Innovation in education: what works, what doesn't, and what to do about it?

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Abstract

Purpose – The purpose of this paper is to present an analytical review of the educational innovation field in the USA. It outlines classification of innovations, discusses the hurdles to innovation, and offers ways to increase the scale and rate of innovation-based transformations in the education system.
Design/methodology/approach – The paper is based on a literature survey and author research.
Findings – US education badly needs effective innovations of scale that can help produce the needed high-quality learning outcomes across the system. The primary focus of educational innovations should be on teaching and learning theory and practice, as well as on the learner, parents, community, society, and its culture. Technology applications need a solid theoretical foundation based on purposeful, systemic research, and a sound pedagogy. One of the critical areas of research and innovation can be cost and time efficiency of the learning.
Practical implications – Several practical recommendations stem out of this paper: how to create a base for large-scale innovations and their implementation; how to increase effectiveness of technology innovations in education, particularly online learning; how to raise time and cost efficiency of education.
Social implications – Innovations in education are regarded, along with the education system, within the context of a societal supersystem demonstrating their interrelations and interdependencies at all levels. Raising the quality and scale of innovations in education will positively affect education itself and benefit the whole society.
Originality/value – Originality is in the systemic approach to education and educational innovations, in offering a comprehensive classification of innovations; in exposing the hurdles to innovations, in new arguments about effectiveness of technology applications, and in time efficiency of education.

Keywords Implementation, Innovation, Educational technology, Time efficiency

Paper type Conceptual paper

Necessity is the mother of invention (Plato).

Introduction

Education, being a social institution serving the needs of society, is indispensable for society to survive and thrive. It should be not only comprehensive, sustainable, and superb, but must continuously evolve to meet the challenges of the fast-changing and unpredictable globalized world. This evolution must be systemic, consistent, and scalable; therefore, school teachers, college professors, administrators, researchers, and policy makers are expected to innovate the theory and practice of teaching and learning, as well as all other aspects of this complex organization to ensure quality preparation of all students to life and work.

Here we present a systemic discussion of educational innovations, identify the barriers to innovation, and outline potential directions for effective innovations. We discuss the current

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status of innovations in US education, what educational innovation is, how innovations are being integrated in schools and colleges, why innovations do not always produce the desired effect, and what should be done to increase the scale and rate of innovation-based transformations in our education system. We then offer recommendations for the growth of educational innovations. As examples of innovations in education, we will highlight online learning and time efficiency of learning using accelerated and intensive approaches.

Innovations in US education

For an individual, a nation, and humankind to survive and progress, innovation and evolution are essential. Innovations in education are of particular importance because education plays a crucial role in creating a sustainable future. "Innovation resembles mutation, the biological process that keeps species evolving so they can better compete for survival" (Hoffman and Holzhuter, 2012, p. 3). Innovation, therefore, is to be regarded as an instrument of necessary and positive change. Any human activity (e.g. industrial, business, or educational) needs constant innovation to remain sustainable.

The need for educational innovations has become acute. "It is widely believed that countries' social and economic well-being will depend to an ever greater extent on the quality of their citizens' education: the emergence of the so-called 'knowledge society', the transformation of information and the media, and increasing specialization on the part of organizations all call for high skill profiles and levels of knowledge. Today's education systems are required to be both effective and efficient, or in other words, to reach the goals set for them while making the best use of available resources" (Cornali, 2012, p. 255). According to an Organization for Economic Cooperation and Development (OECD) report, "the pressure to increase equity and improve educational outcomes for students is growing around the world" (Vieluf *et al.*, 2012, p. 3). In the USA, underlying pressure to innovate comes from political, economic, demographic, and technological forces from both inside and outside the nation.

Many in the USA seem to recognize that education at all levels critically needs renewal: "Higher education has to change. It needs more innovation" (Wildavsky *et al.*, 2012, p. 1). This message, however, is not new – in the foreword to the 1964 book entitled *Innovation in Education,* Arthur Foshay, Executive Officer of The Horace Mann-Lincoln Institute of School Experimentation, wrote, "It has become platitudinous to speak of the winds of change in education, to remind those interested in the educational enterprise that a revolution is in progress. Trite or not, however, it is true to say that changes appear wherever one turns in education" (Matthew, 1964, p. v).

Yet, more than 50 years later, we realize that the actual pace of educational innovations and their implementation is too slow as shown by the learning outcomes of both school and college graduates, which are far from what is needed in today's world. Jim Shelton, Assistant Deputy Secretary of the Office of Innovation and Improvement in the US Department of Education, writes, "Whether for reasons of economic growth, competitiveness, social justice or return on tax-payer investment, there is little rational argument over the need for significant improvement in US educational outcomes. Further, it is irrefutable that the country has made limited improvement on most educational outcomes over the last several decades, especially when considered in the context of the increased investment over the same period. In fact, the total cost of producing each successful high school and college graduate has increased substantially over time instead of decreasing – creating what some argue is an inverted learning curve […]."

"Education not only needs new ideas and inventions that shatter the performance expectations of today's status quo; to make a meaningful impact, these new solutions must also "scale," that is grow large enough, to serve millions of students and teachers or large portions of specific underserved populations" (Shelton, 2011). Yet, something does not work here.

Lack of innovation can have profound economic and social repercussions. America's last competitive advantage, warns Harvard Innovation Education Fellow Tony Wagner, its ability to innovate, is at risk as a result of the country's lackluster education system (Creating innovators, 2012). Derek Bok, a former Harvard University President, writes, "[…] neither American students nor our universities, nor the nation itself, can afford to take for granted the quality of higher education and the teaching and learning it provides" (Bok, 2007, p. 6). Hence it is central for us to make US education consistently innovative and focus educational innovations on raising the quality of learning at all levels. Yet, though there is a good deal of ongoing educational research and innovation, we have not actually seen discernable improvements in either school students' or college graduates' achievements to this day. Suffice it to mention a few facts. Program for International Student Assessment (PISA) evaluations keep revealing disappointing results for our middle school (Pew Research Center, 2015); a large number of high school graduates are not ready for college (College preparedness, 2012); and employers, in turn, are often dissatisfied with college graduates (Thomson, 2015; Jaschik, 2015). No one, be they students, parents, academia, business, or society as a whole, are pleased with these outcomes. Could it be that our education system is not sufficiently innovative?

Danny Crichton, an entrepreneur, in his blog The Next Wave of Education Innovation writes expressly, "Few areas have been as hopeful and as disappointing as innovation in education. Education is probably the single most important function in our society today, yet it remains one of the least understood, despite incredible levels of investment from venture capitalists and governments. Why do students continue to show up in a classroom or start an online course? How do we guide students to the right knowledge just as they need to learn it? We may have an empirical inkling and some hunches, but we still lack any fundamental insights. That is truly disappointing. With the rise of the internet, it seemed like education was on the cusp of a complete revolution. Today, though, you would be excused for not seeing much of a difference between the way we learn and how we did so twenty years ago" (Crichton, 2015).

Editors of the book *Reinventing Higher Education: The Promise of Innovation*, Ben Wildavsky, Andrew Kelly, and Kevin Carey write, "The higher education system also betrays an innovation deficit in another way: a steady decline in productivity driven by a combination of static or declining output paired with skyrocketing prices (Wildavsky *et al.*, 2012, p. 3). This despairing mood is echoed by Groom and Lamb's statement in EDUCAUSE Review, "Today, innovation is increasingly conflated with hype, disruption for disruption's sake, and outsourcing laced with a dose of austerity-driven downsizing" (Groom and Lamb, 2014).

USA success has always been driven by innovation and has a unique capacity for growth (Zeihan, 2014). Nevertheless, it is indeed a paradox: while the USA produces more research, including in education, than any other country (Science Watch, 2009), we do not see much improvement in the way our students are prepared for life and work. The USA can be proud of great scholars, such as John Dewey, B.F. Skinner, Abraham Maslow, Albert Bandura, Howard Gardner, Jerome Bruner, and many others who have contributed a great deal to the theory of education. Yet, has this theory yielded any innovative approaches for the teaching and learning practice that have increased learning productivity and improved the quality of the output?

The USA is the home of the computer and the internet, but has the information revolution helped to improve the quality of learning outcomes? Where and how, then, are all these educational innovations applied? It seems, write Spangehl and Hoffman, that "American education has taken little advantage of important innovations that would increase instructional capacity, effectiveness, and productivity" (2012, p. 21). "The new 'job factory' role American universities have awkwardly stuffed themselves into may be killing the modern college student's spirit and search for meaning" (Mercurio, 2016).

What is interesting here is that while we are still undecided as to what to do with our struggling schools and universities and how to integrate into them our advanced inventions, other nations are already benefiting from our innovations and have in a short time successfully built world-class education systems. It is ironic that an admirable Finnish success was derived heavily from US educational research. Pasi Sahlberg, a Finnish educator and author of a bestselling book, *The Finnish Lessons: What Can the World Learn from Educational Change In Finland*, said in an interview to the Huffington Post, "American scholars and their writings, like Howard Gardner's Theory of Multiple Intelligences, have been influential in building the much-admired school system in Finland" (Rubin, 2015); so wrote other authors (Strauss, 2014). Singapore, South Korea, China, and other forward-looking countries also learned from great US educational ideas.

We cannot say that US educators and society are oblivious to the problems in education: on the contrary, a number of educational movements have taken place in recent US history (e.g. numerous educational reforms since 1957 to this day, including recent NCLB, Race to the Top, and the Common Core). Universities and research organizations opened centers and laboratories of innovation (Harvard Innovation Lab, Presidential Innovation Laboratory convened by American Council on Education, Center for Innovation in Education at the University of Kentucky, NASA STEM Innovation Lab, and recently created National University Center for Innovation in Learning). Some institutions introduced programs focusing on innovation (Master's Program in Technology, Innovation, and Education at Harvard Graduate School of Education; Master of Arts in Education and Innovation at the Webster University). New organizations have been set up (The International Centre for Innovation in Education, Innovative Schools Network, Center for Education Reform). Regular conferences on the topic are convened (AERA, ASU-GSV Summit, National Conference on Educational Innovation, The Nueva School for the Innovative Learning Conference). Excellent books have been written by outstanding innovators such as Andy Hargreaves (2003), Hargreaves and Shirley (2009), Hargreaves *et al.* (2010), Michael Fullan (2007, 2010), Yong Zhao (2012), Pasi Sahlberg (2011), Tony Wagner (2012), Mihaliy Csikszentmihalyi (2013), and Ken Robinson (2015). There is even an Office of Innovation and Improvement in the US Department of Education, which is intended to "[…] drive education innovation by both seeding new strategies, and bringing proven approaches to scale" (Office of Innovation and Improvement, 2016). And still, innovations do not take hold in American classrooms on a wide scale, which may leave the nation behind in global competition.

Society's failure to anticipate the problems and their outcomes may have unpredictable consequences, as Pulitzer Prize winner and Professor Jared Diamond, University of California, Los Angeles, writes in his book, *Collapse: How Societies Choose to Fail or Succeed* (Diamond, 2005). Yong Zhao interpreted Diamond's findings as "[…] society's inability to perceive or unwillingness to accept large and distant changes – and thus work to come up with the right response – is among one of the chief reasons that societies fail. This inability also leads human beings to look for short-term outcomes and seek immediate gratification" (Zhao, 2012, p. 162). It looks like the issue of educational innovation goes beyond the field itself and requires a strong societal response.

Three big questions arise from this discussion: why, having so many innovators and organizations concerned with innovations, does our education system not benefit from them? What interferes with creating and, especially, implementing transformative, life-changing, and much-needed innovations across schools and colleges in this country? How can we grow, support, and disseminate worthy innovations effectively so that our students succeed in both school and university and achieve the best learning outcomes that will adequately prepare them for life and work? Let us first take a look at what is an educational innovation.

What is educational innovation?

> Creativity is thinking up new things. Innovation is doing new things (Theodore Levitt).

To innovate is to look beyond what we are currently doing and develop a novel idea that helps us to do our job in a new way. The purpose of any invention, therefore, is to create something different from what we have been doing, be it in quality or quantity or both. To produce a considerable, transformative effect, the innovation must be put to work, which requires prompt diffusion and large-scale implementation.

Innovation is generally understood as "[…] the *successful* introduction of a new thing or method" (Brewer and Tierney, 2012, p. 15). In essence, "[…] innovation seems to have two subcomponents. First, there is the idea or item which is novel to a particular individual or group and, second, there is the change which results from the adoption of the object or idea" (Evans, 1970, p. 16). Thus, innovation requires three major steps: an idea, its implementation, and the outcome that results from the execution of the idea and produces a change. In education, innovation can appear as a new pedagogic theory, methodological approach, teaching technique, instructional tool, learning process, or institutional structure that, when implemented, produces a significant change in teaching and learning, which leads to better student learning. So, innovations in education are intended to raise productivity and efficiency of learning and/or improve learning quality. For example, Khan's Academy and MOOCs have opened new, practically unlimited opportunities for massive, more efficient learning.

Efficiency is generally determined by the amount of time, money, and resources that are necessary to obtain certain results. In education, efficiency of learning is determined mainly by the invested time and cost. Learning is more efficient if we achieve the same results in less time and with less expense. Productivity is determined by estimating the outcomes obtained vs the invested effort in order to achieve the result. Thus, if we can achieve more with less effort, productivity increases. Hence, innovations in education should increase both productivity of learning and learning efficiency.

Educational innovations emerge in various areas and in many forms. According to the US Office of Education, "There are innovations in the way education systems are organized and managed, exemplified by charter schools or school accountability systems. There are innovations in instructional techniques or delivery systems, such as the use of new technologies in the classroom. There are innovations in the way teachers are recruited, and prepared, and compensated. The list goes on and on" (US Department of Education, 2004).

Innovation can be directed toward progress in one, several, or all aspects of the educational system: theory and practice, curriculum, teaching and learning, policy, technology, institutions and administration, institutional culture, and teacher education. It can be applied in any aspect of education that can make a positive impact on learning and learners.

In a similar way, educational innovation concerns all stakeholders: the learner, parents, teacher, educational administrators, researchers, and policy makers and requires their active involvement and support. When considering the learners, we think of studying cognitive processes taking place in the the brain during learning – identifying and developing abilities, skills, and competencies. These include improving attitudes, dispositions, behaviors, motivation, self-assessment, self-efficacy, autonomy, as well as communication, collaboration, engagement, and learning productivity.

To raise the quality of teaching, we want to enhance teacher education, professional development, and life-long learning to include attitudes, dispositions, teaching style, motivation, skills, competencies, self-assessment, self-efficacy, creativity, responsibility, autonomy to teach, capacity to innovate, freedom from administrative pressure, best conditions of work, and public sustenance. As such, we expect educational institutions to provide an optimal academic

environment, as well as materials and conditions for achieving excellence of the learning outcomes for every student (program content, course format, institutional culture, research, funding, resources, infrastructure, administration, and support).

Education is nourished by society and, in turn, nourishes society. The national educational system relies on the dedication and responsibility of all society for its effective functioning, thus parental involvement, together with strong community and society backing, are crucial for success.

A national education system is commonly the product of a distinctive set of historical, political, social, cultural, and economic effects. As it is a complete system, its different areas are not only interrelated and interdependent but act together. Subsequently, any change in one of them may generate a change in others. A few examples of innovations in some areas that made a drastic impact on the whole educational system are:

- political (NCLB (No Child Left Behind Act), Race to the Top);
- social (Equal Opportunities Act, affirmative action policy, Indivuals with Disabilities Education Act);
- philosophical (constructivism, objectivism);
- cultural (moral education, multiculturalism, bilingual education);
- pedagogical (competence-based education, STEM (curriculum choices in school: Science, Technology, English, and Mathematics);
- psychological (cognitive science, multiple intelligencies theory, Maslow's hierarchy of needs, learning style theory); and
- technological (computer-based learning, networked learning, e-learning).

Though these innovations left a significant mark on education, which of them helped improve productivity and quality of learning? Under NCLB, we placed too much focus on accountability and assessment and lost sight of many other critical aspects of education. In drawing too much attention to technology innovations, we may neglect teachers and learners in the process. Stressing the importance of STEM at the expense of music, arts and physical culture ignores young people's personal, social, emotional, and moral development. Reforming higher education without reforming secondary education is futile. Trying to change education while leaving disfunctional societal and cultural mechanisms intact is doomed. It is crucial, therefore, when innovating to ask, "What is this innovation for?" "How will it work?" and "What effect will it produce?"

Many of us educators naively believe grand reforms or powerful technologies will transform our education system. Did we not expect NCLB to change our schools for the better? Did we not hope that new information technologies would make education more effective and relieve teachers from tedious labor? However, again and again we realize that neither loud reforms nor wondrous technology will do the hard work demanded of teachers and learners.

Innovations can be categorized as evolutionary or revolutionary (Osolind, 2012), sustaining or disruptive (Christensen and Overdorf, 2000; Yu and Hang, 2010). Evolutionary innovations lead to incremental improvement but require continuity; revolutionary innovations bring about a complete change, totally overhauling and/or replacing the old with the new, often in a short time period. Sustaining innovation perpetuates the current dimensions of performance (e.g. continuous improvement of the curriculum), while disrupting innovation, such as a national reform, radically changes the whole field. Innovations can also be tangible (e.g. technology tools) and intangible (e.g. methods, strategies, and techniques). Evolutionary and revolutionary innovations seem to have the same connotation as sustaining and disruptive innovations, respectively.

When various innovations are being introduced in the conventional course of study, for instance Universal Design of Learning (Meyer *et al.*, 2014); or more expressive presentation of new material using multimedia; or more effective teaching methods; or new mnemonic techniques, students' learning productivity may rise to some extent. This is an evolutionary change. It partially improves the existing instructional approach to result in better learning. Such learning methods as inquiry based, problem based, case study, and collaborative and small group are evolutionary innovations because they change the way students learn. Applying educational technology (ET) in a conventional classroom using an overhead projector, video, or iPad, are evolutionary, sustaining innovations because they change only certain aspects of learning. National educational reforms, however, are always intended to be revolutionary innovations as they are aimed at complete system renovation. This is also true for online learning because it produces a systemic change that drastically transforms the structure, format, and methods of teaching and learning. Some innovative approaches, like "extreme learning" (Extreme Learning, 2012), which use technology for learning purposes in novel, unusual, or nontraditional ways, may potentially produce a disruptive, revolutionary effect.

Along with types of innovation, the degree of impact can be identified on the following three levels:

(1) Adjustment or upgrading of the process: innovation can occur in daily performance and be seen as a way to make our job easier, more effective, more appealing, or less stressful. This kind of innovation, however, should be considered an improvement rather than innovation because it does not produce a new method or tool. The term innovative, in keeping with the dictionary definition, applies only to something new and different, not just better, and it must be useful (Okpara, 2007). Educators, incidentally, commonly apply the term "innovative" to almost any improvement in classroom practices; yet, to be consistent, not any improvement can be termed in this way. The distinction between innovation and improvement is in novelty and originality, as well as in the significance of impact and scale of change.

(2) Modification of the process: innovation that significantly alters the process, performance, or quality of an existing product (e.g. accelerated learning (AL), charter school, home schooling, blended learning).

(3) Transformation of the system: dramatic conversion (e.g. Bologna process; Common Core; fully automated educational systems; autonomous or self-directed learning; online, networked, and mobile learning).

First-level innovations (with a small *i*) make reasonable improvements and are important ingredients of everyday life and work. They should be unequivocally enhanced, supported, and used. Second-level innovations either lead to a system's evolutionary change or are a part of that change and, thus, can make a considerable contribution to educational quality. But we are more concerned with innovations of the third level (with a capital I), which are both breakthrough and disruptive and can potentially make a revolutionary, systemic change.

All innnovations are ultimately directed at changing qualitative and/or quantitative factors of learning outcomes:

- qualitative: better knowledge, more effective skills, important competencies, character development, values, dispositions, effective job placement, and job performance; and
- quantitative: improved learning parameters such as test results, volume of information learned, amount of skills or competencies developed, college enrollment numbers, measured student performance, retention, attrition, graduation rate, number of students in class, cost, and time efficiency.

Innovation can be assessed by its novely, originality, and potential effect. As inventing is typically a time-consuming and cost-demanding experience, it is critical to calculate short-term and long-term expenses and consequences of an invention. They must demonstrate significant qualitative and/or quantitative benefits. As a psychologist Mihalyi Csikszentmihalyi writes, "human well-being hinges on two factors: the ability to increase creativity and the ability to develop ways to evaluate the impact of new creative ideas" (Csikszentmihalyi, 2013, p. 322).

In education, we can estimate the effect of innovation via learning outcomes or exam results, teacher formative and summative, formal and informal assessments, and student self-assessment. Innovation can also be computed using such factors as productivity (more learning outcomes in a given time), time efficiency (shorter time on studying the same material), or cost efficiency (less expense per student) data. Other evaluations can include the school academic data, college admissions and employment rate of school graduates, their work productivity and career growth.

Assessing the effects of innvoation can also be based on the scale of implementation:

- singular/local/limited;
- multiple/spread/significant; and
- system-wide/total.

This gradation correlates with the three levels of innovation described above: adjustment, modification, and transformation. To make a marked difference, educational innovation must be scalable and spread across the system or wide territory. Prominent examples include Khan Academy in the USA, GEEKI Labs in Brazil (GEEKI), and BRIDGE International Academies in Kenya (BRIDGE). Along with scale, the speed of adoption or diffusion, and cost are critical for maximizing the effect of innovation.

Innovations are nowadays measured and compared internationally. According to the 2011 OECD report (OECD, 2014), the USA was in 24th place in educational innovativeness in the world. This report singled out the use of student assessments for monitoring progress over time as the top organizational innovation, and the requirement that students were to explain and elaborate on their answers during science lessons as the top pedagogic innovation in the USA. Overall, the list of innovations selected by OECD was disappointingly unimpressive.

Innovations usually originate either from the bottom of the society (individual inventors or small teams) – bottom-up or grass root approach, or from the top (business or government) – top-down or administrative approach. Sometimes, innovations coming from the top get stalled on their way to the bottom if they do not accomplish their goal and are not appreciated or supported by the public. Should they rise from the bottom, they may get stuck on the road to the top if they are misunderstood or found impractical or unpopular. They can also stop in the middle if there is no public, political, or administrative or financial backing. Thus, innovations that start at the bottom, however good they are, may suffer too many roadblocks to be able to spread and be adopted on a large scale. Consequently, it is up to politicians, administrators, and society to drive or stifle the change. Education reforms have always been top-down and, as they near the bottom, typically become diverted, diluted, lose strength, or get rejected as ineffective or erroneous. As Michael Fullan writes in the Foreword to an exciting book, *Good to Great to Innovate: Recalculating the Route to Career Readiness, K012+*, "[…] there is a good deal of reform going on in the education world, but much of it misses the point, or approaches it superficially" (Sharratt and Harild, 2015, p. xiii).

Innovations enriching education can be homegrown (come from within the system) or be imported (originate from outside education). Examples of imported innovations that result from revolution, trend, or new idea include the information technology revolution, social media, medical developments (MRI), and cognitive psychology. Innovations can also be borrowed from

superior international theories and practices (see Globalization of Education chapter). National reform may also be a route to innovation, for instance when a government decides to completely revamp the system via a national reform, or when an entire society embarks on a new road, as has happened recently in Singapore, South Korea, and Finland.

Innovations may come as a result of inspiration, continuous creative mental activity, or "supply pushed" through the availability of new technological possibilities in production, or "demand led" based on market or societal needs (Brewer and Tierney, 2012, p. 15). In the first case, we can have a wide variety of ideas flowing around; in the second, we observe a ubiquitous spread of educational technologies across educational system at all levels; in the third, we witness a growth of non-public institutions, such as private and charter schools and private universities.

Innovation in any area or aspect can make a change in education in a variety of ways. Ultimately, however, innovations are about quality and productivity of learning (this does not mean we can forget about moral development, which prepares young people for life, work, and citizenship) (Camins, 2015). Every innovation must be tested for its potential efficiency. The roots of learning efficiency lie, however, not only in innovative technologies or teaching alone but even more in uncovering potential capacities for learning in our students, their intellectual, emotional, and psychological spheres. Yet, while innovations in economics, business, technology, and engineering are always connected to the output of the process, innovation in education does not necessarily lead to improving the output (i.e. students' readiness for future life and employment). Test results, degrees, and diplomas do not signify that a student is fully prepared for his or her career. Educational research is often disconnected from learning productivity and efficiency, school effectiveness, and quality output. Innovations in educational theories, textbooks, instructional tools, and teaching techniques do not always produce a desired change in the quality of teaching and learning. What, then, is the problem with our innovations? Why do not we get more concerned with learning productivity and efficiency? As an example, let us look at technology applications in teaching and learning.

Effects of technology innovations in education

> A tool is just an opportunity with a handle (Kevin Kelly).

When analyzing innovations of our time, we cannot fail to see that an overwhelming majority of them are tangible, being either technology tools (laptops, iPads, smart phones) or technology-based learning systems and materials, e.g., learning management system (LMS), educational software, and web-based resources. Technology has always served as both a driving force and instrument of innovation in any area of human activity. It is then natural for us to expect that innovations based on ET applications can improve teaching and learning. Though technology is a great asset, nonetheless, is it the single or main source of today's innovations, and is it wise to rely solely on technology?

The rich history of ET innovations is filled with optimism. Just remember when tape recorders, video recorders, TV, educational films, linguaphone classes, overhead projectors, and multimedia first appeared in school. They brought so much excitement and hope into our classrooms! New presentation formats catered to various learning styles. Visuals brought reality and liveliness into the classrooms. Information and computer technology (ICT) offered more ways to retrieve information and develop skills. With captivating communication tools (iPhones, iPads, Skype, FaceTime), we can communicate with anybody around the world in real time, visually, and on the go. Today we are excited about online learning, mobile learning, social networking learning, MOOCs, virtual reality, virtual and remote laboratories, 3D and 4D printing, and gamification. But can we say all this is helping to produce better learning? Are we actually using ET's potential to make a difference in education and increase learning output?

Larry Cuban, an ET researcher and writer, penned the following: "Since 2010, laptops, tablets, interactive whiteboards, smart phones, and a cornucopia of software have become ubiquitous. We spent billions of dollars on computers. Yet has academic achievement improved as a consequence? Has teaching and learning changed? Has use of devices in schools led to better jobs? These are the basic questions that school boards, policy makers, and administrators ask. The answers to these questions are 'no,' 'no,' and 'probably not.'" (Cuban, 2015). This cautionary statement should make us all think hard about whether more technology means better learning.

Technology is used in manufacturing, business, and research primarily to increase labor productivity. Because integrating technology into education is in many ways like integrating technology into any business, it makes sense to evaluate technological applications by changes in learning productivity and quality. William Massy and Robert Zemsky wrote in their paper, "Using Information Technology to Enhance Academic Productivity," that "[…] technology should be used to boost academic productivity" (Massy and Zemsky, 1995). National Educational Technology Standards also addressed this issue by introducing a special rubric: "Apply technology to increase productivity" (National Educational Technology Standards, 2004). Why then has technology not contributed much to the productivity of learning? It may be due to a so-called "productivity paradox" (Brynjolfsson, 1993), which refers to the apparent contradiction between the remarkable advances in computer power and the relatively slow growth of productivity at the level of the whole economy, individual firms, and many specific applications. Evidently, this paradox relates to technology applications in education.

A conflict between public expectations of ET effectiveness and actual applications in teaching and learning can be rooted in educators' attitudes toward technology. What some educational researchers write about technology in education helps to reveal the inherent issue. The pillars and building blocks of twenty-first century learning, according to Linda Baer and James McCormick (2012, p. 168), are tools, programs, services, and policies such as web-enabled information storage and retrieval systems, digital resources, games, and simulations, eAdvising and eTutoring, online revenue sharing, which are all exclusively technological innovations. They are intended to integrate customized learning experiences, assessment-based learning outcomes, wikis, blogs, social networking, and mobile learning. The foundation of all this work, as these authors write, is built on the resources, infrastructure, quality standards, best practices, and innovation.

These are all useful, tangible things, but where are the intangible innovations, such as theoretical foundation, particularly pedagogy, psychology, and instructional methodology that are a true underpinning of teaching and learning? The emphasis on tools seems to be an effect of materialistic culture, which covets tangible, material assets or results. Similarly, today's students worry more about grades, certificates, degrees, and diplomas (tangible assets) than about gaining knowledge, an intangible asset (Business Dictionary, 2016). We may come to recognize that modern learning is driven more by technological tools than by sound theory, which is misleading.

According to the UNESCO Innovative Teaching and Learning (ITL) Research project conducted in several countries, "ICT has great potential for supporting innovative pedagogies, but it is not a magic ingredient." The findings suggest that "[…] when considering ICT it is important to focus not on flash but on the student learning and 21st century skills that ICT can enable" (UNESCO, 2013). As Zhao and Frank (2003)argue in their ecological model of technology integration in school, we should be interested in not only how much computers are used but also how computers are used. Evidently, before starting to use technology we have to ask first, "What technology tools will help our students to learn math, sciences, literature and languages better, and how to use them efficiently to improve the learning outcomes?"

Thus, the problem of ET innovations is twofold: any integration of technology in teaching and learning has to demonstrate an increased productivity of teaching and learning, but it can be achieved only when ET applications are based on an effective pedagogic theory. Technology innovation will eventually drive pedagogic innovations, without a doubt, however, this path is slower, more complicated, and leads to an enormous waste of financial, technical and human resources.

Technocentric syndrome

More disquieting than even the lack of pedagogical foundation for technology-enhanced education is the sincere belief of many educators that technology will fix all the problems they encounter in the classroom, be they live or virtual. Consequently, fewer university professors nowadays perceive the need for pedagogic mastery in online teaching in addition to content-area expertise as they reason technology will solve all instructional difficulties anyway. This belief is called "technocentrism" (Pappert, 1990), which, according to Nickols (2011), is common in higher education and e-learning discussions. It is probably common in secondary school as well. Unfortunately, educators often forget that the computer is only an extension of human abilities, not a replacement or substitute. We, as educators, must realize that for technology innovation to produce a positive effect in learning it must be preceded by pedagogic leadership, research, and sound theory; however, the reality is typically the reverse. We are excited to grab the new gadget and try to fit it into the classroom without preliminary assessment of its implementation challenges and potential effects, solid research, or laying out a theoretical foundation based on advanced pedagogic theory which will ensure its effective use. Former Kodak Chairman George Fisher described it this way, "Even good people get locked into processes that may be totally inappropriate to deal with a new technology attacking from underneath (Christensen and Eyring, 2011, p. 16).

Technology (as an entity) contains an inherent pedagogical value (Accuosti, 2014, p. 5). It pushes the limits of what educators can do but is not a magic wand; it is only a means, an instrument, a tool for an innovative teacher and learner. That we overestimate technology's power in education has its roots in human anticipation of a miracle, or a hope of finding a quick fix. But "[…] we can't just buy iPads (or any device), add water, and hope that strategy will usher schools to the leading edge of 21st century education. Technology, by itself, isn't curative. Human agency shapes the path" (Levasseur, 2012). We are all excited by the technology and information revolution and believe in its potential but "[…] perhaps the next important revolution isn't technological, even as technology marches forward unabated. Perhaps the revolution that we need, the one we should aspire to, is societal. Indeed, the next revolution should be one of education, empathy, and a broader understanding of the world, and of its people and culture" (Jiang, 2015).

One of my students wrote in a recent online class, "Students learn from their teachers, not from electronic gadgets." Do we understand how students learn in a technology-based environment, one-on-one with the laptop or mobile phone? Can we estimate possible changes in the students' cognition, learning style, behavior, attitudes, values, and social relationships under the influence of electronic devices? It is certainly true that live interaction between students and their teachers offers worthy examples and enlightening experiences for students and gratifying moments for teachers. Overestimating the power of technology, regrettably, leads to the deterioration of the "human element" (Serdiukov, 2001) in technology-based and, particularly, online teaching and learning. It further underestimates the need for sound pedagogy and quality teacher preparation. It may also have a devastating impact on our ability to socialize, collaborate, and survive. George Friedman argues that computers have had "profoundly disruptive consequences on cultural live throughout the world" (Friedman, 2012, p. 25), which could not have left education unperturbed.

Neil Postman addressed another concern of overemphasizing the role of technology in education, cautioning against "[…] surrendering education to technology" (Postman, 1993), which may have far-reaching social and cultural consequences (Serdyukov, 2015b). According to Sousa (2014), the widespread use of technology is having both positive and negative effects on students' attention and memory systems. A strong warning about the negative effects of the Web comes from Maurer *et al.* (2013), who caution that modern media, particularly networked computers, are endangering our capacity to think, to remember clearly, and to read and write with concentration; they also imperil creativity. "New technologies, whether or not they succeed in solving the problem that they were designed to solve, regularly create unanticipated new problems" (Diamond, 2005, p. 505). There are numerous social, cultural and psychological side effects of technology-enhanced or technology-based education, among them placing unrealistic hopes on technology, which leads to weakening a student's and teacher's effort and eventually takes the teachers out of the equation. This in turn makes the outcomes of online learning overly dependent on the LMS platform, washing away human interaction and communication by industrializing and formalizing learning.

Christensen and Eyring (2011), who wrote about disruptive innovations that force universities to change, predict that teaching in the future will be disruptable as technology improves and shifts the competitive focus from a teacher's credentials or an institution's prestige to what students actually learn. Their observations support the findings of other studies that indicate learning occurs best when it involves a blend of online and face-to-face learning, with the latter providing essential intangibles best obtained on a traditional college campus. From this statement, one can extrapolate that technology alone cannot ensure productive and enriched learning and, especially, personal and social development as students still need a human element in a technology-enhanced environment. Additionally, when planning to apply a new technology to education, we have to consider its potential pedagogic and psychological effects. Finally, we need a solid, innovative, theoretical foundation for online learning. This foundation would help teachers do a better job in both classroom and online environments than simply integrating computers and other gadgets into learning. It would help enrich students' otherwise almost entirely independent online experiences using only LMS navigation as a GPS in the world of knowledge with inspiring interaction with a live instructor, peers, and real life.

As technology-based education is unquestionably going to grow, we need to make it pedagogically, psychologically, and socially meaningful and effective. At the same time, we want to minimize its negative short- and long-term consequences, which reaffirms the need for a comprehensive theory of technology-based education and serious research.

Online learning concerns

Demand for online learning is largely driven by working adult students (WALs) willing to have broad access to education and, at the same time, to accommodate learning to their busy lives, rather than by its effectiveness as a cognitive tool, which is determined by its most attractive feature – convenience (Christensen and Eyring, 2011; Song *et al.*, 2004). In studies of student satisfaction, students commonly rate their online experiences as satisfactory, with convenience being the most cited reason (Cole *et al.*, 2014). We observe students' preference for convenience as a consumer strategy, and regrettably, not only in online higher education but across the whole educational system (Kerby *et al.*, 2014). Convenience, along with comfort, helps reduce workload and complexity of learning, as well as the strain of face-to-face interaction with the class and instructor. It produces a sense of privacy and self-satisfaction. It also generates a false perception that online learning is easier than learning in the classroom (Aaron, 2007; Westra, 2016), and often leads to online cheating (Spalding, 2012). The convenience, like the happiness factor, however, means a less

demanding and less rigorous school experience (Zhao, 2012, p. 137). Convenience can be a blessing for creative people, liberating them from the need to waste time and energy on trifles; however, it may also develop self-gratification and laziness instead of struggling with obstacles and doing the hard job of digging in the knowledge mine.

So, accessibility and, especially, convenience, enhanced by flexibility of the study schedule and comfortable learning environment of one's office or bedroom are evidently the key factors of its popularity among students. The motto of online education, "Any time, any place, any pace" is extremely seductive. Yet, despite a number of studies showing that online learning is on a par with traditional, campus-based learning (Ni, 2013; Wrenn, 2016), it is going to take more time and effort to really make online learning deliver outcomes comparable to the traditional classroom-based, face-to-face education. Mattan Griffel, Founder of "One Month," an online education startup, rethinks online education in the aftermath of the MOOC explosion writing, "[Online education] has kind of overstepped its current effectiveness, and everyone is saying what is possible by painting this picture, but the tools haven't reached that point yet" (Crichton, 2015). We know very well online education suffers from restricted interaction among students and with the instructor, is deficient of live collaboration, and lacks opportunities for relationships that take form in a study group. These collective relationships are crucial for individual success. Productive online learning also depends on well-developed learning, technology, critical thinking, research, and even reading and writing skills, as well as strong intrinsic motivation, perseverance, and self-efficacy, which many students do not possess. Finally, substituting real-life objects and processes with virtual reality is not helpful in developing practical skills, which makes real-world laboratory and experimental work less effective in virtual online environments.

Still, the question remains whether online education has helped improve teaching and learning. With the popularity of online education and enormous investment, do online college programs now prepare better specialists? Have we achieved the result we had expected, besides widening access to education for working adult learners, formerly marginalized groups, such as disabled students and minorities, and people geographically separated from the learning centers, thus reaching multi-million enrollment in online programs by 2016 and making sure that students enjoy convenience in their studies?

Innovative technology may bring performance enhancement in some ways but does not necessarily produce a direct benefit to education expressed by increased learning productivity. Are the secondary benefits, like convenience or fun with technology, worthy of heavy investment? What, then, is needed to raise the quality of education? The real question here is, as always, do we control technology, or do we let ourselves be controlled by it and those who have created it? "Choose the former," writes an innovative author Douglas Rushkoff, "and you gain access to the control panel of civilization. Choose the latter, and it could be the last real choice you get to make" (Rushkoff, 2010). The raw powers of technology should be harnessed by sound pedagogy.

Pedagogy of online education is just being developed, after two decades of titanic effort (Serdyukov, 2015a). Online learning is a big business (Stokes, 2012), which should be turned into a serious academic endeavor. When improving online learning, we should not narrow our innovative focus down to only technical solutions in all educational issues. We need to develop a broader look at all aspects of teaching and learning rather than trying to resolve problems and overcome barriers with technology alone.

Barriers to innovation

There are reasons for the discrepancy between the drive for educational innovation that we observe in some areas, great educational innovations of recent times, and the daily reality of the education system.

First of all, if we look at the education holistically, as a complete system in charge of sustaining the nation's need for educating society members and building their knowledge and expertise throughout their active lifetime, we have to acknowledge that all educational levels are interrelated and interdependent. Moreover, education being a system itself is a component of a larger social supersystem, to which it links in many intricate and complicated ways. As a social institution, education reflects all the values, laws, principles, and traditions of the society to which it belongs. Therefore, we need to regard education as a vital, complete, social entity and address its problems, taking into account these relations and dependencies both within the educational system and society.

In turn, if the society supports innovations in education, then its educational system will continuously and effectively evolve and progress. If it does not, education will stagnate and produce mediocre outcomes. An example of negative socio-cultural impact on education is mercantilism, which is destroying the ultimate purpose of education, and consumerism which is degrading institutions of higher education (Feeman and Thomas, 2005; Ng and Forbes, 2009; Abeyta, 2013). Other harmful social and cultural trends exert a powerful influence. These include monetization of education, entitlement, instant gratification, and egotism, which destroy education in general and the development of creativity and innovative spirit of students in particular (Kerby *et al.*, 2014). Such grave societal issues must be dealt with forcefully.

Second, it is well known that higher education has been historically slow to adopt innovations for various reasons (Hoffman and Holzhuter, 2012; Marcus, 2012; Evans, 1970). Because it is complex (due to cohesion and contuinuity of science) and labor intensive, higher education is particularly difficult to make more productive (Brewer and Tierney, 2012). Secondary school is even more conservative than universities because they cater more and more to students' well-being and safety than to their preparation for real life and work (Gibbons and Silva, 2011). Both secondary and higher education function as two separate and rather closed systems in their own rights. They are not only loosely connected to the wider world but also suffer from a wide disconnect between high school output measured in graduate learning outcomes and college entrance student expectations. It seems that "[…] the systems and values of industrial education were not designed with innovation and digital tools in mind. Innovation, whether it is with technology, assessment or instruction, requires time and space for experimentation and a high tolerance for uncertainty. Disruption of established patterns is the *modus operandi* of innovation. We like the fruits of innovation, but few of us have the mettle to run the gauntlet of innovation" (Levasseur, 2012). It is paramount, nonetheless, to accept that "innovation is linked to creativity, risk taking, and experimentation" (Brewer and Tierney, 2012, p. 15), which must be a part of the education system.

Innovation is difficult to spread across school and academia because it disrupts the established routine and pushes implementers out of their comfort zone. Terry Heick writes that "[…] many K-12 schools give lip-service to the concept of innovation in mission statements, on websites, in PDs (professional development), and during committee, council, and board meetings, but lose their nerve when it's time to make it happen. Supporting something seen as secondary (innovation) in the face of pressure, far-reaching programs, external standards ranging from Common Core to Literacy, Technology, and Career Readiness becomes a matter of priority and job security. While education begs for innovation, arguments against it often turn to tempting, straw man attacks" (Heick, 2016). In many instances, innovation in educational institutions does not take priority over pressing routine issues – really, abiding by the state standards is more urgent.

Teachers and school administrators are commonly cautious about a threatening change and have little tolerance for the uncertainty that any major innovation causes. Of course there are schools and even districts that are unafraid to innovate and experiment but their

success depends on individual leaders and communities of educators who are able to create an innovative professional culture. Pockets of innovation give hope but we need a total, massive support for innovations across society.

Third, one of the reasons for the slow pace of improvements in education is a sharp conflict between society's welfare and political and business interests, as vividly illustrated when the NCLB took US education on the path of rigid accountability. It was used by standardized testing companies to reap huge profits (or, may be, vice versa, these companies influenced NCBL). The trend stifled true education and produced unsatisfactory learning outcomes that changed the nature of teaching, narrowing the curriculum and limiting student learning. (National Council of Teachers of English, 2014; The National Center for Fair and Open Testing, 2012).

Fourth, even when an innovation comes to life, it is of little worth without implementation (Csikszentmihalyi, 2013). Innovation is not about talking the talk but walking the walk. Moreover, an innovation can make a significant difference only when it is used on a wide scale. To create innovations is not enough, they need to be spread and used across schools and universities, a more difficult task. For the innovation to make a sizable effect, we need an army of implementers together with favorable conditions for the invention to spread and produce a result. Implementers in turn have to be creative and motivated to do their job; they must also have freedom to innovate in the implementation, security on the job to take risks, and control of what they are doing. Ultimately, they need be trusted (as are teachers in Finland) to do their job right. In short, there must be an "innovation-receiving system" (Evans, 1970), or a "change zone" (Polka and Kardash, 2013). Is this where one of the main problems of innovating lies?

A growing trend in higher education is a market approach wherein the main goal is set for "meeting the demands of the student population that is learning – a life-long population of learners" (Afshar, 2016). Universities today are busy innovating how to increase students' satisfaction and create "exceptional," "premier," or "extraordinary" learning experiences rather than caring about their true knowledge and quality achievements. This is clearly an extension of the adaptive or differentiated approach to teaching and learning, thereby leading to customization of education (Schuwer and Kusters, 2014). But this view raises a question: are students' demands and satisfaction the proper indicators of quality learning? When we began to be more concerned about how students feel in the classroom, what bothers them, and how best to accommodate them to make their learning experiences superior and anxiety-free, we began to set aside the quality outcomes of the learning process.

Every cloud has a silver lining, fortunately. When market approach is applied to higher education, as it is in the current national and global competitive environment, the contest for enrollments increases and forces colleges to decrease attrition in all ways possible. This requires innovative approaches. The institutions that depend on enrollment for their revenue appear more willing to innovate than traditional, public universities that enjoy government support. "Hence, innovation is likely to vary by several characteristics, including type of institution, institution size, market niche, and resources" (Brewer and Tierney, 2012, p. 22). Clearly, private institutions are more adept at innovating than public ones. The market is a powerful factor, however, the changes it may bring have to be tackled cautiously.

The hurdles to technology integration are described by Peggy Ertmer (1999) as external (first-order) and internal (second-order) barriers. The first-order barriers are purely operational (technological), while the second-order barriers are applicational (pedagogical). The difference in approaches to applying technology to teaching and learning (overcoming technological vs pedagogical barriers) might explain why huge investments in ET have brought little if any effect to the quality of learning outcomes.

Last but not least, innovations grow in a favorable environment, which is cultivated by an educational system that promotes innovation at all levels and produces creative, critical thinking, self-sufficient, life-long learners, problem solvers, and workers. This system enjoys

a stimulating research climate, encourages uplifting cultural attitudes toward education, and rallies massive societal support.

The ultimate question is, what innovations do we really need, and what innovations might we not need?

The Finnish example can teach us a good lesson. Pasi Sahlberg identifies a set of reforms popular in many countries that Finland has not adopted, including:

- standardization of curriculum enforced by frequent external tests;
- narrowing of the curriculum to basic skills in reading and mathematics;
- reduced use of innovative teaching strategies;
- adoption of educational ideas from external sources, rather than development of local internal capacity for innovation and problem-solving; and
- adoption of high-stakes accountability policies, featuring rewards and sanctions for students, teachers, and schools (Sahlberg, 2010, p. 10).

Instead, the Finns went their own, the Finnish Way, so profoundly described by Pasi Sahlberg in his bestselling book (Sahlberg, 2011). So would it be innovative not to adopt some reforms? A big question now arises, what is then the American way to build innovative education? And what would be the global way?

What to do? Possible solutions

To create innovations, we need innovators, and many of them. But though innovation is often a spark originated in the mind of a bright person, it needs an environment that can nourish the fire. This environment is formed and fed by educational institutions, societal culture, and advanced economy. Csikszentmihalyi underlines the importance of creating a stimulating macroenvironment, which integrates the social, cultural, and institutional context, and also microenvironment, the immediate setting in which a person works. "Successful environment […] provide(s) freedom of action and stimulation of ideas, coupled with a respectful and nurturant attitude toward potential geniuses" (2013, p. 140). Control over such an environment, he reasons, is in the educators' hands.

Then, when the invention is created, it must fall into a fertile ground like a seed and be cultivated to grow and bring fruit. Csikszentmihalyi writes, "Creative ideas vanish unless there is a receptive audience to record and implement them […]. Edison's or Einstein's discoveries would be inconceivable without the prior knowledge, without the intellectual and social network that stimulated their thinking and without the social mechanisms that recognized and spread their innovations (2013, p. 6)". The audience is not only the educators but also students, parents, policy makers, and all other members of society who act either as implementers or consumers of the innovation.

Coherent systemic support is essential for growing innovations. As the ITL Research project states, "Important school-level supports tend to be present in schools with higher concentrations of innovative teaching. Based on survey data, in schools where teachers reported higher average levels of innovative teaching practices, they also tended to report […] a professional culture aligned to support innovation, reflection, and meaningful discourse about new teaching practices" (UNESCO, 2013). The OECD report on teaching practices and pedagogical innovation also argues that "Teaching practices […] are factors affecting student learning that are more readily modifiable. Moreover, additional professional practices have received attention, especially those that help transform the school into a professional learning community" (Vieluf *et al.*, 2012, p. 3).

Technology integration in education can be successful only when the human element is taken into consideration. This then integrates innovators, implementers, educational leadership,

professional community and, certainly, the learners. Walter Polka and Joseph Kardash argue that the effectiveness of a computer innovation project they developed "[…] was facilitated by the school district leadership because of their focus on the 'human side' of change" (Polka and Kardash, 2013, p. 324). They found correlation between the implementation process employed in the district and the concepts associated with the three general need categories of innovation implementers: organizational needs, professional needs, and personal needs, which contributed to the innovation's success. Long-lasting changes require "[…] a mixture of cultural and institutional changes, commitment from those within the program, and active and engaged leadership," writes Leticia De León, addressing technological innovations in higher education (De León, 2013, p. 347).

When we try to innovate education, we often leave students out of the equation. We do not innovate in students' learning, their mind, attitudes, behaviors, character, metacognition, and work ethics enough. Yet, we try everything we can to improve teaching (delivery), while what we actually need is to improve learning. In education, nothing works if the students do not. According to the famous Bulgarian scholar Georgi Lozanov (1988), learning is a matter of attitude, not aptitude. This is where the greatest potential for improving education lies. As a renowned cognitive scientist Daniel Willingham writes, "[…] education makes better minds, and knowledge of the mind can make better education" (Willingham, 2010, p. 165). The most important goal, thus, should be not so much to learn STEM but to cultivate innovative people in K-12, grow their autonomy, self-efficiency, and foster an entrepreneurial mindset or "a critical mix of success-oriented attitudes of initiative, intelligent risk taking, collaboration and opportunity recognition" (Zhao, 2012, p. 5). To help develop new survival skills, effective communication and critical thinking skills, and nurture curious, creative, critical thinking, independent and self-directed entrepreneurs, we must disrupt the ways of our school system and the ways our teachers are prepared. It may be worthwhile to extend the commonly used term "career readiness" to "life readiness."

Research of exemplary educational systems across the world vividly demonstrates that teacher quality is the fundamental element of educational success: "It is especially teachers who shape students' learning environments and help them reach their intellectual potential": (Vieluf *et al.*, 2012, p. 113). Teacher education and professional development are definitely one of the primary areas that call for innovative approaches: teachers must be taught to teach well (Marcus, 2012). The "how" of the teaching (instructional methodology) is as important as the "what" (content) (Morais *et al.*, 2004). A great resource for effective education is the instructional design and methodology used by teachers, as shown by the ITL Research project: "Across countries and classrooms, the characteristics of assigned classroom activities strongly predicted the 21st century skills that students exhibited in their work. Students are much more likely to learn to solve real-world problems and collaborate productively with their peers, for example, if their learning activities are carefully designed to offer opportunities for them to do these things. This finding suggests that professional development for innovative teaching might begin with lesson design" (UNESCO, 2013).

Teacher social status is one of the determining factors of the teacher quality. Teachers' status in the most advanced countries like Finland, Singapore, South Korea, and Japan is very high. It reflects the quality of teaching and learning and also the level of pedagogic innovations. In our drive to enhance educational innovation, empowering school teachers and college instructors may be the most important task. Mattan Griffel writes, "We need to change the role of teachers. What kind of people do we consider teachers? How do we elevate teachers in society?" (Crichton, 2015). He believes we have to make them "rock stars" and bring new perspectives into the profession.

Eventually, the most recognized pathway to education innovation, writes Shelton, is "[…] basic and applied research […] with more and better leveraged resources, more focus, and

more discipline, this pathway can accelerate our understanding of teaching and learning and production of performance enhancing practices and tools" (Shelton, 2011). Research focusing on raising productivity and efficiency and improving the quality of learning has to increase in all critical areas of education. One crucial indicator of educational effectiveness is measuring the quality of learning that remains imperfect. "The lack of good measures has severely limited the degree to which market forces can discipline the provision of educational quality" (Massy, 2012). Developing clear and effective measures of educational quality is an important venue for future innovative research.

Societal support for innovative education and building up a new culture of educational preeminence both inside the education system and around it is paramount for its success. Brunner (1996) suggests viewing education in a broader context of what society intends to accomplish through its educational investment in the young. The best way to achieve superior education is to shape a new educational culture. As Pasi Sahlberg explains, "We are creating a new culture of education, and there is no way back" (Sahlberg, 2011, p. 2).

Innovation can be presented as a model in the context of its effects on the quality of teaching and learning within an educational environment, which is permeated by professional and societal cultures (Figure 1).

Americans' love affair with the car extends to computers, iPhones, and the internet. Therefore, innovations in education focus primarily on technology and technology applications. Technocentrists want to see education more automated, more technology-enhanced, and more technology-controlled in the hope of making education more effective. The way of doing so would be through more sophisticated LMS's, automated analytics, customization, or individualization of learning and developing the student as an avid consumer of digital information. While we realize there is no stopping the technological revolution, we educators must do all we can to preserve the primary mission of education, which is reflected in a humanistic approach that caters to the whole person wherein efforts are made to develop a free, independent, critical thinking, active, and effective thinker, doer, citizen, and worker. Educational innovations embrace both views, interacting and enriching each other for society's common good.

Globalization in education

Along with developing our own innovations and creating a broad base for implementation, it might be useful to look outside the box. As the world becomes more and more globalized, national education systems are shedding their uniqueness and gaining a more universal, homogeneous look (e.g. the Bologna process, which has brought 50 national higher education systems to a common denominator in Europe and beyond) (Bologna process, 2016). Scholars indicate there is "[…] the need for US universities to keep up with the rest of

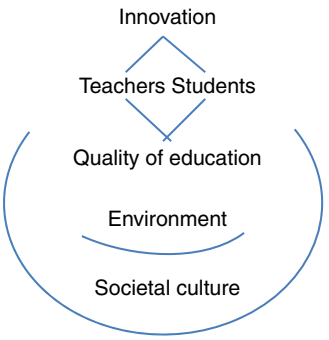

Figure 1.
Model of educational innovation

the world in today's highly competitive educational marketplace" (Wildavsky *et al.*, 2012, p. 1). It is also economically and culturally beneficial to learn from each other in the spirit of global cooperation and share one's achievements with others. While in the context of globalization it may be convenient to have a common education system across the world, however, to satisfy the needs and expectations of the nation-state it is necessary to continue innovating within one's own system. The rich international educational palette offers unique solutions to many issues facing US schools and universities.

What attractive innovative approaches exist in the world that could be applied to the US education system? To mention just a few, the Confucian culture of appreciating education in China, Japan, South Korea, and other South-East Asian nations which brings students' and parents' positive and respectful societal attitudes toward education and educators; cultural transformation in education and quality teacher preparation in Finland, Singapore, and Shanghai; organizational innovations in schools of Ontario, Canada. In Finland, a new ecosystem for learning was created (Niemi *et al.*, 2014). Singapore, for one, has become one of the top-scoring countries on the PISA tests by cultivating strong school leadership, committing to ongoing professional development, and exploring innovative models, like its tech-infused Future Schools (EDUTOPIA, 2012b). In Shanghai, China, every low-performing school is assigned a team of master teachers and administrators to provide weekly guidance and mentorship on everything from lesson plans to school culture (EDITOPIA, 2012a). The list of international innovations to cogitate is, fortunately, extensive. Is this what our educational innovators could do something about?

Daniel Willingham demonstrates a very interesting angle in international education that substantially differs from ours: "In China, Japan and other Eastern countries, intelligence is more often viewed as malleable. If students fail a test or don't understand a concept, it's not that they are stupid – they just haven't worked hard enough yet. This attribution is helpful to students because it tells them that intelligence is under their control. If they are performing poorly, they can do something about it […] Children do differ in intelligence, but intelligence can be changed through sustained hard work" (Willingham, 2010, p. 131).

There are numerous exciting foreign examples for the US educators to learn from and innovate, implementing and adapting them to US schools.

Many US educators certainly learn from advanced nations' educational experiences (Darling-Hammond, 2010; Stewart, 2012), but these innovations find a hard way into the school system. A right step in this direction is to integrate global education ideas into teacher preparation programs. A worthy case of opening up a wide world of global education to US teachers and developing outside-the-box thinking is a new specialization in the Master of Arts in Teaching program, "U.S. Education in Global Context" which has been offered at National University since 2014. The principal focus of this specialization is on advanced, innovative, and effective international approaches, ideas, and strategies in teaching and learning that address the needs of the nation and create contemporary school environments to accommodate diverse student populations. Specialization's goals and objectives are designed to help students develop the knowledge, competencies, skills, and dispositions required of a globally competent citizen and world-class educator. Focusing on the universal need for continuous improvement in teaching and learning, this specialization provides students with a balance of philosophy and theory, practice and application through collaborative research projects and field-based activities. The ultimate outcome of the four-course specialization is an innovative, practical implementation project to apply in the candidates' schools.

The Finns, Singaporeans, South Koreans, Hong Kongers, and citizens of other nations consider education the best way to improve their country's economy, and it has worked. An even more remarkable consequence has been a change to their national cultures.

This provides a worthy example for other nations, including ours. To sum up, we need to create favorable conditions for growing our own innovations, while taking advantage of the best international theories and practices.

Learning faster, learning better, and at a lower cost?

> You don't have the time, you make the time (Thorin Klosowski).

Among many points for educational innovations time definitely deserves close attention. Time is a significant factor in education. Attempts to save time on learning and raise its productivity are well known to each of us. To increase learning efficiency using so-called accelerated and intensive approaches is a promising path for innovation. These two approaches demonstrate the difference between evolutionary and revolutionary disruptive approaches.

Innovation, as we know, can be called to life by social, political, or professional factors but the strongest is definitely economic. A flat world (Friedman, 2005) means global competition, faster production cycles, and more to keep up with. Time is speeding up. Requirements for workers are rapidly mounting in industry and business due to swiftly changing technologies and fierce international competition. It is impractical to spend a third of one's active lifetime attending secondary school and college learning in advance what may not be useful on the job in the next 10 to 15 years because manufacturing, technology, and business will completely change.

Additionally, the cost of a college education is rising faster than inflation, though the outcomes are disproportionate to this rise: "[…] tuition has increased faster than inflation, without a comparable increase in the quality or results" (Brewer and Tierney, 2012, p. 13). If you ask students what worries them most, it is the cost of the next course and its value for their future job. Education has become more expensive and less affordable for many people. This also creates a heavy burden on the state's budget. Therefore, educators need to find ways to make education more time and cost efficient (Hjeltnes and Hansson, 2005).

We can identify two possible roads to take. The first is to increase revenue, and this is what the majority of colleges and universities are doing. Raising tuition, however, has its limits; government support is drying out. Cutting costs, on the other hand, may undermine some essential aspects of higher education. The second road is to increase learning productivity defined as the output (learning outcomes measured in certain units) per dollar or per time unit (academic year, semester, month, week, day, or hour). The former can be used to compute cost efficiency, while the latter will help to define time efficiency. Time efficiency and cost efficiency of education are evidently interrelated. The most obvious source of enhancing educational productivity is integration of ICT; however, there are other ways.

Time is the most precious of commodities, especially for WALs. Our own survey of National University students who take accelerated programs, which allow them to graduate sooner than in conventional programs, shows that time is paramount when selecting their learning program (Serdyukov *et al.*, 2003). When asked what is more important for them, the cost of the program or the time spent learning, 88 percent of surveyed WALs stated that time was more important, and they were willing to pay more for a shorter program of the same quality. So accelerated programs are often more competitive than the conventional extended ones. Serdyukov and Serdyukova (2012) posit that time efficiency of the learning process is a decisive factor in assessing a program or a course. In their opinion, colleges and universities, which are now evaluated based upon the quality of their education, will soon be selected and valued based on the time needed for the learning to take place.

In the same way, programs that cost less will be more competitive than those that cost more. With education budgets decreasing and numbers of learners taking part in education increasing, time and cost efficiency will play an increasing role in determining a program's, and thus an institution's, value.

When considering time investment, instructional activities are basically concerned with either learning more in the same time (i.e. growth in learning outcomes without increasing learning time) or learning the same amount of information in less time (decreasing learning time or compressing the course). As Serdyukov and Serdyukova (2006) write: "Can we, the educators, teach more effectively; can students learn more, better and in less time?" (p. 255). The answer to this question can have profound social, economic and personal significance as it may affect a learner's career and lifestyle, societal attitude toward education, the rate of investment in education, and eventually the nation's well-being (Barbera *et al.*, 2015).

Consideration of time investment in learning coupled with recent innovations in cognitive psychology and ET is what brought to life accelerated and intensive programs. Various approaches and methodologies for providing faster and shorter education without compromising academic quality have been described in the literature (Scott and Conrad, 1992; Rose and Nicholl, 1997; Bowling *et al.*, 2002; Serdyukov, 2008). They are grounded in the newest brain research in the cognitive and emotional potential of learners (Lozanov, 1978, 1988; Kitaigorodskaya, 1995), innovative approaches to teaching and learning that use nontraditional organizational forms, techniques and processes (Boyes *et al.*, 2004; Serdyukov *et al.*, 2003), ET applications, and even fancy programs of learning during sleep (Ostrander and Schroeder, 2000). The most popular approaches are accelerated learning (AL) programs, which use a compressed, short-term course format, and intensive learning (IL) programs, which employ specially organized course structure, visuals, music, and suggestive techniques to open up students' intellectual and sensitive capacities, thereby contributing to more effective learning.

Accelerated and intensive programs can significantly shorten the duration of the learning measured in class hours, days, weeks, or semesters. In some cases, they can also increase learning outcomes measured in the volume of knowledge constructed or skill sets learned in a given time. (Serdyukov, 2008).

A conventional semester model of college education may not suit a new generation of WALs who take school part-time and need to speed up learning to obtain employable competencies and skills. The AL model delivers a semester program in a shorter period of time than the conventional program model but with the comparable results. National University, for example, offers undergraduate and graduate-level programs using a nontraditional, accelerated 1×1 model of instruction (one month long, one course at a time) for adult learners (Serdyukov *et al.*, 2003). Onsite classes usually meet two evening sessions per week for four-and-a-half hour each; in some cases, there are two additional Saturday morning sessions of the same duration. Thus, each course runs for eight evenings with one Saturday morning final session for graduate programs (totaling 40.5 hours) or two Saturday sessions for undergraduate programs (totaling 45 hours). Similar models are used by such schools as Cornell College, Colorado College, DeVry University, Northeast University, Grand Canyon University, Tusculum University, and Colorado State University Global.

Online courses also run for four weeks but instead of face-to-face classroom sessions students participate in threaded discussions (one or two per week), view live videoconferencing sessions (one per week), carry out weekly written assignments, develop projects, and in some courses complete mandatory field activities (e.g. teacher preparation programs require school visits for observing and teaching lessons).

The sequential approach when students take one course after another allows for more accumulated and integrated learning experiences. Besides, according to the student survey (Serdyukov *et al.*, 2003), this 1×1 format helps to unshackle students' minds and focus their attention and energy on a single subject. It can also make it easier to adapt to the same teaching/learning style in this instructional model. The advantages

observed for the sequential model appear to occur because the more intense, consecutive instruction reduces the number of distractions in the students' lives, thus allowing for more focused attention and ultimately creating a more effective learning environment. Csikszentmihalyi's (1982) research suggests that "deep concentration," "immersion" in an activity, and "undivided intentionality" lead to increasingly rewarding "optimal experiences" which nourish and strengthen the self. He also comments that "optimal experience stands out against this background of humdrum everyday life by excluding the noise that interferes with it in normal existence" (p. 22). This becomes evident when we consider the working adult's hectic life and complicated everyday experiences. Scott and Conrad (1992) state that "concentrated study may cultivate skills and understandings which will remain untapped and undeveloped under the traditional system" (p. 417). Therefore, learning only one content area at a time has become one of the crucial factors of AL.

The intensive approach, a superior level of AL, has been used in many countries primarily for foreign language education, probably the most time-consuming didactic endeavor. One indicator of how efficiently a student has learned a foreign language is the number of words learned, retained, and correctly used in communication, both in oral and written speech (reading and writing). According to research (Longman Dictionary of Contemporary English, 2007), a person needs to know and be able to use two to three thousand words in a foreign language for basic communication. These so-called communicative skills can be assessed by the ability of the learner to accomplish a communication task in certain communicative situations. Duration of the study course at this level in a conventional institution can reach 200-300 hours. At a rate of two hours a week, the course duration may extend to 100 or more weeks (two years).

When an innovative, intensive instructional methodology, such as suggestopedia (Lozanov, 1978; Kitaigorodskaya, 1995; Rose and Nicholl, 1997), is used to teach a foreign language, the learning efficiency significantly rises, and the course duration with the same outcomes can be reduced by approximately 50 percent, as compared to a conventional college course. For instance, an initial intensive course can take up to 100 to 150 hours. The course is usually taught with higher frequency and longer lessons (usually four to five hours, two to three or more times a week). Thus, a complete course of study may be completed only in ten weeks (2.5 months). So time efficiency (*Et*) of an intensive foreign language course in the number of hours (*t*) is of the order of 2 (200 hours of a conventional course (*c*) divided by 100 hours of an intensive course (*i*)):

$$Et = \frac{tc}{ti};$$

Time efficiency of the same intensive course in the number of weeks is of the order of 10: duration of a conventional course (*dc*) (100 weeks) divided by the duration of an intensive course (*di*) (ten weeks):

$$Et = \frac{dc}{di}.$$

This is a case of disruptive, revolutionary innovation that produces a radical transformation in foreign language learning where learners achieve course goals and objectives in half the study hours and one-tenth of a typical course duration. This approach, which was extremely popular in Eastern Europe (Bulgaria, Soviet Union) in the 1980s and 1990s, was to a larger extent inspired by the rise of the Iron Curtain and prospective emigration to the west. Some variations or similar approaches emerged later in Germany, England, Japan, and the USA (Rose and Nicholl, 1997). Why it was not

recognized and did not spread throughout US schools and colleges may be partially due to a lack of need (English is spoken worldwide). In addition, it is labor intensive and demands high-level teacher qualifications (special preparation, dedication, excellent dispositions, inventiveness, and very hard work in the class). In addition, it must be taught in specially designed and equipped classrooms. Finally, it depends on students' elevated intrinsic motivation, work ethic, trust and respect for the teacher, and perseverance, though for a limited time.

Both accelerated and intensive short-term courses demand highly efficient planning, organization, and management of the instructional process. Furthermore, to ensure efficient course delivery, innovative methods and technologies are required for effective presentation, processing, skill development, and real-life applications. Many accomplishments in AL and IL methodologies, incidentally, can be used to teach other than foreign language programs.

We formulated ten major principles that create the foundation of IL:

- learner-centered approach;
- specific structure and organization of the course and its content for consistent, "whole" student experience;
- effective content presentation in various formats and modalities;
- immediate application of new knowledge in authentic situations in the class and real life, and gaining practical outcomes of the course;
- iterative process of knowledge construction and skill development (Serdyukov and Ryan, 2008);
- situated learning (Lave and Wenger, 1991) that uses real-life situations as the basis of learning activities and, especially, in developing professional competence;
- continuous active communication, collaboration, and cooperation among students in various small- and big-group activities;
- high level of intrinsic motivation developed and constantly supported through emotional involvement of each student in team work and learning process;
- instructor's suggestive, supportive, and efficient teaching style incorporating incessant involvement with the class; immediate, objective, and stimulating feedback; continuous student support;
- systemic use of ET in classroom and homework both for content acquisition and skill development, for communication and collaboration, and for maintaining students' high level of cognitive, physical, and emotional state;
- application of suggestive techniques, such as relaxation, ritual structure of classroom activities, positive environment, emotional involvement, and music; and
- combination of intensive work and total relaxation.

This approach is rooted in consistent, systemic application of all these principles.

The formula for IL is as follows: The more organized and efficient the instructional system, the more focused the student, the more effort is produced, the better the effect of learning, the faster the rate of learning, and the shorter the process duration (Serdyukov and Serdyukova, 2006). This is why all accelerated and intensive courses are always short (two weeks to 1-2 months long). If no significant effort is applied to learning, then there is no effect, no increase in productivity, and consequently, no opportunity to shorten the duration of the course.

So, accelerated programs that speed up learning by compressing the course duration, while requiring the same number of hours for the same learning outcomes, are an evolutionary innovation. Intensive programs that provide better outcomes in a considerably shorter time are a revolutionary innovation. We can state now that when an innovation ensures significantly better outcomes and saves on cost or time by at least an order of 2 (100 percent) or more, we can call it a revolutionary innovation.

Measuring time in learning can be instrumental for increasing its productivity. Learning to manage time productively is especially acute for independent learners and online students for whom effective time management is a well-known issue. Therefore, teachers need be taught to use time effectively. In teacher preparation programs, for instance, we recommend that teachers use time estimates when planning lessons (Serdyukov and Ryan, 2008; FEA, 2016). Thus, making learning more time and cost efficient offers a promising venue for further innovations.

Conclusion

US education desperately needs effective innovations of scale that can help produce high quality learning outcomes across the system and for all students. We can start by intensifying our integration of successful international learning models and creating conditions in our schools and colleges that foster and support innovators and educational entrepreneurs, or edupreneurs (Tait and Faulkner, 2016). Moreover, these transformations should be varied, yet systematic, targeting different vital aspects of education. Deep, multifaceted, and comprehensive innovations, both tangible and intangible, have the capacity to quickly generate scalable effects.

Radically improving the efficiency and quality of teaching and learning theory and practice, as well as the roles of the learner, teacher, parents, community, society, and society's culture should be the primary focus of these changes. Other promising approaches should seek to improve students' work ethic and attitudes toward learning, their development of various learning skills, as well as making learning more productive. We also have to bring all grades, from preschool to higher and postgraduate levels, into one cohesive system.

As the price of education, especially at colleges and universities, continues to rise, cost and time efficiency of learning, effective instructional approaches, and methods and tools capable of fulfilling the primary mission of education all will become critical areas of research and inventive solutions. Colleges and universities must concentrate on expanding the value of education, maximizing the productivity of learning, correlating investments with projected outcomes, and improving cost and time efficiency.

Whatever technologies we devise for education, however much technology we integrate into learning, the human element, particularly the learner and teacher, remains problematic. So, while taking advantage of effective educational technologies, we must situate those modern tools within a wider context of human education in order to preserve its humanistic, developmental purpose and, thus, make more effective use of them.

Computers for schools are ready, but are we ready? Our understanding of how students learn and how teachers teach and craft their methodology in technology-based environments remains lacking. Questions to ask are whether current methods help increase learning productivity, and as a result, time and cost efficiency. All technology applications require a solid theoretical foundation based on purposeful, systemic research and sound pedagogy to increase efficiency and decrease possible side issues. When integrating novel technologies in teaching and learning, we must first consider their potential applicability, anticipated costs and benefits, and then develop successful educational practices.

Therefore, the key to a prosperous, inventive society is a multidimensional approach to revitalizing the educational system (structures, tools, and stake holders) so that it breeds learners' autonomy, self-efficacy, critical thinking, creativity, and advances a common

culture that supports innovative education. In order to succeed, innovative education must become a collective matter for all society for which we must generate universal public responsibility. Otherwise, all our efforts to build an effective educational system will fail.

References

Aaron, S. (2007), "An insider's look at online learning", *Teaching Community*, available at: http://teaching.monster.com/education/articles/1599-an-insiders-look-at-online-learning?print=true (accessed September 3, 2016).

Abeyta, E. (2013), "Lifelong customers: the response to student consumerism", *The Evolllution*, available at: http://evolllution.com/opinions/lifelong-customers-response-student-consumerism/ (accessed September 10, 2016).

Accuosti, J. (2014), "Factors affecting education technology success", *ASEE 2014 Zone I Conference*, *April 3-5*, available at: www.asee.org/documents/zones/zone1/2014/ Student/PDFs/112.pdf

Afshar, V. (2016), "Disrupting higher education", a blog, *The Huffington Post*, August 5,available at: www.huffingtonpost.com/vala-afshar/disrupting-higher-educati_b_11341146.html?

Baer, L. and McCormick, J. (2012), "Building the capacity for change through innovation", in Hoffman, A. and Spangehl, S. (Eds), *Innovation in Higher Education: Igniting the Spark for Success*, American Council on Education, Rowman&Litttlefield Publishers Inc., Lanham, MD, pp. 165-181.

Barbera, E., Gros, B. and Kirschner, P. (2015), "Paradox of time in research on educational technology", *Time & Society 2015*, Vol. 24 No. 1, pp. 96-108, available at: http://tas.sagepub.com/ content/24/1/96.refs (accessed August 13, 2016).

Bok, D. (2007), *Our Underachieving Colleges*, Princeton University Press, Princeton, NJ, p. 6.

Bologna Process (2016), "European higher education area and Bologna process", available at: www.ehea.info/ (accessed May 28, 2016).

Bowling, N., Ries, K. and Ivanitskaya, L. (2002), "How effective are compressed courses?", *On Target*, Vol. 1 No. 3, pp. 3-7, available at: www.cel.cmich.edu/ontarget/aug02/ (accessed April 1, 2012).

Boyes, L., Reid, I., Brain, K. and Wilson, J. (2004), *Accelerated Learning: A Literature Survey*, Unit for Educational Research & Evaluation, University of Bradford, Bradford, available at: www.standards.dfes.gov.uk/giftedandtalented/downloads/word/accellearnreport.doc (accessed April 1, 2006).

Brewer, D. and Tierney, W. (2012), "Barriers to innovation in the US education", in Wildavsky, B., Kelly, A. and Carey, K. (Eds), *Reinventing Higher Education: The Promise of Innovation*, Harvard Education Press, Cambridge, MA, pp. 11-40.

Brunner, J. (1996), *The Culture of Education*, Harvard University Press, Cambridge, MA.

Brynjolfsson, E. (1993), "The productivity paradox of information technology: review and assessment", *Communications of the ACM*, Vol. 36 No. 12, pp. 67-77.

Business Dictionary (2016), "Definition of the term 'intangible asset'", available at: www.businessdictionary.com/definition/intangible-asset.html (accessed November 11, 2016).

Camins, A. (2015), "What's the purpose of education in the 21st century?", *Washington Post'* education blog, The Answer Sheet, February 12, available at: www.arthurcamins.com/?p=319 (accessed October 14, 2016).

Christensen, C. and Eyring, H. (2011), *The Innovative University: Changing the DNA of Higher Education from the Inside out*, Jossey-Bass, San Francisco, CA.

Christensen, C. and Overdorf, M. (2000), "Meeting the challenge of disruptive change", *Harvard Business Review*, Vol. 2 No. 78, pp. 47-76.

Cole, M., Shelley, D. and Swartz, L. (2014), "Online instruction, e-learning, and student satisfaction: a three year study", *The International Review of Research in Open and Distance Learning*, Vol. 13 No. 6, available at: www.irrodl.org/index.php/irrodl/article/view/1748/3123 (accessed July 22, 2016).

Cornali, F. (2012), "Effectiveness and efficiency of educational measures", *Evaluation Practices, Indicators and Rhetoric*, Vol. 2 No. 3, pp. 255-260, available at: www.SciRP.org/journal/sm

Creating Innovators (2012), "America's last competitive advantage", available at: http://creatinginnovators.com/ (accessed September 28, 2016).

Crichton, D. (2015), "Searching for the next wave of education innovation", *TechCrunch*, available at: https://techcrunch.com/2015/06/27/education-next-wave/ (accessed September 23, 2016).

Csikszentmihalyi, M. (1982), "Toward a psychology of optimal experiences", *Review of Personality and Social Psychology*, No. 3, pp. 13-36.

Csikszentmihalyi, M. (2013), *Creativity: The Psychology of Discovery and Invention*, Harperperennial, New York, NY.

Cuban, L. (2015), "Larry Cuban on school reform and classroom practice: the lack of evidence-based practice: the case of classroom technology", available at: https://larrycuban.wordpress.com/2015/02/05/the-lack-of-evidence-based-practice-the-case-of-classroom-technology-part-1/ (accessed August 29, 2016).

Darling-Hammond, L. (2010), *The Flat World and Education: How America's Commitment to Equity will Determine Our Future*, Teachers College Press, New York, NY.

De León, L. (2013), "Managing technological innovation and issues of licensing in higher education", in Ran, B. (Ed.), *The Dark Side of Technological Innovation*, Information Age Publishing, Charlotte, NC, pp. 347-371.

Diamond, J. (2005), *Collapse: How Societies Choose to Fail or Succeed*, Penguin Book, New York, NY.

EDITOPIA (2012a), "Shanghai", George Lucas Educational Foundation, available at: www.edutopia.org/education-everywhere-international-shanghai-china-video

EDUTOPIA (2012b), "Singapore", George Lucas Educational Foundation, available at: www.edutopia.org/education-everywhere-international-singapore-video

Ertmer, P. (1999), "Addressing first- and second-order barriers to change: strategies for technology integration", *Educational Technology Research and Development*, Vol. 47 No. 4, pp. 47-61, available at: http://link.springer.com/article/10.1007/BF02299597

Evans, R. and Leppmann, P. (1970), *Resistance to Innovation in Higher Education*, Jossey-Bass Publishers Inc., San Francisco, CA.

Extreme Learning (2012), available at: www.extreme-learning.org/ (accessed September 22, 2016).

FEA (2016), "Time-on-task: a strategy that accelerates learning", FEAWeb, available at: https://feaweb.org/time-on-task-a-teaching-strategy-that-accelerates-learning (accessed August 9, 2016).

Feeman, I. and Thomas, M. (2005), "Consumerism in education: a comparison between Canada and the United Kingdom", *International Journal of Educational Management*, Vol. 19 No. 2, pp. 153-177, available at: www.emeraldinsight.com/doi/abs/10.1108/09513540510582444

Friedman, T. (2005), *The World is Flat: A Brief History of the Twenty-First Century*, Farrar, Straus and Giroux, New York, NY.

Friedman, G. (2012), *The Next Decade: Empire and Republic in a Changing World*, Anchor Books, New York, NY.

Fullan, M. (2007), *Leading in a Culture of Change*, Jossey-Bass, San Francisco, CA.

Fullan, M. (2010), *All Systems Go: The Change Imperative for Whole System Reform*, Corwin, Newbury Park, CA.

Gibbons, S. and Silva, O. (2011), "School quality, child well-being and parents' satisfaction", *Economics of Education Review*, Vol. 30 No. 2, pp. 312-331.

Groom, J. and Lamb, B. (2014), "Reclaiming innovation", *EDUCAUSE Review*, Vol. 49 No. 3, available at: www.educause.edu/visuals/shared/er/extras/2014/ReclaimingInnovation/default.html

Hargreaves, A. (2003), *Teaching in the Knowledge Society: Education in the Age of Insecurity*, Teachers College Press, New York, NY.

Hargreaves, A. and Shirley, D. (2009), *The Fourth Way: The Inspiring Future of Educational Change*, Corwin, Thousand Oaks, CA.

Hargreaves, A., Lieberman, A., Fullan, M. and Hopkins, D. (Eds) (2010), *Second International Handbook of Educational Change*, Springer, New York, NY.

Heick, T. (2016), "12 Barriers to innovation in education", TeachThought. available at: www.teachthought.com/the-future-of-learning/disruption-innovation/12-barriers-innovation-education/ (accessed August 12, 2016).

Hjeltnes, T. and Hansson, B. (2005), "Cost effectiveness and cost efficiency in e-learning", The TISIP Foundation, Trondheim, available at: www2.tisip.no/quis/public_files/wp7-cost-effectiveness-efficiency.pdf (accessed September 29, 2016).

Hoffman, A. and Holzhuter, J. (2012), "The evolution of higher education: innovation as natural selection", in Hoffman, A. and Spangehl, S. (Eds), *Innovation in Higher Education: Igniting the Spark for Success*, American Council on Education, Rowman & Litttlefield Publishers Inc., Lanham, MD, pp. 3-15.

Huffington Post (2012), "College preparedness lacking, forcing students into developmental coursework, prompting some to drop out", *Huffington Post*, June 6, available at: www.huffingtonpost.com/ 20 12/06/18/students-lacking-college-_n_1606201.html (accessed May 1, 2015).

Jaschik, S. (2015), "Well-prepared in their own eyes", Inside Higher, available at: www.insidehighered.com/news/2015/01/20/study-finds-big-gaps-between-student-and-employer-perceptions (accessed August 25, 2016).

Jiang, L. (2015), "Why education innovation is the most important thing you could pursue", Getting Smart, available at: http://gettingsmart.com/2015/04/why-education-innovation-is-the-most-important-thing-you-could-pursue/ (accessed July 18, 2016).

Kerby, M., Branham, K. and Mallinger, G. (2014), "Consumer-based higher education: the uncaring of learning", *Journal of Higher Education Theory and Practice*, Vol. 14 No. 5, pp. 42-54, available at: www.na-businesspress.com/JHETP/KerbyMB_Web14_5_.pdf

Kitaigorodskaya, G. (1995), *Intensive Foreign Language Teaching: History, Current Status and Future Trends*, MGU, Moscow (in Russian).

Lave, J. and Wenger, E. (1991), *Situated Learning. Legitimate Peripheral Participation*, University of Cambridge Press, Cambridge.

Levasseur, A. (2012), "Does our current education system support innovation?", MindShift, July 17, available at: ww2.kqed.org/mindshift/2012/07/17/does-our-current-education-system-support-innovation/ (accessed September 21, 2016).

Longman Dictionary of Contemporary English (2007), *Longman Communication 3000*, Pearson Longman ELT, White Plains, NY.

Lozanov, G. (1978), *Suggestology and Outlines of Suggestopedy*, Gordon and Breach Science Pub, New York, NY.

Lozanov, G. (1988), *The Foreign Language Teacher's Suggestopedic Manual*, Routledge, London.

Marcus, J. (2012), "Old school: four-hundred years of resistance to change", in Wildavsky, B., Kelly, A. and Carey, K. (Eds), *Reinventing Higher Education: The Promise of Innovation*, Harvard Education Press, Cambridge, MA, pp. 41-72.

Massy, W. (2012), "Creative paths to boosting academic productivity", in Wildavsky, B., Kelly, A. and Carey, K. (Eds), *Reinventing Higher Education: The Promise of Innovation*, Harvard Education Press, Cambridge, MA, pp. 73-100.

Massy, W. and Zemsky, R. (1995), *Using Information Technology to Enhance Academic Productivity*, Educom, Washington, DC, available at: http://net.educause.edu/ir/ library/html/ nli0004.html (accessed September 24, 2016).

Matthew, M. (Ed.) (1964), *Innovation in Education*, Teachers College Press, New York, NY.

Maurer, H., Mehmood, R. and Korica-Pehserl, P. (2013), "How dangerous is the web for creative work?", *Journal of Computing and Information Technology*, Vol. 21 No. 2, pp. 59-69.

Mercurio, Z. (2016), "How college kills purpose", *The Huffington Post*, May 24, available at: www.huffingtonpost.com/zach-mercurio/how-college-kills-purpose_b_10013944.html

Meyer, A., Rose, D. and Gordon, D. (2014), *Universal Design of Learning: Theory and Practice*, CAST Professional Publishing, Wakefield, MA.

Morais, A., Neves, I. and Pires, D. (2004), "The what and the how of teaching and learning: going deeper into sociological analysis and intervention", in Muller, J., Davies, B. and Morais, A. (Eds), *Thinking with Bernstein, Working with Bernstein*, Routledge, London.

National Council of Teachers of English (2014), "How standardized tests shape – and limit – student learning: a policy research brief produced by the National Council of Teachers of English", available at: www.ncte.org/library/NCTEFiles/Resources/Journals/CC/0242-nov2014/CC0242PolicyStandardized.pdf (accessed September 9, 2016).

National Educational Technology Standards (2004), ISTE, available at: http://ced.ncsu.edu/techcomps/unets5.html (accessed March 12, 2013).

Ni, A. (2013), "Comparing the effectiveness of classroom and online learning: teaching research methods", *Journal of Public Affairs Education*, Vol. 1 No. 19, pp. 199-215.

Nickols, M. (2011), "Articulating e-pedagogy for education. Open learning for an open world", in Barrett, J. (Ed.), *Reflections on Open and Distance Learning and Teaching at the Open Polytechnic of New Zealand*, Lower Hutt, pp. 321-336.

Niemi, H., Multisilta, J., Lipponen, L. and Vivitsou, M. (Eds) (2014), *Finnish Innovations and Technologies in Schools: A Guide Towards New Ecosystems of Learning*, Sense Publishers, University of Helsinki, Rotterdam, available at: www.cicero.fi/files/Cicero/site/2121-finnish-innovations-and-technologies-in-schools_ToC.pdf (accessed October 2, 2016).

Ng, I. and Forbes, J. (2009), "Education as service: the understanding of university experience through service logic", *Journal of Marketing for Higher Education*, Vol. 19 No. 1, pp. 38-64.

OECD (2014), *Measuring Innovation in Education: A New Perspective*, OECD Publishing, Paris, available at: http://dx.doi.org/10.1787/9789264215696-en (accessed August 30, 2016).

Office of Innovation and Improvement (2016), "US Department of Education", available at: http://innovation.ed.gov/ (accessed September 1, 2016).

Okpara, F. (2007), "The value of creativity and innovation in entrepreneurship", *Journal of Asia Entrepreneurship and Sustainability*, Vol. III No. 2, pp. 2-14, available at: www.asiaentrepreneurshipjournal.com/ajesiii2okpara.pdf

Osolind, K. (2012), "Revolutionary vs evolutionary innovation", Reinvention Consulting, available at: www.reinventioninc.com/revolutionvsevolution (accessed October 16, 2016).

Ostrander, S. and Schroeder, L. (2000), *Superlearning: New Triple Fast Ways You Can Learn, Earn, and Succeed in the 21st Century*, Delacorte Press, New York, NY.

Pappert, S. (1990), "A Critique of technocentrism in thinking about the school of the future", available at: www.papert.org/articles/ACritiqueofTechnocentrism.html (accessed December 25, 2015).

Pew Research Center (2015), "US students improving – slowly – in math and science, but still lagging internationally", Pew Research Center, February 2, available at: www.pewresearch.org/fact-tank/2015/02/02/u-s-students-improving-slowly-in-math-and-science-but-still-lagging-internationally/ (accessed July 27, 2016).

Polka, W. and Kardash, J. (2013), "Managing in the effective change zone to implement a '1-to-1' laptop program in a rural school district", in Ran, B. (Ed.), *The Dark Side of Technological Innovation*, Information Age Publishing, Charlotte, NC, pp. 323-346.

Postman, N. (1993), *Technopoly: The Surrender of Culture to Technology*, Vintage Books, New York, NY.

Robinson, K. (2015), *Creative Schools: The Grassroots Revolution that's Transforming Education*, Viking Press, New York, NY.

Rose, C. and Nicholl, M.J. (1997), *Accelerated Learning for the 21st Century. The Six-step Plan to Unlock Your Master-Mind*, Dell Publishing, New York, NY.

Rubin, C. (2015), "The global search for education: United States and Finland – why are they so great?", *The Huffington Post*, February 6, available at: www.huffingtonpost.com/c-m-rubin/the-global-search-for-edu_b_6992056.html (accessed July 19, 2016).

Rushkoff, D. (2010), *Program or be Programmed. Ten Commands for a Digital Age*, OR Books, New York, NY.

Sahlberg, P. (2010), "Educational change in Finland", in Hargreaves, A., Lieberman, A., Fullan, M. and Hopkins, D. (Eds), *Second International Handbook of Educational Change*, Springer, New York, NY, pp. 323-348.

Sahlberg, P. (2011), *Finnish Lessons: What Can the World Learn from Educational Change in Finland*, Teachers College, Columbia University, New York, NY.

Schuwer, B. and Kusters, B. (2014), "Mass customization of education by an institution of HE: what can we learn from industry?", *The International Review of Research in Open and Distributed Learning*, Vol. 12 No. 2.

Science Watch (2009), "Top 20 countries in all fields", Science Watch, Clarivate Analytics, Philadelphia, PA, available at: http://archive.sciencewatch.com/dr/cou/2009/09decALL/ (accessed August 6, 2016).

Scott, P. and Conrad, C. (1992), "A critique of intensive courses and an agenda for research", *Higher Education: Handbook of Theory and Research*, Agathon Press, New York, NY, pp. 411-459.

Serdiukov, P. (2001), "Models of distance higher education: fully automated or partially human?", *Educational Technology Review. International Journal on Educational Technology Issues & Applications*, Vol. 9 No. 1, pp. 15-25.

Serdyukov, P. (2008), "Accelerated learning: what is it?", *Journal of Research in Innovative Teaching*, Vol. 1 No. 1, pp. 36-59.

Serdyukov, P. (2015a), "Does online education need a special pedagogy?", *Journal of Computing and Information Technology*, Vol. 23 No. 1, pp. 61-74, available at: http://cit.srce.unizg.hr/index.php/CIT/ article/ view/2511

Serdyukov, P. (2015b), "Paradox of teacher and student in online education and societal culture", *Proceedings of Global Learn 2015. Association for the Advancement of Computing in Education (AACE)*, pp. 713-723.

Serdyukov, P. and Ryan, M. (2008), *Writing Effective Lesson Plans: The 5-Star Approach*, Allyn&Bacon, Boston, MA.

Serdyukov, P. and Serdyukova, N. (2006), "Innovative approaches in technology-based education: Accelerated and intensive learning", *Proceedings of the Ninth IASTED International Conference on Computers and Advanced Technology in Education, CATE 2006*, *Lima*, *October 4-6*, pp. 45-50.

Serdyukov, P. and Serdyukova, N. (2012), "Time as factor of success in online learning", *Journal of Information Technology and Application in Education*, Vol. 1 No. 2, pp. 40-46, available at: www.jitae.org/paperInfo.aspx?ID=1203

Serdyukov, P., Subbotin, I. and Serdyukova, N. (2003), "Accessible, convenient and efficient education for working adults in a shorter time: is it possible?", *CAEL Forum and News*, Vol. 26 No. 3, pp. 24-28.

Sharratt, L. and Harild, G. (2015), *Good to Great to Innovate: Recalculating the Route to Career Readiness, K-12+*, Corwin, Thousand Oaks, CA.

Shelton, J. (2011), "Education innovation: what it is and why we need more of it", *Education Week*, Sputnik post, September 28, available at: http://blogs.edweek.org/edweek/sputnik/2011/09/education_innovation_what_it_is_and_why_we_need_more_of_it.html (accessed September 16, 2016).

Song, L.S., Singleton, E., Hill, J. and Koh, M. (2004), "Improving online learning: student perceptions of useful and challenging characteristics", *Internet and Higher Education*, pp. 59-70.

Sousa, D. (2014), *How the Brain Learns Mathematics*, Korwin, Thousand Oaks, CA.

Spalding, E. (2012), *Claire Fox: Is Consumerism Bad for Education?* Liberty World Press, available at: http://libertyuom.wordpress.com/2012/04/30/claire-fox-is-consumerism-bad-for-education/ (accessed September 12, 2016).

Spangehl, S. and Hoffman, A. (2012), "Perspectives on innovation", in Hoffman, A. and Spangehl, S. (Eds), *Innovation in Higher Education: Igniting the Spark for Success*, American Council on Education, Rowman & Litttlefield Publishers Inc., Lanham, MD, pp. 17-26.

Stewart, V. (2012), *A World-Class Education: Learning from International Models of Excellence and Innovation*, ASCD, Alexandria, VA.

Stokes, P. (2012), "What online learning can teach us about higher education?", in Wildavsky, B., Kelly, A. and Carey, K. (Eds), *Reinventing Higher Education: The Promise of Innovation*, Harvard Education Press, Cambridge, MA, pp. 197-224.

Strauss, V. (2014), "Five US innovations that helped Finland's schools improve but that American reformers now ignore", *The Washington Post*, July 25, available at: www.washingtonpost.com/news/answer-sheet/wp/2014/07/25/five-u-s-innovations-that-helped-finlands-schools-improve-but-that-american-reformers-now-ignore/?utm_term=.cec08c870e6b (accessed October 4, 2016).

Tait, A. and Faulkner, D. (2016), *Edupreneur: Unleashing Teacher Led Innovation in Schools*, Wiley, Hoboken, NJ.

The National Center for Fair and Open Testing (2012), "How standardized testing damages education", Fair test, The National Center for Fair and Open Testing, Jamaica Plain, MA, available at: http://fairtest.org/how-standardized-testing-damages-education-pdf (accessed August 20, 2016).

Thomson, J. (2015), "Poor grades", *Inside Higher Ed*, July 9, available at: www.insidehighered.com/news/2015/06/09/national-poll-finds-overall-dissatisfaction-college-selection-process-while-parents (accessed August 20, 2016).

UNESCO (2013), "ITL – Innovative teaching and learning research: a global look at pedagogies for 21st century skills", ICT in Education, UNESCO, Bangkok, available at: www.unescobkk.org/ education/ict/online-resources/databases/ict-in-education-database/item/article/innovative-teaching-and-learning-itl-research-a-global-look-at-pedagogies-for-21st-century-skills/ (accessed August 18, 2016).

US Department of Education (2004), "What do we mean by 'innovation'?", US Department of Education, available at: www2.ed.gov/about/offices/list/oii/about/definition.html

Vieluf, S., Kaplan, D., Klieme, E. and Bayer, S. (2012), *Teaching Practices and Pedagogical Innovation: Evidence from TALIS*, OECD Publishing, Paris, available at: www.oecd.org/edu/school/TalisCeri%202012%20(tppi)–Ebook.pdf

Wagner, T. (2012), *Creating Innovators: The Making of Young People who Will Change the World*, Scribner, New York, NY.

Westra, K. (2016), "Faculty and student perceptions of effective online learning environments", Paper No. 596, all theses, dissertations, and other capstone projects, Minnesota State University, Mankato, MN, available at: http://cornerstone.lib.mnsu.edu/cgi/viewcontent.cgi?article=1595&context=etds (accessed August 25, 2016).

Wildavsky, B., Kelly, A. and Carey, K. (Eds) (2012), *Reinventing Higher Education: The Promise of Innovation*, Harvard Education Press, Cambridge, MA.

Willingham, D. (2010), "Why don't students like school?", *A Cognitive Scientist Answers Questions about How the Mind Works and What it Means for Your Classroom*, Jossey-Bass, San Francisco, CA.

Wrenn, V. (2016), "Effects of traditional and online instructional models on student achievement outcomes", Paper No. 1135, doctoral dissertations and projects, Liberty University, Lynchburg, VA, available at: http://digitalcommons.liberty.edu/doctoral/1135 (accessed August 22, 2016).

Yu, D. and Hang, C.C. (2010), "A reflective review of disruptive innovation theory", *International Journal of Management Reviews*, Vol. 12 No. 4, pp. 435-452, available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1468-2370.2009.00272.x/full

Zeihan, P. (2014), *The Accidental Superpower: The Next Generation of American Preeminence and the Coming Global Disorder*, Twelve Hachette Book Group, New York, NY.

Zhao, Y. (2012), *World Class Learners: Educating Creative and Entrepreneurial Students*, Corwin, Thousand Oaks, CA.

Zhao, Y. and Frank, K. (2003), "Factors affecting technology uses in schools: an ecological perspective", available at: https://msu.edu/~kenfrank/papers/Factors%20affecting%20technology%20uses%20in%20schools.pdf (accessed July 21, 2016).

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