy to meet this goal. These are the mavericks who envision and champion bold new ideas and are willing to take risks to put them into play. Such entrepreneurs are essential to challenging education's sacred cows, looking for gaps and opportunities, and rallying support for designing and adopting better solutions.

Equipping schools to innovate will require sustained focus and commitment of time, finances, technology and professional expertise to create a **climate for innovation**.[41] Such a climate is necessary to support schools in designing and implementing new methods, technologies and pedagogies.

As important, education professionals must become agents of change rather than the objects of change as education develops. Their practice should be reflective, assessing innovative practices and approaches and determining what works best in which circumstances. Such approaches require rethinking of teacher training with the aim of cultivating educators who actively shape and advance their discipline.[42]

Networks and innovation hubs

Breakthrough ideas and brilliant educators are abundant. The trouble is, they too often exist and work in isolated microcosms, slowing progress and undermining transformation.

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[38] www.lektion.se (May 2010).

[39] See OECD (2009) *Study On Digital Learning Resources As Systemic Innovation Country Case Study Report On Sweden.*

[40] Becta (2009) *Harnessing Technology: business practices which support risk-taking and innovation in schools and colleges.*

[41] For more on the barriers to educational innovation, see *Overcoming the barriers to educational innovation: A literature review* by Kieron Kirkland and Dan Sutch (2009).

[42] For more on these strategies, see *Promoting transformative innovation in schools* by Dan Sutch, Tim Rudd and Keri Facer (2008).

Innovators must be broadly recognized and supported as champions of new approaches to teaching and learning. Likewise, promising ideas need to be highlighted, evaluated and shared widely—what David Hargreaves refers to as "disciplining innovation." To do this, education must develop improved infrastructure and processes for networking and sharing professional knowledge.[43]

Partnerships between schools have emerged as a particularly important mechanism for encouraging and spreading innovative ideas and practices.[44] These partnerships are often supported by intermediary organizations established by governments.[45]

Practitioners consistently cite these opportunities to collaborate with their peers as being more effective than any other form of continuing professional development (CPD).[46] The OECD reinforces these ideas in its recommendations to governments on providing the conditions that encourage innovative use of digital learning resources. The OECD recommends linking innovation initiatives, making researchers and entrepreneurs more visible, and establishing a forum for dialogue between innovators and stakeholders.[47]

Greater use of technology can also link the goals and work of innovators. The process of innovation in education should shift to take greater advantage of platforms and forums that support open communication and collaboration. These resources encourage distributed leadership, use of networked technologies and greater work at the intersection of disciplines.

The notion of "community" is taking on new meaning as global demographics shift and networked technologies change how people access information and resources. New thinking about what it means to participate —both physically and digitally—in a community of networked, mobile individuals will help strengthen how social innovations are developed, shared and implemented.

2.2.2. Education's role in preparing students to be entrepreneurs and social innovators

The role of education in preparing young people to be entrepreneurs is receiving more attention but is not yet widely practiced. As the Horizon 2010 K–12 Report states, "The perceived value of innovation and creativity is increasing. Innovation is valued at the highest levels of business and must be embraced in schools if students are to succeed beyond their formal education. The ways we design learning experiences must reflect the growing importance of innovation and creativity as professional skills."

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[43] A larger strategy around this is detailed in David Hargreaves' *Education Epidemic: Transforming Secondary Schools through Innovation Networks* (2003).

[44] M. Harris and R. Halkett (2007). *Hidden Innovation, How innovation happens in six 'low innovation' sectors,* NESTA Research Report.

[45] For example, in the UK, the National College for School Leadership (NCSL), the Specialist Schools and Academies Trust (SSAT), and the Innovation Unit.

[46] M. Fielding, S. Bragg, J. Craig, I. Cunningham, M. Eraut, S. Gillinson, M. Horne, C. Robinson and J. Thorp (2005). Factors Influencing the Transfer of Good Practice, DfES Research Report No. 615, (Department for Education and Skills, London).

[47] OECD (2009). *Beyond Textbooks: Digital Learning Resources as Systemic Innovation in Nordic Countries.*

School systems have traditionally focused on providing basic skills and preparing students for higher education or employment—not teaching students to become entrepreneurs. But the nature of work has radically changed through globalization, the rapid development of technology and the lower cost of travel. As a result, it is no longer enough to train students for a career. Schools and universities must prepare students to work in a dynamic, rapidly changing entrepreneurial global marketplace. Entrepreneurial skills are critical for young people to be successful in the current and future global economy.[48]

Embedding entrepreneurship education

The World Economic Forum report observes that "entrepreneurial skills, attitudes and behaviors can be learned, and that exposure to entrepreneurship education throughout an individual's lifelong learning path, starting from youth and continuing through adulthood into higher education—as well as reaching out to those economically or socially excluded—is imperative."

The report also states that it is not sufficient to add entrepreneurship to the perimeter—it must be integral to education. This requires a fundamental rethinking of educational systems, both formal and informal, to encourage creativity, innovation and unconventional problem-solving. Also in need of rethinking are the ways in which teachers and educators are trained; how examination systems work; and how rewards, recognition and incentives are distributed.

The importance of science, technology, engineering and math

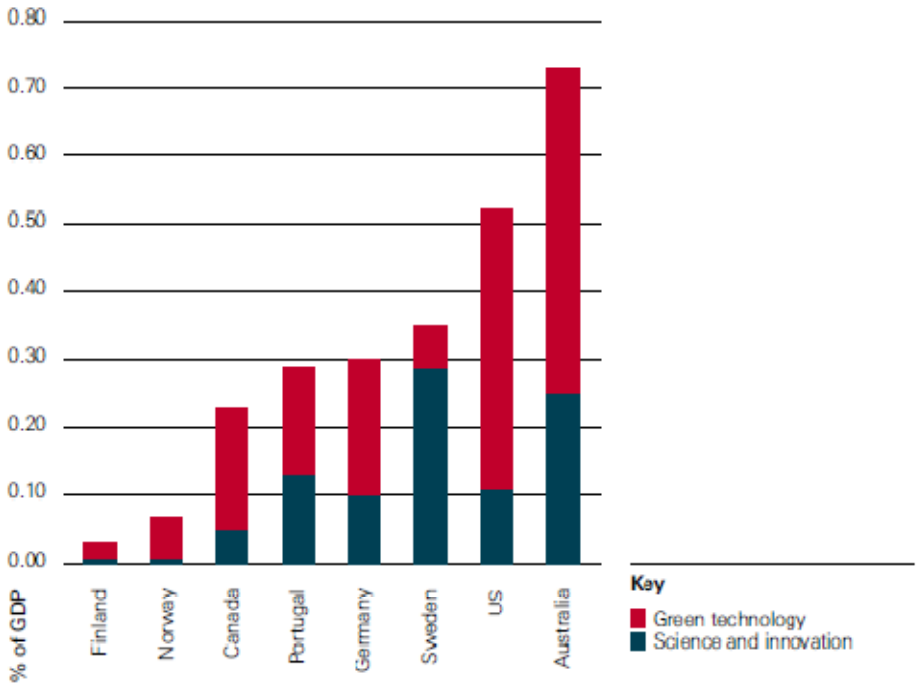
While we cannot predict this century's equivalent of quantum theory, the double helix or the Internet, we can anticipate that advances in STEM will transform how billions live, learn, work and drive economic growth.[49]

Given the type and scope of challenges facing the world, much of future innovation will likely take place across the spectrum of scientific fields. Recognizing this, governments have placed emphasis on funding STEM-based programs in economic stimulus packages developed in response to the global financial crisis. See Exhibit 5 for more detail.

While science requires investment and infrastructure, its most important resource is people. This is why effective STEM education is critical to inspiring young people to enter scientific professions and to become citizens literate in the sciences.

Exhibit 5: Science and innovation investments in stimulus packages as a percentage of GDP

[48] *Educating the next wave of entrepreneurs* (2009). World Economic Forum.
[49] *The Scientific Century, Securing our future prosperity* (2010). Royal Society, London.



Source: OECD (2009). Policy Responses to the Economic Crisis: Stimulus Packages, Innovation and Long-Term Growth.

Entrepreneurialism can advance and build upon academic discoveries in the sciences by making them available to the public. Supporting links between companies and universities can also be mutually beneficial. Consider the "Cambridge Phenomenon," where a large number of high-tech companies have sprung out of or around Cambridge University in the UK. A similar example is Silicon Valley in the United States, where the intersection of academia and the private sector gave rise to the information technology industry.

Beyond local efforts, there is an opportunity to better coordinate STEM research and learning across international networks. Interdisciplinary collaboration will become increasingly crucial to addressing issues, such as climate change and food security, that transcend national interests and borders.

2.3. What areas of opportunity arise from social innovation and education?

Driving social innovation through new approaches to education suggests numerous areas of opportunity:

- Developing education's capacity to adopt and benefit from innovative practice through technology
- Supporting continued discovery, ingenuity and innovation in use of technology for teaching and learning
- Using technology to facilitate collaboration between innovators and experts, and between institutions
- Developing education leadership capacity in the strategic development and innovative deployment of technology

- Developing a culture of entrepreneurship within education's leaders, teachers and students
- Addressing the development of STEM knowledge and skills and their broad application within education
- Developing high-tech classroom design
- Developing a dedicated technology and education research network

3. HP education and social innovation strategy

3.1. Introduction

The trends and challenges identified in the preceding sections present opportunities for using technology to solve education's challenges in new and innovative ways. Responding to these opportunities will require sustained commitment and broad collaboration among education systems, educators and other stakeholders.

It will also require leadership from government, not-for-profit organizations and the private sector. As the largest IT company in the world, HP is uniquely positioned to be a catalyst for leading efforts to transform education. HP has a long track record of applying its technology and expertise to improve education, and has identified education and entrepreneurship as strategic to its business goals.

HP's overarching strategy is to collaborate with partner organizations to push the boundaries of what education can achieve. Through such partnerships, HP has developed innovations that billions rely on every day. From cloud computing solutions that are revolutionizing how people think about, access and use technology, to products and services such as HP Halo, which provides an immersive telepresence experience that makes collaboration possible from a distance, HP is providing technologies with tremendous potential to enrich teaching and learning.

3.2. HP's Social Innovation Program

The garage in Palo Alto, California, where Dave Packard and Bill Hewlett founded HP more than 70 years ago is famed for not only giving rise to one of the world's most successful IT companies, but also one of the earliest and most influential pioneers in corporate social responsibility. Among HP's core principles is a commitment to its people and communities that still resonates today. These principles are upheld through global citizenship, a corporate objective that aligns HP's business goals with its impacts on society and the planet.

Under the mantle of global citizenship, HP´s OGSI focuses its work on three areas that are strategic to HP's business: health, education and community.

HP in health

In health, HP is applying its technology and expertise to increase the availability of healthcare services, and to improve the effectiveness of healthcare by accelerating adoption of e-Health solutions.

In both areas, HP works with nongovernmental organizations and governments, particularly in regions where access to healthcare is lacking. For example, HP cooperates closely with

strategic partners, such as PATH or the Clinton Health Access Initiative (CHAI), to design and implement open standards that increase the efficiency of healthcare systems.

HP is also improving access to and the quality of healthcare by accelerating the implementation of e-health solutions. By developing generic tools that streamline and support electronic health records, patient administration, and hospital and general practitioner information systems, HP is making it easier to reliably deliver healthcare services in underserved regions.

HP in the community

HP is dedicated to being an active, productive community member in the 170 countries where it operates. Each year, thousands of HP employees donate their time, expertise and resources to support their local communities. From developing microenterprises in the Asia Pacific region to donating equipment, cash and expertise to primary schools in South America, HP employees are helping others gain access to technology, training and other resources to enrich their lives.[50] For example, in India, HP has partnered with the Self Employed Women's Association (SEWA)to provide basic ICT training to SEWA members. So far, nearly 9,000 employees have completed the program, resulting in 30 percent of trainees going on to start their own businesses and increase their incomes.

HP in education

In education, HP's goal is to transform teaching and learning through innovative uses of technology. HP OGSI has identified two areas of focus: innovation in education and entrepreneurship education. It supports these areas through three flagship programs: the HP Catalyst Initiative, the HP EdTech Innovators Award and the HP Learning Initiative for Entrepreneurs (HP LIFE).

HP works with partners worldwide to help educators and organizations use technology in innovative ways to redesign learning experiences—both inside and outside traditional classroom settings—and increase learner achievement. HP emphasizes STEM education to help foster the next generation of workers and high-tech innovators.

HP believes that much more can be achieved through cooperation and collaboration than working in isolation, and continues to refine its education strategy to take into account key developments in education and opportunities presented by new technologies.

4. Impact of social innovation program

4.1. Current impact

In 2009, HP contributed more than $30 million to support education and training programs worldwide. Over the past five years, more than 1,100 educational institutions in over 40 countries received support via HP grants, benefiting more than 110,000 teachers and students.

The impact of HP's commitment to education has been far-reaching and positive. For example, over a period of six years, more than 95 percent of secondary school educators

[50] http://h20430.www2.hp.com/program/globalcitizenship/ap/en/philanthropy.asp

participating in the former HP Technology for Teaching program reported improvements in their instruction and on student learning.[51]

Similarly, educators in higher education who participated in the program reported improved understanding of student learning needs, enhanced ability to connect learning with real world problems, and greater sharing of best practices among colleagues.

Some examples of HP's leadership in education are described below.

"Encouraging attention, participation and excitement"
The University of Pavia's Technology for Teaching project team used HP mobile wireless technologies to create a link between immuno-deficient patients in isolation rooms and the outside world.[52] Through these links, medical and biomedical engineering students working with patients were able to interact with university instructors in real time. Student performance increased 18 percent when technology was used, and 82 percent of students responded positively to their technology-facilitated learning.

Reaching out to disengaged learners through active learning
With the help of an HP grant, Clemson University in South Carolina introduced HP tablet PCs and Message Grid software into math classrooms to foster a more interactive and effective learning environment. The HP tablet PCs and software enable students to respond to questions anonymously, encouraging them to participate more actively in lessons. With the HP technology, teachers are also able to provide more personalized instruction to students, which contributes to greater engagement and success.

Supporting underperforming students through analysis of performance on individual questions to identify the most challenging concepts for teaching and learning
Clemson is also using HP tablet PCs to track how students solve problems. By recording and playing back what students write on their tablet while working through an assignment, teachers can gain insight into student understanding. This has helped teachers design more effective classroom and group activities to check progress and reinforce learning.

Increasing efficiency through flexible solutions that can be rapidly scaled up or down
HP is working with partners to offer educational institutions core technologies, such as data centers and cloud-based computing, that can rapidly scale to meet their needs. As a result, small school districts in the United States, which otherwise lack the resources to implement and manage sophisticated technology solutions, have been able to take advantage of powerful and highly efficient infrastructure.

Enabling remote student collaboration and engagement with high schools on engineering projects
Boise State University in Idaho is using an HP education grant to dramatically expand how, where and when students learn. Engineering students are tapping into HP blade servers to remotely develop and access learning modules and simulations. Having access to such powerful computing power from virtually anywhere is creating previously unavailable collaborative, interactive and customized learning environments. Boise State is also making these resources available to local high schools and the broader community. This has given

[51] HP Technology for Teaching 2004–09: media release. M. P. Andrews: ISTE director of professional development services, education leadership division.
[52] http://techforteach.sanmatteo.org

younger students access to sophisticated software that they would not otherwise have been able to afford, and to collaborate with engineering undergraduates, fostering deeper interest in STEM education. Joe Guarino, a professor at Boise State said:

"The HP grant enabled us to create new learning environments where students are immersed in virtual reality but can work together as a team. This has been particularly successful in developing math courses (e.g. in differential equations) for engineering majors where simulations are used to reinforce and inspire students to learn math"[53]

Using solution software to predict future classrooms requirements
HP is supporting government and school districts to forecast where and when new classrooms and schools will be needed. It uses sophisticated modeling techniques that account for changing demographics, town planning and building development requirements to help municipalities plan for future educational facilities.

Commitment to NMC Horizon Reports to ensure wider engagement with technology in education
When funding was withdrawn by another sponsor, HP made an ongoing commitment to the NMC Horizon Reports, which chart the landscape of emerging technologies for teaching, learning and creative inquiry. HP supported the New Media Consortium's development of a toolkit to better reach and influence skeptics of the role of technology in education. The toolkit is designed to stimulate discussion within local educational institutions on the major trends in new technology for teaching and learning. HP has also supported the development of a new platform—Navigator, a multi-language social media platform supported by an innovative set of intelligent search tools and resources drawn from the Horizon Project—to promote and assess education technology projects globally. Larry Johnson, CEO of the New Media Consortium, said:

"With HP's support, we were able to scale much more quickly than we could have without their help."[54]

4.2. Potential future impact

In interviews, HP's partners cited the company's technology leadership, role in recognizing and supporting innovators in education, and development of practitioner networks as areas where HP's future support could have significant impact.

Leadership for technology
Convincing skeptics of technology's potential to transform education requires clear vision, consistent communications and strong leadership. Advocates must calibrate their position based on the audience, focusing on opportunities—such as classroom instruction, professional development for educators, outreach to local communities or new approaches to assessment—that are of greatest relevance and importance. Given the depth of HP's experience in education, the breadth of its technology portfolio and the range of partnerships it maintains, it is well positioned to credibly address this diverse range of issues. Leslie Conery, of the International Society for Technology in Education, said:

[53] Interview with Prof Joe Guarino, Boise State University, April 2010.
[54] Interview with Larry Johnson, CEO New Media Consortium, April 2010.

"The number one focus area is leadership. There are a lot of people who don't understand how technology can extend and enhance learning for kids … they think it's PowerPoint. Helping leaders understand its potential, and then take it through to application in the classroom so that kids have access is the key challenge."[55]

Scaling up and creating a culture of innovation
Merely flooding education with technology will not have the transformative effect described in this paper. Technology must be accompanied with comprehensive and ongoing change management programs that cultivate innovation. It is crucial to engage educational leaders and influencers to deepen understanding and build support for new applications of technology in teaching and learning. HP can play a leadership role in bringing together stakeholders in this effort, particularly by tapping into online networks and practitioner communities that can quickly widen discussion, disseminate ideas and scale innovation. Keith Krueger, president of the Consortium for School Networking, CoSN, said: "How do we get the right leaders and systems that enable a culture of innovation? Otherwise all we have is little islands of innovation in a sea of mediocrity."[56]

Leveraging the innovators
One HP grant recipient suggested that HP better leverage the best practices of educational innovators. The recommendation is that HP challenge those who have received grants through its educational programs to describe how they are using HP Tablet PCs with web-based software packages to improve teaching and learning. The most promising and effective examples could be made available for widespread use in presentations by grantees to local and regional schools.

4.3. How can HP's Office of Global Social Innovation make the greatest positive impact on education?

HP OGSI should focus its efforts to transform education on areas aligned with the company's strengths and relevant to its interactions with customers and other stakeholders. For greatest effect, HP OGSI must engage, educate and motivate not only external audiences but also employees to champion the role of technology in education.

HP is already addressing many of the opportunities identified in this paper. For example, at the most basic level, it supports programs to increase online access by making mobile devices readily available to students and teachers. At the other end of the spectrum, HP is exploring more ambitious applications of technology to transform education, such as nanotechnology and augmented reality.

In between, HP is involved in an array of initiatives focused on developing new capabilities, systems and cultures at the intersection of education and technology. These efforts emphasize unleashing human ingenuity and creativity, with the aim of facilitating greater collaboration between educators dedicated to rethinking not only the practice of teaching but the role of education in driving social innovation.

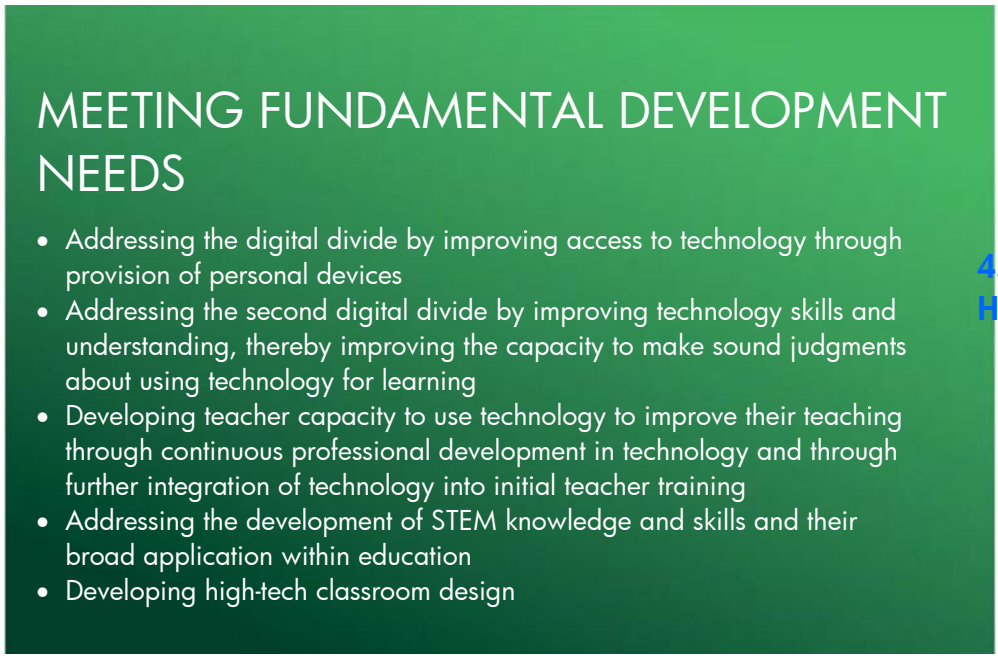
Exhibit 6 presents the opportunities listed at the end of sections 2 and 3 above. The opportunities fall broadly into three categories. At the top of the pyramid is academic

[55] Interview with Leslie Conery, International Society for Technology in Education, April 2010.
[56] Interview with Keith Krueger, president of CoSN, April 2010.

research, followed by socialization of innovation, which rests on a foundation of providing fundamental development needs.

HP OGSI is focused on the center of the pyramid through its three flagship education programs, the HP Catalyst Initiative, the HP EdTech Innovators Award and the HP Learning Initiative for Entrepreneurs (HP LIFE), which are described in greater detail below.

Exhibit 6: Analysis



4.3.1. HP

Catalyst Initiative

HP is funding a global network of five consortia of education experts and supporting organizations to explore what the future of STEM education can look like. Each consortium will receive more than US$1 million in technology, cash and professional support. HP wants to help build a future where students use their technical and creative ingenuity in innovative ways to address urgent social challenges in their communities and around the world.

Organizations will be selected through a competitive call for proposals, which is open to institutions that serve tertiary or secondary students (i.e., schools, colleges, nonprofit or nongovernmental organizations) in 11 targeted countries. Additional details, including deadlines and eligibility, are available at www.hp.com/go/hpcatalyst.

4.3.2. HP EdTech Innovators Award

HP is supporting and showcasing educators who are using technology in groundbreaking ways inside and outside the classroom. In 2010, a maximum of ten institutions will each be awarded an HP technology grant valued at approximately US$40,000 (HP list price). HP will invite the winners to participate in a social network of educators, giving them further access to support, training and other resources to help grantees develop and share their ideas beyond the award. The award is open to accredited private or public education institutions at any level of formal education (i.e., primary, secondary, tertiary) and nonprofit organizations that foster the use of technology in education. Additional details, including deadlines and a list of more than 50 eligible countries, are available at www.hp.com/go/edtech.

4.3.3. HP Learning Initiative for Entrepreneurs (HP LIFE)

HP Learning Initiative for Entrepreneurs (HP LIFE) is a global program for training students, aspiring entrepreneurs and small business owners to harness the power of IT to establish and grow their business. HP and its partners—Micro-Enterprise Acceleration Institute MEA-I, Education Development Center (EDC), ORT Russia and United Nations Industrial Development Organization (UNIDO)—work with more than 200 organizations worldwide to deliver training through the program. The goal is to reach 500,000 students by the end of 2010.

HP LIFE combines face-to-face training and online tools to address the educational needs of students, regardless of their backgrounds, locations or circumstances. These virtual tools and games allow students to access training virtually anywhere. HP LIFE training modules are constantly refreshed and updated to incorporate tools and techniques that are most relevant for young entrepreneurs.

Readers can learn more about HP's programs by visiting the HP Social Innovation website at www.hp.com/hpinfo/grants/education.

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The following interviews are used in this paper:

- Interview with Prof. Joe Guarino, Boise State University, April 2010.
- Interview with Larry Johnson, CEO New Media Consortium, April 2010.
- Interview with Leslie Conery, International Society for Technology in Education, April 2010.
- Interview with Keith Krueger, President of Consortium of School Networking, April 2010.
- Interview with Marilyn Reba and Roy Pargas, Clemson University, South Carolina, May 2010.

Additional interviews informed development of this paper:

- Barbara Chow, Hewlett Foundation, April 2010.
- Kim Elise Chrissan, HP, May 2010.
- Brad Dupuy, HP, April 2010.
- John Hoak, HP, April 2010.
- Todd Korth, HP, April 2010.
- Francesc Pedro, OECD, April 2010.
- Caleb Shutz, The Jason Project, National Geographic, May 2010.
- Mike Trucano, The World Bank, April 2010.
- Connie Yeowell, MacArthur Foundation, May 2010.

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