The Routledge International Handbook of Innovation Education

Larisa V. Shavinina

The fundamentals of innovation education

Publication details
Larisa V. Shavinina
Published online on: 25 Mar 2013

How to cite :- Larisa V. Shavinina. 25 Mar 2013, The fundamentals of innovation education from: The Routledge International Handbook of Innovation Education Routledge
Accessed on: 16 Jul 2019

PLEASE SCROLL DOWN FOR DOCUMENT

Full terms and conditions of use: https://www.routledgehandbooks.com/legal-notices/terms

This Document PDF may be used for research, teaching and private study purposes. Any substantial or systematic reproductions, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The publisher shall not be liable for an loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.
Summary: If we want to develop innovative abilities of children and adolescents, then a special, new direction in education is needed: innovation education. This chapter describes the fundamentals of innovation education, which refers to a wide range of educational interventions aimed at identifying, developing, and transforming child talent into adult innovation. These are those societal actions aimed at preparing children and adolescents to become adult innovators. Such educational interventions should include, but should not be limited to, the eleven interrelated elements. The chapter discusses each of them.

Key words: Innovation, innovation education, innovation science, innovation gap, individual differences principle of innovation, courage, deadline management.

Introduction

In contrast to the universal readiness to develop innovators pointed out in the Preface (Shavinina, this volume), researchers occasionally study how to develop innovators. From many chapters included in the best-selling International Handbook on Innovation (Shavinina, 2003a), only few of them discussed the development of innovators in science (Root-Bernstein, 2003; Root-Bernstein & Root-Bernstein, 2003; Shavinina, 2003b; Weisberg, 2003) or the development of innovative abilities via the stimulation of creativity (Clapham, 2003; Reis & Renzulli, 2003; Shavinina & Ponomarev, 2003). How to specifically develop innovators in science, technology, engineering, and mathematics is a relatively new direction in the interdisciplinary science of innovation.

The US government, who realized a need to develop innovators in science, technology, engineering, and math (STEM) disciplines, is behind a recent push for more research in this area. The National Science Board led the efforts of the US administration in this direction (NSF, 2009). Specifically, in August 2009 the Board invited a group of experts in the areas of giftedness, creativity, cognitive psychology, and science education for a panel discussion on how to develop the next generation of innovators in STEM disciplines (NSF, 2009). This event—with a subsequent report to Congress and President Obama—demonstrates that the US government is indeed interested in developing innovators.

For the most part, experts invited for a hearing in August 2009 emphasized policy issues related to the development of innovators (Subotnik et al., 2009), findings from high ability studies (Lubinski & Benbow, 2006; VanTassel-Baska & MacFarlane, 2009), and a need to radically change the existing...
practice of the development of scientists in sciences, engineering, and mathematics (Root-Bernstein, 2008). Shavinina (2009g) underlined the need to better study the high achievers in STEM disciplines (e.g., Nobel Prize winners in science and great inventors), whose innovation achievements are undeniable, as well as a need to focus on innovation education for everyone. Experts agree that the existing research base is rather thin (Benbow, 2009), that a comprehensive research plan is necessary, and that there is need for basic research in this area (Marett & Johnson, 2009).

If we want to actualize the innovative potential of today’s children and develop their unique innovative talents, then we have to concentrate on innovation education. It is necessary to point out that innovation education is not about innovations in teaching mathematics, physics, biology, chemistry, and other disciplines. These are the so-called domain-specific innovations in each particular area of human endeavor (Shavinina, 2003a). They also help develop innovators. However, this is not what innovation education is all about. Innovation education refers to a wide range of educational interventions aimed at developing and transforming child talent into adult innovation. It means those societal actions aimed at helping children to become adult innovators. These educational interventions should include, but should not be limited to, the following eleven elements:

1. The programs for gifted and talented children existing in the area of gifted education, which seem to be effective, and may be useful for many other categories of learners (e.g., the Renzulli Enrichment Program, the Future Problem Solving, Creative Problem Solving, the Center for Talented Youth programs, the Belin-Blank International Center for Gifted Education and Talent Development programs, and other programs, just to mention a few: Brody, 2009; Cramond, 2009; Cramond et al., this volume; Jones et al., this volume; Lyons & Reis, this volume; Renzulli & Reis, 2009; VanTassel-Baska & MacFarlane, 2009; Wallace, this volume).
2. The best programs from science and technology education.
3. New programs aimed at the development of entrepreneurial giftedness that is closely related to innovation.
4. Programs for the development of children’s metacognitive abilities. It means that special emphasis should be made on fostering their abilities to implement things: the so-called executive abilities. It is important for innovators, because innovation is about the implementation of ideas into practice.
5. New programs, which should be based on recent progress in the study of scientific talent of Nobel laureates.
6. Programs that would incorporate the essentials of research on polymaths.
7. New programs for the development of applied wisdom and moral responsibility.
8. Programs aimed at the development of managerial talent.
9. The basics of deadline management.
10. The foundations of innovation science: a general “know-what” and “know-how” about innovation, including the psychological basis of innovation, innovation gap, the individual differences principle of innovation, innovation management, just to mention a few.
11. Courage-related issues. For innovators to succeed, the courage is compulsory. It is sad that no one teaches today’s children and adolescents to be courageous in pursuing their unique interests and implementing their novel ideas into practice in the form of new products, processes, or services.

The structure of innovation education can, therefore, be presented as eleven overlapping elements; each of them is described below.
The structure of innovation education

Gifted education programs
Successful programs for gifted and talented children are well described in the literature (Colangelo & Davis, 2003; Heller, Monks, Sternberg, & Subotnik, 2000; Shavinina, 2009a). They will not be, therefore, discussed in detail here. Nevertheless, it is important to emphasize that although gifted education programs are included as the first element in the structure of innovation education, they are not sufficient for developing innovators. It would be a huge mistake to suppose that gifted education itself will “produce” innovators. There are at least two reasons for this.

First, by definition, innovation is the implementation of ideas into practice in the form of new products, processes, and services. This is not about the generation of novel, original, and appropriate ideas, that is, creativity. People—and especially the gifted—are far better in generating new ideas than in their implementation into practice. The implementation of new ideas into practice requires many talents (e.g., an ability to meet deadlines), which are not normally taught in gifted education programs. Therefore, if we indeed want to develop innovators, then innovation education should incorporate such elements, which may help the gifted to cultivate talents necessary for becoming innovators (e.g., to foster their practical intuition and applied wisdom).

It should be pointed out that innovation education is not intended to replace gifted education. At the same time successful development of all talents of the gifted will eventually put them at the cutting edge in their areas of endeavors and, consequently, chances are pretty high that they will innovate. Similarly, if the ultimate goal of gifted education is to produce innovators, and the majority of students do not become innovators, then it probably means that programs are not quite successful.

Second, research on gifted entrepreneurs–innovators demonstrates that many of them could not be considered the gifted in accordance with the prevailing definitions of giftedness and practice of gifted education (Shavinina, 2008, 2009a). Entrepreneurial giftedness is a special type of high ability that significantly deviates from existing types of giftedness. The study of entrepreneurial giftedness is a relatively recent enterprise (Shavinina, 2006). This line of research shows that innovators do not necessarily come from the population of gifted children, are viewed as the gifted, and are enrolled in the existing gifted education programs (see also Chapter 16 of this volume, The trajectory of early development of prominent innovators: entrepreneurial giftedness in childhood). Based on this, one cannot, consequently, expect that 100% of future innovators will come from the population of today’s gifted and talented children. In order to increase the chance of the gifted becoming innovators, innovation education should thus include other elements, which will be presented and discussed below.

Science and technology education

Today innovation is often associated with scientific discoveries and technological inventions implemented into practice. Tomorrow’s innovators should be aware of scientific and technological breakthroughs, as well as to develop an advanced scientific thinking and a technological state of mind. As this element of innovation education is well presented in the chapters included in Parts VII, VIII, and IX in the handbook, it will not be considered here.

Entrepreneurial giftedness

The most important element of innovation education should be related to entrepreneurial giftedness. This is because entrepreneurs put ideas into practice via the creation of new ventures, which, in turn, create employment and—in successful cases—lead to economic prosperity. The
essence of entrepreneurship thus greatly, but not entirely, coincides with the nature of innovation. Innovation is about the implementation of ideas into practice in the form of new products, processes, and services, whereas entrepreneurship, per se, may or may not be about new ideas. At the same time, keen entrepreneurs are necessary to carry innovations forward to market. This is why the research findings regarding entrepreneurial giftedness must be the cornerstone of innovation education.

Based on the existing research, the following facets of entrepreneurial giftedness should be incorporated in innovation education:

**Early manifestations of entrepreneurial giftedness.** From early childhood, gifted entrepreneurs demonstrated two types of characteristics—specific and general ones—which helped them to succeed in business (Shavinina, 2008). Specific characteristics refer to those abilities, skills, or personality traits that are directly related to entrepreneurial giftedness. For instance, the creation of ventures with money-making potential belongs to the specific manifestations of entrepreneurial giftedness. General manifestations refer to those abilities, skills, or personality traits that can also be useful in other types of giftedness and are not exclusively associated with entrepreneurial giftedness. For example, competitiveness as a personality trait is helpful in business and sports alike. The following interrelated yet different specific manifestations of entrepreneurial giftedness were identified:

- **Constantly generate ideas on how to make money** (i.e., creative abilities conducive to entrepreneurial giftedness).
- **Love to generate and implement real-life projects with at least a minimal financial reward.** This is the key characteristic of entrepreneurial giftedness that incorporates both creative and innovative abilities of entrepreneurs. This is because innovation is essentially about the implementation of creative ideas into practice in the form of new products, processes, or services.
- **Love doing real business plans with predicted financial outcomes.**
- **Work passionately and hard on executing their plans.** Young gifted entrepreneurs do everything necessary for their projects to succeed (e.g., they are able to convince other people to participate in the implementation of their ventures).
- **Wish to do “real” things that bring money and try to do whatever possible to cut unnecessary steps.** It is one of the manifestations of practical intelligence in young gifted entrepreneurs. Examples are abundant and they are discussed in Shavinina (2008).

The general manifestations of entrepreneurial giftedness include the following interrelated characteristics.

- **Perseverance to succeed:** if I put my mind to something, I can do almost everything. The best manifestation of gifted entrepreneurs’ persistence is the fact that they do not give up after the first failed project(s). Failures do not stop them.
- **Optimism and “change the world” attitude.** Gifted entrepreneurs from early years believe in themselves and their ability to change the world by succeeding with their projects. They have a positive vision of the future and of every venture they initiate. Optimism helps gifted entrepreneurs succeed. This supports scientific findings demonstrating that optimists always outperform pessimists (Carver & Scheier, 2003).
- **Early exposure to challenges.** It is amazing how gifted entrepreneurs liked challenges from their early years, had a lot of exposure to them, and, as a result, the love of challenges became one of the distinguishing characteristics of talented entrepreneurs.
The fundamentals of innovation

- Competitiveness, excellence, and perfection. As a consequence of the early exposure to challenges or an intensive involvement in sport activities, young gifted entrepreneurs possess competitive personalities. When they compete, they always try to be the best and win.

- Neglect of academic subjects. Probably because gifted entrepreneurs live in their own world of “real practical” projects (often with money-making potential), school subjects do not make much sense to them. Many do not do well at school and simply ignore academic subjects (e.g., Richard Branson). This is also because teachers often do not show the practical applications of those subjects; they just ask children to memorize a great deal of knowledge. This directly contradicts the essence of the practical mind of gifted entrepreneurs who are eager to do “real” things in real life; not in the classroom for their teachers. However, with respect to this characteristic, there are some exceptions. Bill Gates is one of them. For instance, he was doing well in the elementary school. Nevertheless, it is not clear whether Bill’s success in academic subjects was determined by his intellectual abilities or by his extraordinary competitiveness. Jeff Bezos, who was enrolled in a gifted education program, is another exception.

- Independence in thoughts and actions. From early years gifted entrepreneurs are very independent in their thoughts and actions: authorities do not exist for them. For example, Mary Gates, in describing her son, Bill, has said that “he has pretty much done what he wanted since the age of eight” (Wallace & Erickson, 1992, p. 11).

- Rule-breaking attitude. As a result of their extreme independence, a rule-breaking attitude is another distinguishing characteristic of gifted entrepreneurs. This is why talented entrepreneurs are innovators: they are able to break all the existing rules of the game and introduce something new. This is how and why great innovations happen.

Therefore, this element of innovation education should convey a valuable knowledge about specific and general signs of entrepreneurial giftedness. It is interesting to point out that these signs manifested in childhood became strong characteristics of talented entrepreneurs in their adulthood (Shavinina, 2006).

Creative abilities of great entrepreneurs. Gifted entrepreneurs developed their own, highly individual methods and techniques for producing new, original, and appropriate ideas (Shavinina, 2009d). It is interesting to note that traditional creativity training does not contain anything similar. Creativity techniques and methods of great entrepreneurs will help to enhance abilities of tomorrow’s innovators. For instance, I translated some of those methods into a series of practical techniques for my workshops on creativity for teachers and managers alike.

Furthermore, gifted entrepreneurs are polymaths (this concept will also be discussed below), that is, multi-talented individuals, because they are able to both generate ideas with money-making potential and to implement them into practice. It is a rare ability. This unique ability of talented entrepreneurs has allowed me to talk about the phenomenon of individual innovation. Usually, innovation is a “team sport” in that it involves many individuals to implement ideas into practice. The case of individual innovators is a complete exception from this rule: they are able to put into action all the ingredients necessary for the implementation of their ideas (for a detailed account of this phenomenon see Chapter 36, What can innovation education learn from innovators with longstanding records of breakthrough innovations? included in this volume).

Metacognitive or executive abilities of gifted entrepreneurs. Innovation is essentially about the implementation of ideas into practice in the form of new products, processes, or services. Lessons from famous entrepreneurs on how they do it successfully and what helps them will be of immense
importance to today’s children. Translated into a set of special exercises, these “know-what” and “know-how” facets of the executive abilities of talented entrepreneurs will be an important part in developing innovative abilities. From early childhood gifted entrepreneurs tried to implement their ideas into practice. For instance, when Richard Branson was twelve years old, he decided to grow Christmas trees. Today’s children should use every opportunity to implement their ideas into practice and parents and teachers should support them in their endeavors. For example, if a child wants to write a book, parents and/or teachers should help him in this endeavor and a real book should be eventually produced.

Motivation of gifted entrepreneurs. Many gifted entrepreneurs founded new companies not because they wanted to make money. They started businesses for variety of reasons, which were not related to financial rewards (Shavinina, 2009e). For instance, creativity has always been behind the entrepreneurial motivation of Richard Branson. Thus, he wrote in his autobiography that “I have never gone into any business purely to make money. . . . A business has to exercise your creative instincts” (Branson, 2002, p. 57). In the case of Michael Dell it is excellence that is in the heart of his entrepreneurial motivation. When 18-year-old Michael almost left university and his father asked him what he was planning to do with his life, he replied: “I want to compete with IBM!” (Dell, 1999, p. 10). High abilities—for example, creativity or excellence—and achievement related issues are behind great entrepreneurs’ wish to create new ventures. Children and adolescents should know that money was not the driving force for many renowned entrepreneurs.

Unique vision: unusual type of representations. Unique point of view or unique type of representations is the very essence of giftedness (Shavinina, 2009c). This is the basis of entrepreneurial giftedness as well. Talented entrepreneurs see, understand, and interpret everything in an unusual way. Thus, not many eighteen-year-olds could say with all the certitude that they “want to compete with IBM” and consider it as the goal of their life. Cases of the unique vision of great entrepreneurs and how many important business decisions were made based on their unusual points of view will contribute to the development of innovative abilities of today’s children. Independently of high ability studies, leadership researchers5 have also found that vision is a critical aspect of great leaders (for a more detailed account on a unique vision see Chapter 12, Do not overlook innovators!: discussing the “silent” issues of the assessment of innovative abilities in today’s children–tomorrow’s innovators included in this volume).

Specific extracognitive abilities: practical intuition. Gifted entrepreneurs are characterized by specific feelings, intentions and beliefs, preferences and values, as well as intuition (their definition will be presented below). Examples of these abilities (which can be found in Shavinina, 2009d) and the demonstration of their exceptional role in entrepreneurial giftedness along with exercises designed to develop them in children should be an essential part of innovation education. It is fascinating how many important business decisions in all areas of human endeavor were made based on intuition (Branson, 2002; Morita, 1987). This is especially appropriate for women-entrepreneurs who have more developed intuition in comparison with men (Kay Ash, 1996; Roddick, 2000).

Micro-social factors stimulating or inhibiting the development of entrepreneurial giftedness. Tomorrow’s innovators should also be aware of the macro- and micro-social factors, which can facilitate or hinder the development of their entrepreneurial giftedness. There is a difference between micro-social and macro-social factors. The micro-social factors refer to the influence of
such social institutions as family, school, university, and proximal social surrounding (e.g., childhood friends). The macro-social factors refer to those societal, cultural, and historical contexts in which individuals live (i.e., the contemporary Zeitgeist). Definitely, macro-social factors often operate through micro-social factors. Examples from the lives of gifted entrepreneurs are necessary for innovation education. Specifically, the information about the role of nuclear and extended family, significant others, and great contemporaries, as well as knowledge of how gifted entrepreneurs were able to turn negative micro-social influences into the beneficial ones are of great importance to today’s children and adolescents (Shavinina, 2006).

To sum up this section, entrepreneurial giftedness should be a major element in the structure of innovation education. Any child will benefit from this, regardless of his or her actual abilities. It will also help us to identify many potentially talented young entrepreneurs and businessmen. At the moment entrepreneurial giftedness is a type of high ability that is not measured in any way. When talented children are selected for gifted education programs, the entrepreneurially gifted are usually overlooked and, therefore, lost.

Metacognition in action: ability to implement things

The development of children and adolescents’ abilities to implement things—or their executive abilities—is an important element of innovation education, because innovation is mainly about the implementation of new ideas into practice. This is a unique ability and not everyone is capable of it.

A few years ago one management book became a bestseller on Amazon.com. Why? Because its authors demonstrated that many executives never execute. This is why the issue of the innovation gap is an important one. The concept of the innovation gap means that people have a lot of creative ideas, but they are not able to implement them due to various reasons. There are many barriers to innovation (Shavinina, 2007). Although a majority of people believe that innovation is a good thing, researchers found that obstacles are the norm, rather than the exception, on the way to innovation (Hadjimanolis, 2003). There exist human-related, technology-related, and policy-related barriers to innovation, just to mention the main, broad groups of barriers. A wide range of these obstacles make it difficult for potential innovators to implement their creative ideas into practice. Consequently, the topic of the innovation gap should be kept in mind when we are discussing the executive abilities of today’s children. This also explains in part why innovation is still a relatively rare thing and why innovators’ executive abilities—that is, individuals’ abilities to both generate and implement great ideas—are unique ones and should be highly appreciated. Every effort should thus be made to develop them in today’s children. And this is not an easy task.

Human abilities to implement things—or our executive abilities—are in fact our metacognitive abilities. Metacognition refers to one’s own knowledge about one’s own cognitive abilities, as well as guiding, monitoring, and executing of one’s own mental processes (Brown, 1978, 1987; Flavell, 1976, 1979; Kholodnaya, 1997). Ann Brown (1994) and other researchers (Brown & Palincsar, 1989) working in the area of metacognition designed special educational programs aiming to develop children’s metacognitive abilities. Innovation education can benefit from those programs by incorporating its best practices (Barfurth, Ritchie, Irving, & Shore, 2009).

Scientific talent: lessons learned from Nobel laureates

Tomorrow’s innovators should learn interesting lessons from Nobel laureates in science. Scientific discoveries made by Nobel laureates are scientific innovations. The nature of innovation is cross-disciplinary, that is, in any field of human endeavor innovation begins from great ideas. If we are
concerned with the development of children’s scientific talents, then we should study the Nobel Prize winners and their high abilities in detail (Shavinina, 2003b, 2004). Why? This is because winning a Nobel Prize represents the pinnacle of accomplishment possible in one’s field of expertise. This prize in science is associated with a rare, high degree of intellectually creative achievement that testifies to innovative minds of its recipients.

Today we know that during their early years, Nobel laureates in science encompassed a wide range of human abilities including the gifted (e.g., Marie Curie or Gertrude B. Elion), the gifted underachievers (e.g., Albert Einstein), and children without any special talents (e.g., Barbara McClintock). It is amazing that these different profiles of abilities—that manifested themselves in clearly divergent trajectories of talent development—eventually led to the same outcome: great scientific discoveries, which means that those who made them possessed exceptional intellectually creative abilities. At the very end, all the various trajectories of talent development led to the same result: astonishing scientific achievements. The study of (auto) biographical accounts on Nobel Prize winners shows that among many factors, which made it possible, their extracognitive abilities and their objectivization of cognition played an important role (Shavinina, 1996a, 1996b, 2003b, 2009b). Extracognitive abilities refers to the following interrelated elements, including:

- specific intellectually creative feelings: feelings of direction, harmony, beauty, and style, including senses of “important problems,” “good” ideas, “correct” theories, elegant solutions; and feelings of “being right, being wrong, or having come across something important”;
- specific intellectually creative beliefs and intentions (e.g., belief in elevated standards of performance);
- specific preferences and intellectual values (e.g., the “inevitable” choice of great mentors and internally developed standards of working); and

The word “specific” embodies the uniqueness of these aspects in the structure of Nobel laureates’ high abilities. For instance, Barbara McClintock pointed out that her “feeling for organism” was behind her breakthrough discoveries in genetics (Keller, 1984). The extracognitive abilities of Nobel laureates represent the highest level of the manifestation of human intellectual and creative potential, as well as predict outstanding scientific talent of Nobel caliber (Shavinina, 2003b, 2004).

It is useful for future innovators to know how specific feelings, beliefs and intentions, preferences, and intuitive processes helped Nobel laureates to be innovative. In short, a special program for the gifted can be based on these research findings, which would explain the nature of extracognitive abilities, why they are needed to make innovation happen, and how everyone can develop them.

Lessons from Nobel laureates’ childhood and adolescence are another important facet of learning from them. I am currently working on a project entitled A Study of Early Childhood and Adolescent Education of Nobel Laureates and the Implications for Gifted and General Education: Developing Scientific Talent of Nobel Calibre. The project studies early childhood and adolescent education of Nobel laureates in science—starting with the first laureate, who received his prize in 1901, and ending with the most recent laureates, who received their prizes in 2010 (N = 611). The goals of this research are twofold. The first is to discover the unique aspects of the early childhood and adolescent education of Nobel laureates, which contributed to their superior intellectual and creative development and had led to their excellent achievements in science. The second goal is related to translating the results of this investigation into larger-scale innovation, gifted, science, and general education worldwide. The discovery of the principles involved in the educational development of Nobel laureates will allow educators to accordingly improve, develop, modify, and transcend areas in the current curriculum in an attempt to cultivate outstanding scientific talent, of Nobel caliber,
in today’s children. This is why this research is an exceptionally timely and important endeavor and lessons that can be derived for gifted education are enormous (see Chapter 18, Where did all great innovators come from?: lessons from early childhood and adolescent education of Nobel laureates in science, this volume).

Another important and unexpected aspect of learning from Nobel laureates came from a gifted ten-year-old boy, Alexander, who became interested in this project. When he started to read books about Nobel Prize winners’ childhood and adolescence education written for children, he discovered many interesting things. In spite of the fact that Alexander heard many times that Nobel laureates were excellent students, he found, for example, that Guglielmo Marconi was not a good boy at school. Nonetheless, it was he who pioneered radio communication. Albert Einstein was expelled from his school in Munich, Germany; however, he had one of the greatest minds of the 20th century. Fred Banting was not good at school either, but it was only him who was able to discover insulin and saved the lives of millions of diabetics worldwide. The father of Barbara McClintock told teachers to not give any homework to his children. Her dad believed that eight hours at school was more than enough for learning.

Alexander, therefore, originally thought that the Nobel laureates in science were great students. However, he has since found out that they were not. To be more precise, many of them were not the best in school. This made their stories so much more interesting to the boy. As the principal investigator on the above-mentioned project, I was intrigued by Alexander’s research findings and suggested that other kids and adults might also be fascinated. As a result, he is currently working on a book about young Nobel laureates’ educational stories that will be of interest to children, their parents, and teachers. The stories of Nobel laureates are very encouraging and motivating for today’s children (Ponomarev, 2013).

It is interesting to note that in a time when researchers think of how to stimulate kids’ interest in science, Alexander has found some useful ways to do this. When invited to present at a special hearing at the US National Science Board on how to develop the next generation of innovators in STEM disciplines with a subsequent report to Congress and President Obama in August 2009, I discussed Alexander’s case. Specifically, his first degree of interest was his interest in why not all Nobel laureates in science were good boys or girls at school. Then this initial interest motivated him to learn more about Nobel Prize winners’ discoveries. This was Alexander’s second degree of interest. As a result, he is becoming seriously interested in science, which can be considered the third degree of interest. A deep involvement in science might be a desired final outcome and this is the highest degree of interest. Alexander’s book on how “supposed” delinquent boys and girls in school still managed to make great scientific discoveries and became Nobel laureates is a “by-product” of his developing interest in science (Ponomarev, 2013).

Teachers can learn from today’s talented children how they get interested in science and use those lessons. In a time when world-renowned specialists from a variety of disciplines try to suggest ways to stimulate children’s interest in science, Alexander discovered a great way to motivate kids to learn more about science. By using these lessons, parents and teachers will foster scientific talents of Nobel caliber in today’s children, which will enrich the world by subsequent scientific innovations. The development of scientific talents is, therefore, an important element of innovation education.

**Polymathy or multiple giftedness**

Polymathy should be another element of innovation education. The concept polymathy refers to the cases of multiply talented individuals who made significant major contributions to multiple domains (Root-Bernstein, 2003, 2009; Root-Bernstein & Root-Bernstein, 1999). Researchers
studying the nature of expertise often state that specialization is a requirement for adult success, that skills and knowledge do not transfer across domains, and that the domain-dependence of creativity and giftedness makes general creativity and talent impossible (Ericsson, Nandagopal, & Roring, 2009). The absence of people who have made key contributions to multiple domains supposedly supports the specialization thesis. Root-Bernstein’s (2009) study challenges all three legs of the specialization thesis. He had identified individuals who have made important contributions to several domains; thus demonstrating polymathy among creatively gifted adults. Today’s children–future innovators will greatly benefit from the knowledge about the phenomenon of polymathy that must be included in innovation education programs. Parents and teachers should also encourage the gifted to develop their talents to the fullest extent in all possible areas of human endeavor.

**Applied wisdom and moral responsibility**

It is important to develop wisdom in tomorrow’s innovators because this is the most critical talent in the structure of individual innovation (see Chapter 36 of this volume, *What can innovation education learn from innovators with longstanding records of breakthrough innovations?*). The collapse of Enron, Worldcom, and other companies demonstrated that wisdom is a much needed, yet a relatively rare, human ability. “Mistakes will be made,” repeats the Auditor General of Canada, Sheila Fraser. The most powerful way to prevent future mistakes of any kind is to rely on human wisdom. (Auto) biographical accounts on great innovators show that they have highly developed wisdom-related skills (Branson, 2002; Dell, 1999; Grove, 1987, 1996; Lowenstein, 1996; Morita, 1987). Wisdom and innovation are thus highly related. Societies can progress today only by innovating; therefore, every effort should be made to develop wisdom in today’s gifted children—tomorrow’s innovators. Wisdom is behind success of any human endeavor.

Shavinina and Medvid (2009) analyzed the wisdom-based performance of Richard Branson, a famous innovator and entrepreneur. This and similar cases (e.g., the business philosophy of Mary Kay Ash or the entrepreneurial approach of Anita Roddick), as well as practical techniques aimed at developing wisdom-related abilities of children, should be included in innovation education. Future innovators must understand the nature of wisdom and its important role in the innovative decision making process, as well as be aware of the basic traits of wise individuals, and know how wisdom-related performance can be enhanced.

Moral responsibility is closely related to wisdom. Prominent innovators are characterized by a high level of moral development (see Chapter 36 of this volume, *What can innovation education learn from innovators with longstanding records of breakthrough innovations?*). They feel personal responsibility for the future of our planet. Thus, Warren Buffet gave almost all his fortune to the Melinda and Bill Gates Foundation being convinced that they are doing great things in Africa and other poor regions of the world.

Richard Branson is another impressive example. He has always given a lot to charities and founded his own not-for-profit foundation, *Virgin Unite* (see www.virginunite.com). He often helps people who are in difficult situations. For instance, Richard flew on the *Virgin* plane to Iraq under fire in 1991 to release British and other foreign nationals. His recent publications are full of concerns about environment and sustainable development of the Earth (Branson, 2008), and about turning capitalism upside down—shifting the focus from profit alone to also caring for people and communities all around the world (Branson, 2011).

Today’s children–tomorrow’s innovators should be aware of such remarkable examples and well understand that end results of their innovative efforts may lead to incredible fortunes, which automatically implies extraordinary moral responsibility.
Developing managerial talent: Lessons from great managers

As noticed above, innovators are distinguished by an excellent ability to put into place all the organizational, human, and “environmental” structures necessary for implementing their ideas into practice in the form of new products, processes, or services. The human aspect is very important here. David Ogilvy, the legendary founder and CEO of the advertising agency Ogilvy & Mather Worldwide liked to repeat: “people are the only thing that matters, and the only thing you should think about, because when that part is right, everything else works” (Wademan, 2005, p. 36). Innovators should, therefore, be very good in managing people. This is why managerial talent is a critical ingredient of innovation talent. Research shows that many famous innovators were excellent in managing the human part of business. See, for example, Shavinina and Medvid (2009) for a special case study of Richard Branson as a great manager. Mary Kay Ash, Anita Roddick, Nelson Mandela, Akio Morita, Michael Dell, Andy Grove, just to mention a few, were also good in managing people. Lessons from these managers should be an important element of innovation education. The knowledge of their unique approaches to and methods of managing people will be an asset for today’s children—tomorrow’s innovators.

Another part of learning from great managers should be based on the Gallup organization’s study of more than 80,000 best managers in the world (Buckingham & Coffman, 1990). The gifted will benefit from knowing how and why the best managers in the world break all the rules of conventional management wisdom in every facet of their professional activity. Practical cases with exercises will help develop children’s managerial abilities. For example, future innovators should know that best managers hire for talent (not only for brainpower, experience, and willpower), because they are convinced that every role performed at excellence requires talent. When these managers set expectations for their employees, they define the right outcomes, not the right steps. It is up to employees to determine the appropriate steps. When motivating someone, great managers focus on human strengths, not on weaknesses. This is because they understand well that the greatest room for our enhancement is in the area of our strengths, not weaknesses. It means that best managers in the world even do not try to change or improve people. Instead, they concentrate on human strengths and work from there. When developing employees, great managers try to find the right fit between the individual’s abilities and the job requirements; not just promote someone.

Great managers also realized that they can manage people only by remote control. Real control is an illusion of mediocre managers. The best managers spend more time with their “stars”—the best, high performing employees. In brief, everything that great managers do is a complete deviation from conventional management wisdom. This is why the Gallup researchers concluded that the best managers around the globe break all the rules of conventional management wisdom (Buckingham & Coffman, 1990).

Adding these two parts of lessons from great managers to innovation education will allow educators to guarantee that tomorrow’s innovators will really develop their managerial talents and thus will be well prepared to deal with a human part, the most important part of innovation.

Deadline management

A new and exciting research discipline has recently emerged within administrative sciences: deadline management. Every single project—including innovative one—has its beginning and end. The same is true for any innovation that often depends on timely efforts, namely: time needed to develop it, to introduce it to the market place, and so forth. In general, shorter period of time is better for innovation. It means that with respect to innovation those individuals and organizations, who are fast in the innovation process, will win. This is why knowledge about deadline management
should be an essential aspect of innovation education. The fundamentals of deadline management include the understanding that deadlines bring out the best in people, a need to cultivate positive attitude to deadlines, as well as to develop a culture conducive to deadlines (Amabile, Hadly, & Kramer, 2002; Gersick, 1995).

The basics of innovation science

Innovation education will not be comprehensive without some general “know-what” and “know-how” about innovation science and practice such as: the tyranny of success—when winners often become losers—(i.e., when companies lose their innovative edge), conflicting organizational pressures (i.e., functioning efficiently today while innovating effectively for the future), problems associated with partial views of innovation, individual differences in innovation, multiple barriers to innovation, how innovation can help individuals and organizations increase performance, why it is important to work on many types of innovation simultaneously, and many others (Shavinina, 2003a).

Look at the individual differences principle of innovation (Shavinina, 2007). Because of individual differences among people and organizations, there is no one best “recipe” for making innovation happen, which would fit everyone. Something that works perfectly for one individual or organization may not work well for others and might lead to collapses in the third case. Even if one company does almost always come up with great solutions, which excellently work for them—say, Dell Computer Inc.—it does not follow at all that everyone else adopting those solutions will meet with the same degree of success. Copying may simply make the problem worse, if those things, which we try to copy, do not correspond to our individual differences. Our individual differences play an important role in success or failure of our efforts aimed at innovation. This is what “the individual differences principle of innovation” is all about (Shavinina, 2007). For example, Richard Branson’s innovative approaches to creating a highly successful Virgin Group and a unique brand name—as well as Virgin’s expansion through branded venture capital—are well known for many years (Branson, 2002). Nevertheless, how many entrepreneurs and businessmen did follow his example and did the same?

The individual differences principle of innovation explains why innovation is anything but business as usual. “There are no reliable templates, rules, processes, or even measures of success. . . . Innovation is not like most other business functions and activities” (Editorial, Harvard Business Review, 2002, p. 39). Innovation poses a constantly mutating puzzle, or set of puzzles. Individuals and organizations cannot afford not to play the game but the rules are anything but clear. There is not the comfort of a single “right” answer because the question keeps changing. Yet certain individuals and organizations are somehow able to come up with great ideas and implement them over and over again into practice. The theory of individual innovation explains why and how it happens (Shavinina & Sheeratan, 2003). The individual differences principle of innovation also suggests that innovation agenda or innovation strategy will vary significantly for different individuals and organizations.

Children are able to understand these complex issues in detail.

Courage: much needed and untrained talent

Research on famous innovators—such as Jeff Bezos, Richard Branson, Michael Dell, Thomas Edison, Mary Kay Ash, Akio Morita, Anita Roddick, Fred Smith, Sam Walton, and many others—shows that they were and are very courageous people (Shavinina, 2006, 2008, this
The fundamentals of innovation

Courage is much needed for future innovators. When they are about to implement great ideas into practice and thus introduce breakthrough innovations that have not existed before and nobody can predict the response from markets, they should not afraid to go ahead. Markets simply do not exist for the revolutionary innovations. It is innovators who have to create them. In order to reach that point, they should be courageous enough to convince everyone around them that the market for such and such particular product, process, or service will exist. Akio Morita is a great example.

He was a co-founder and the Chairman of Sony when he decided to develop Walkman. And he faced strong resistance. “Everybody gave me a hard time. It seemed as though nobody liked the idea” (Morita, 1987, p. 79). Sony’s Walkman thus appeared despite very strong marketing input to suggest there was no demand for this kind of product. The marketing department at Sony even resisted using the word Walkman, explaining that it does not exist in English language and sounds very strange to English-speaking people. The incredible intuition of Akio Morita made Walkman possible. He pioneered the Walkman project and took personal responsibility for it. At the peak of a very strong resistance to the idea of the Walkman, he resolved the problem by threatening to leave the Chairman position if Sony did not sell 100,000 Walkman in the first six months. Sony sold many more in the first half a year, and Akio Morita was later awarded by the Royal Academy of the UK for his contributions to the development of English language (Morita, 1987). That is, he introduced the words Sony and Walkman. It is impossible to imagine modern English language without these words. He emphasized later that creativity “requires human thought, spontaneous intuition, and a lot of courage” (Morita, 1987, p. 83). It is sad that today’s children are not taught to be courageous. This element of innovation education will thus fill in an apparent niche in general and gifted education by developing this much needed and untrained talent.

The “know-how” part of innovation education: high intellectual and creative educational multimedia technologies

Up to this point, various elements of innovation education were considered. This is the know-what part of innovation education. Its know-how part is about how to present these elements in a better possible way that would be the most productive for teaching the world’s innovators. High intellectual and creative educational multimedia technologies (HICEMTs) can be a good carrier of the know-how part of innovation education. These technologies aim to develop an individual’s intellectual and creative abilities in accordance with his or her time, speed, and learning needs.

Psychoeducational multimedia technologies (PMTs) and HICEMTs were first introduced in 1997 (Shavinina, 1997a). PMTs are multimedia technologies that base their five-part educational essence (discussed below) on fundamental psychological processes and phenomena (Shavinina, 1998a). HICEMTs constitute a special type of PMT whose general content is elaborated in accordance with underlying psychological mechanisms and states and whose special content is developed, structured, presented, and delivered according to the key principles of human intelligence and creativity (Shavinina, 2000).

The term high in HICEMTs refers to a significant saturation of the special content of these technologies through educational materials directed toward the actualization and development of human intellectual potential and creative abilities. HICEMTs emerge at the crossroads of many subfields of psychology (e.g., general, cognitive, developmental, educational, personality, media, cyber, and applied), education, and multimedia technology. At the moment HICEMTs represent
an ideal, the realization of which will require the joint efforts of many psychologists, educators, technology specialists, and even venture capitalists. The next high peak of the development of high technology in, say, Silicon Valley will allow generous financial investments in the development of HICEMTs. Considerable support of public granting agencies will be required as well. Leaving for now the investment part for the future, this section briefly describes HICEMTs and their huge potential for educating tomorrow’s innovators.

**General characteristics of HICEMTs**

The nature of HICEMTs can be described through a set of their general and specific characteristics. The general characteristics of HICEMTs include: (a) general psychological basis, (b) actualization of fundamental cognitive mechanisms, (c) new targets of educational and developmental influences, (d) better adaptation to an individual’s psychological organization, and (e) “psycho-education” as an overall framework. Each of these five characteristics actually represents clusters of characteristics, which are highly interrelated within clusters.

**General psychological basis**

The general psychological basis means that HICEMTs are based on psychological processes and phenomena and particularly on the mechanisms of human intellectual and creative functioning. General psychological processes and phenomena include perception, attention, short-term and long-term memory, visual thinking, knowledge base, mental space, concept formation, analytical reasoning, metacognitive abilities, cognitive and learning styles, critical thinking, motivation, and many other psychological mechanisms. One of the strong arguments to place psychological foundations at the heart of HICEMTs is the fact that the educational process is always a psychological process. Learning, teaching, and training are based on fundamental psychological mechanisms.

For instance, an individual’s knowledge base is an important psychological foundation for the process of knowledge transfer, which is usually considered a purpose of education. Researchers have found that knowledge base is a critical one in the successful functioning of human mind (Bjorklund & Schneider, 1996; Chi & Greeno, 1987; Chi & Koeske, 1983; Kholodnaya, 1997; Runco, 2006; Runco & Albert, 1990; Schneider, 1993; Shavinina & Kholodnaya, 1996; Sternberg, 1985, 1990). Psychologists demonstrated that domain-specific knowledge is crucial in highly intellectual performance and in the process of acquiring new knowledge, especially its quantity and quality. For example, an individual will not be able to solve any problem productively if he or she does not possess relevant prior knowledge (Chi & Greeno, 1987). The knowledge base can facilitate the use of particular learning strategies, generalize strategy use to related domains, or even diminish the need for strategy activation. Furthermore, a rich knowledge base can sometimes compensate for an overall lack of general cognitive abilities (Bjorklund & Schneider, 1996; Schneider, 1993). Despite all these findings, current educational multimedia products do not take into account the psychological nature of the human knowledge base, particularly with respect to its optimum functioning, which characterizes exceptional creative and intellectual performance that is the case of the gifted (Rabinowitz & Glaser, 1985; Shavinina & Kholodnaya, 1996; Shore & Kanevsky, 1993; Sternberg & Lubart, 1995) and innovators. Innovation is a special type of giftedness. Other psychological processes and phenomena and their appropriateness for the development of HICEMTs have been described elsewhere (Shavinina, 1997a, 1997b, 1998a).
The fundamentals of innovation

Fundamental cognitive mechanisms

HICEMTs should be directed toward actualization of fundamental cognitive mechanisms, which play a significant role in an individual’s intellectual and creative functioning. Broadly speaking, these technologies aim to actualize and develop an individual’s cognitive abilities. This is the second main characteristic of HICEMTs. The following cognitive processes and phenomena are viewed as important in contemporary accounts of human intelligence and creativity (Brown, 1978, 1984; Flavell, 1976, 1979; Khododnaya, 1997; Runco & Albert, 1990; Shavinina & Khododnaya, 1996; Sternberg, 1984, 1985, 1988a, 1988b, 1990): conceptual structures (Case, 1995; Khododnaya, 1983, 1997), knowledge base (Chi & Greeno, 1987; Chi & Koeske, 1983), mental space (Khododnaya, 1997; Shavinina & Khododnaya, 1996), cognitive strategies (Bjorklund & Schneider, 1996; Pressley, Borkowski, & Schneider, 1987), meta-cognitive processes (Borkowski, 1992; Borkowski & Peck, 1986; Brown, 1978, 1984; Campione & Brown, 1978; Flavell, 1976, 1979; Shore & Dover, 1987; Barfurth et al., 2009; Sternberg, 1985, 1990), specific intellectual intentions or extracognitive abilities (Shavinina, 1996b, 2003b, 2004; Shavinina & Ferrari, 2004), objectivization of cognition (Shavinina, 1996a), and intellectual and cognitive styles (Jones, 1997; Khododnaya, 1997; Martin- sen, 1997; Riding, 1997; Sternberg, 1985, 1987), just to mention a few. Other processes and phenomena should also be embedded in HICEMTs. These psychological mechanisms provide a necessary foundation for the further successful development of human creative and intellectual abilities, because development of an individual’s mental potential must be based on already-actualized cognitive resources (Shavinina, 1998a).

The great French scientist Blaise Pascal said, “Chance favours the prepared Mind.” To rephrase Pascal’s words with respect to HICEMTs, it should be said that the prepared mind will gain much more advantage from specially elaborated psychoeducational multimedia technologies designed for the development of human mental abilities. Through repeated exposure to the fundamental processes and phenomena of the human cognitive system, HICEMTs will become “know-how” learning and training multimedia technologies by providing an underlying educational basis for the subsequent development of an innovator’s mind.

New targets of educational and developmental influences

HICEMTs will change the conventional point of view about the targets of educational and developmental influences. The conventional wisdom of companies and developers of current educational multimedia technologies is to address their products to the abstract “user” as a whole. Designers are mostly unconcerned with where their products and services are directed. There is a general user (i.e., children, adolescents, or adults), and what is needed is to specify to what age category a given product is addressed. From a psychological point of view, it is unproductive to direct educational multimedia technologies to users in general, because people in general and children in particular are complex psychological systems with many hierarchical components, multidimensional variables, multifaceted parameters, and structural interrelations. To direct any educational influence to such complex systems as a whole is to decrease immediately the quality of education. As a result, the exact targets of the existing educational multimedia applications are missing, although they could be responsible for the higher productivity of the educational process. When analyzing educational multimedia technologies, one has always to ask him or herself: “To what exactly, in the structure of users’ mind or personality, is the given educational multimedia technology directed?” It is not easy to answer this question, because the developers of educational multimedia usually do not ask it. The importance of asking the right questions was emphasized by Einstein (1949) and other brilliant minds of the 20th century.
For the most part, the main goal of current educational multimedia is “knowledge transfer.” However, today such transfer is not fully realized, because successful knowledge transfer is a derivative of fundamental psychological mechanisms. The basic mental processes and phenomena should be viewed as the real targets of innovation education. The development of HICEMTs leads to a change in the traditional audience (i.e., targets) of available educational multimedia products from “users as a whole” to the underlying mechanisms of human intellectual and creative functioning. The primary objective of education has also changed: from realizing simple knowledge transfer to developing an individual’s intellectual and creative abilities. Such changes will result in significant increases in the quality of education for today’s children—tomorrow’s innovators (Shavinina, 2000).

Better adaptation to individuals’ psychological organization

The foregoing features of HICEMTs will allow them to be better adapted to an individual’s psychological organization than current educational multimedia. HICEMTs can take into account numerous psychological characteristics of users, such as behavioral, developmental, emotional, motivational, personality, and social ones. HICEMTs should be directly built on the psychological specificity of users. For instance, any two educational multimedia courses for learning of a foreign language are certainly different for children and adults. It is clear that this difference is mainly connected to content and developers of educational multimedia, for the most part, are limited by content issues. Their way of thinking is as follows: “Children cannot understand some educational material, so we need to present them with more simple information.” Nonetheless, this is not enough. Another difference between educational multimedia courses for children and adults concerns the psychological organization of the two groups of users. Adults have an internal motivation to study foreign languages, whereas children should have a strong, ongoing external motivation in addition to the internal one (or even instead of it; Shavinina & Ponomarev, 2003).

HICEMTs have the potential to generate the necessary conditions for the appearance and maintenance on the appropriate level of a child’s motivation to learn, cognitive behavior, emotional involvement, and personal satisfaction with her or his gradual progress through the educational content. It does not matter by what means developers of educational multimedia can reach this goal (e.g., exciting scenarios, specific multimedia effects, user-friendly means, innovative learning methods, and so on; of course, their combination would be preferable). The bottom line is that HICEMTs should fit the internal psychological structures of human intellectual, creative, behavioral, cognitive, developmental, emotional, motivational, and other systems.

Psycho-edutainment

As was predicted earlier, the appearance of “psycho-edutainment”—a new area of the global educational multimedia market—is an inevitable event (Shavinina, 1998a). This innovative multidisciplinary multimedia field that emerges at the crossroads of existing multimedia fields (i.e., education, entertainment, and edutainment) and a new area—psychology—is the only scientifically viable framework for the development of HICEMTs. Taking into account that (a) education is, in its essence, a psychological process, (b) entertainment involves its own psychological mechanisms related to games, (c) play is a preferable and leading form of children’s activity, and (d) fun and positive emotions accompany successful learning, as well as is highly desirable as one of the means to sustain children’s curiosity, then one can conclude that HICEMTs cannot be developed other than through the synthesized regrouping of contemporary fields of multimedia (Shavinina, 2000). The nature of HICEMTs cannot be associated with one particular multimedia field; they may be created only in the space of “psycho-edutainment.”
The five features described above provide the general characterization of HICEMTs. The other considerable portion of the features of HICEMTs relates to their more specific characteristics.

Specific characteristics of HICEMTs

Among specific characteristics of HICEMTs, the following can be distinguished: (a) “intellectual” content, (b) “creative” content, and (c) “intellectually creative edutainment.” The first two characteristics deal with the specific content of HICEMTs, and they demonstrate “what” should be included in these technologies. Intellectually creative edutainment, on the other hand, represents a substantial part of the important characteristics related to the mode of presentation of this content. Therefore, intellectually creative edutainment describes “how” specific content might be embedded in HICEMTs.

Intellectual and creative contents cover many different, multidimensional, and interrelated aspects. However, it is not possible to consider all of them here, because they vary significantly and depend on developers. At the current level of the development of psychology, there are many different theories of human intelligence and creativity (Detterman, 1994; Kholodnaya, 1997; Miller, 1996; Runco, 2006; Runco & Albert, 1990; Shavinina, 1998b; Simonton, 1988; Sternberg, 1982, 1985, 1988b, 1990; Sternberg & Lubart, 1995) that determine developers’ conceptions of creative and intellectual contents. A variety of the psychological approaches to the understanding of the nature of individual intelligence and creativity will strongly influence differences in the content of HICEMTs through developers’ conceptions. These different approaches will predetermine what is intellectual and creative in HICEMTs.

One of the most promising approaches to developing the content of HICEMTs can be based on Kholodnaya’s (1997) theory of individual intelligence. In other words, this theory might underlie the development of HICEMTs. Sternberg’s triarchic theory of human intelligence and Gardner’s multiple intelligences theory are examples of other theories that could also serve as foundations for the development of HICEMTs.

The joining of entertainment and education has led to the appearance of “edutainment,” a rapidly developing multimedia field. Similarly, the combining of psychology and edutainment has led to the emergence of “psycho-edutainment,” a promising new multimedia area. Likewise, the combination of intelligence and creativity with edutainment leads to “intellectually creative edutainment,” a framework for the development of HICEMTs. HICEMTs will significantly transform “edutainment.” Taken together, modern multimedia technology, educational games, and entertainment—built on the fundamental psychological processes and basic principles of human intellectual functioning and creative performance—form an “intellectually creative edutainment” that provides a real opportunity to develop HICEMTs.

How many HICEMTs: one, two, or more?

Definitely, a question might arise: how many HICEMTs can be developed? The answer is: an unlimited number can be developed. There are a few scientific reasons for this. First, as discussed above, the variety of psychological approaches and theories in the areas of human intelligence and creativity—which provide a foundation for developers’ conceptions of creativity and intelligence—exclude at all a limited number of HICEMTs.

Second, the complex multidimensional nature of intellectual and creative abilities of today’s children–tomorrow’s innovators (toward the actualization and development of which HICEMTs are directed) excludes in principle a single educational multimedia technology that would be more productive than other technologies, because the development of innovative talent can be achieved through
various psychoeducational methods. Different methods are suitable for different individuals in general and for innovators in particular, who have various, multiple profiles of innovative abilities.

Third, the transdisciplinary nature of HICEMTs (i.e., in contrast to traditional interdisciplinary and multidisciplinary approaches, “the complete fundamental-level merging of ‘disciplinary’ sources of knowledge is the focus,” Vandervert, 2001) provides a basis for the development of a variety of new psycho-educational multimedia technologies (Vandervert, Shavinina, & Cornell, 2001). Finally, technological and economic factors also result in the exclusion of a limited quantity of HICEMTs.

Therefore, with their general and specific sets of characteristics, HICEMTs seem to be a good way to deliver all the above-mentioned elements of innovation education. This is a challenging task for the future. However, even today some of the new educational multimedia technologies incorporate certain general characteristics of HICEMTs (see Shavinina, 2009f, for examples and directions in which HICEMTs can be developed).

Innovation education for today’s adults: the case of INNOCREX

So far innovation education for children and adolescents was discussed. However, it should be accessible to all members of any society. Everyone will benefit from innovation education: children, adolescents, and adults. Innovation can come from any person in society (Bessant, 2003). In this case the above-described elements of innovation education should be slightly modified. INNOCREX (www.innocrex.com), a special organization founded in 2005, is an example of such modification. Its mission is to develop adults’ abilities via a series of seven one-day workshops on creativity (From New Ideas to Success and Prosperity: Managing for Creativity), innovation (How to Realize the Innovative Potential of Your Organization: The Basics of Innovation Management), excellence (Managing for Excellence in Your Organization), managerial talent (On Managerial Talent: Skills Recognition and Development), entrepreneurial giftedness (Recognizing Entrepreneurial Giftedness), practical intuition (Developing and Using Practical Intuition), and applied wisdom (Applied Wisdom for Individuals and Organizations: Managing for Wisdom-Related Performance).

The intention was to offer these workshops to all people working in the private, public, and not-for-profit organizations. For instance, teachers and managers alike find these workshops useful for their professional development. Specifically, they learn important practical tools (for example, intuition and wisdom), which help them to channel their talent, to motivate their students and employees to be more creative, to solve everyday problems in innovative ways, and to perform professional activities at the level of excellence.

Conclusion

This chapter described the basics of innovation education. Its structure consists of the following eleven elements:

- The programs available in the field of gifted education, which prove their effectiveness.
- The best programs from science and technology education.
- New programs aim to develop entrepreneurial giftedness, which is closely related to innovation.
- Programs for the development of children’s metacognitive abilities or abilities to implement things: the so-called executive talent. It is essential, because innovation is about the implementation of ideas into practice.
- New programs based on recent progress in the study of scientific talent of Nobel laureates.
- Programs, which would incorporate the essentials of research on polymaths.
• New programs for the development of applied wisdom and moral responsibility.
• Programs aim to develop managerial talent.
• The fundamentals of deadline management.
• The foundations of innovation science: a general “know-what” and “know-how” about innovation, including the psychological basis of innovation, innovation gap, the individual differences principle of innovation, innovation management, and so on.
• Courage-related issues. Courage is mandatory for tomorrow’s innovators.

HICEMTs seem to represent one of the best ways to deliver these components of innovation education. If educators are indeed concerned about the future of our world, then they have to focus on innovation education. Policy makers have an important role to play in order to help teachers and parents to achieve this goal. Its successful accomplishment will ultimately mean the fulfillment of one of the most important missions of any government: economic prosperity for all in the whole world.

Acknowledgments
The work presented herein was supported under the Support for Innovative Projects program (Grants AN-129135 and AN-143064) of the Fonds québécois de la recherche sur la société et la culture (FQRSC) and by the Social Sciences and Humanities Research Council (SSHRC) of Canada and the Templeton Foundation/the Institute for Research and Policy on Acceleration of the Belin-Blank International Center for Gifted Education and Talent Development of the University of Iowa. The findings and opinions expressed in the chapter do not reflect the positions or policies of these granting agencies. Special thanks to Larry Vandervert for his detailed feedback on early drafts of this chapter.

Notes
1 As the identification aspects are discussed in Shavinina’s chapter on the assessment of innovative abilities in this volume, they are not, therefore, considered here.
2 Entrepreneurial giftedness refers to talented individuals who have succeeded in business by creating new ventures with at least a minimal financial reward (fulfilled entrepreneurial giftedness) or who demonstrated an exceptional potential ability to succeed (prospective entrepreneurial giftedness; Shavinina, 2009d).
3 The difference between entrepreneurship and innovation is based on the fact that entrepreneurs can implement any ideas into practice, not necessarily new ones (e.g., to open a pizzeria); while innovation is associated with the implementation of new ideas (e.g., to produce iPhones or iPods). In other words, one can distinguish between conventional entrepreneurs and entrepreneurs–innovators.
4 For the most part, people either produce ideas or implement them in life. The first group is called “creators” and the second group “innovators.”
5 Leadership research traditionally belongs to the field of management and business studies, administrative sciences. It means that leadership scholars found the importance of vision in great leaders independently of giftedness researchers.
6 For definitions of these concepts please see Shavinina (2009d).
7 Wisdom refers to the application of intelligence, creativity, and experience as guided by values toward the achievement of a common good, through a balance among (a) intrapersonal, (b) interpersonal, and (c) extrapersonal interests, over the (a) short and (b) long term, to achieve a balance among (a) adaptation to existing environments, (b) shaping of existing environments, and (c) selection of new environments. A lack of wisdom is thus characterized by the faulty acquisition or application of intelligence, creativity, and experience knowledge as guided by values away from the achievement of a common good, through an imbalance among intrapersonal, interpersonal, and extrapersonal interests, of the short and long term, resulting in a failure in balance among adaptation to existing environments, shaping of existing environments, and selection of new environments. Foolishness is an extreme failure of wisdom (Sternberg, 1998).
Traditionally, managerial talent is associated with an individual’s exceptional ability to deal with people, mainly to motivate them to achieve high performance (Buckingham & Coffman, 1990). Recently Shavinina and Medvid (2009) defined managerial talent as a combination of applied wisdom, practical intuition, excellence, entrepreneurial giftedness, creative abilities, and innovation.

Stelios Haji-Ioannou, a founder of EasyJet, is an obvious exception. EasyJet has been so successful that it now has a stock-market quote and Stelios Haji-Ioannou is developing new businesses, using the same brand, through his separate private venture-capital vehicle easyGroup.

Stelios Haji-Ioannou, a founder of EasyJet, is an obvious exception.

References


The fundamentals of innovation


L.V. Shavinina


