

Leapfrog Principles and Practices: Core Components of Education 3.0 and 4.0

by

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Abstract

This paper describes the paradigm and practices of educational “Leapfrogging.” Leapfrog Principles and Practices are introduced and explained as components of “Education 3.0,” or knowledge-producing education, and “Education 4.0,” or innovation-producing education. Examples are provided of human capital enhancements relevant to knowledge production and innovation applications of knowledge. The author contends that the first nations to Leapfrog into local expressions of Education 3.0 and 4.0, support them with advanced technologies, and apply them in early childhood through tertiary and adult education, will become bellwether human capital development leaders among 21st creative economies of the 21st Century.

The Leapfrogging context: moving from Education 1.0 to Education 4.0

Leapfrogging is synergistically composed of three education paradigms, but in particular Education 3.0, which empowers students to produce, not merely to consume, knowledge. Education 3.0 is made possible by Education 2.0 (Internet-enabled learning), and by centuries of experience with memorization (Education 1.0). Education 4.0 empowers students to produce innovations, the follow-on substantiations of knowledge production. The following modified taxonomy, originated by John Moravec and continued to Education 4.0 by the author, demonstrates that each of these four incarnations of education is interactive, yet comparatively very different. Education 2.0 begins the transition to a new educational paradigm based on knowledge production and innovation production, the appropriate engines for viable 21st Century economies.

| | “Download” Education 1.0 | “Open Access” Education 2.0 | Knowledge Producing Education 3.0 | Innovation Producing Education 4.0 |
|-------------------------------|--|--|---|--|
| Meaning is... | Dictated | Socially constructed, with aid of (usually limited) Internet access | Socially constructed and contextually reinvented knowledge | Built through selective individual and team-driven embodiments in practice, i.e., through focused innovations |
| Technology is... | Confiscated at the classroom door (digital refugees) | Cautiously adopted open access (digital immigrants) | Everywhere (digital natives in a digital universe) for ubiquitous knowledge construction and transmission | Always changing with the direct input of learners acting as a major source of tech evolution in the service of innovation production |
| Teaching is done ... | Teacher to student | Teacher to student and student to student (progressivism); Internet resources are a normal part of learning activities | Teacher to student, student to student, student to teacher, people-technology-people (co-construction of knowledge) | Amplified by positive innovation feedback loops; ubiquitously and creatively 24/7 in all phases of living, learning, and working; |
| Schools are located... | In a building (brick) | In a building or online (brick and click), but increasingly on the Web through hybrid and full internet courses | Everywhere in the “creative society” (thoroughly infused into society: cafes, bowling alleys, bars, | In the globally networked human body, a continuously evolving instrument innovatively supplementing |

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|--|---|---|--|---|
| | | | workplaces, etc.) | <i>and replacing the classroom</i> |
| Parents view schools as... | Daycare | Daycare with an laboratory edge, provided by open access and gradual movement toward project-based learning | Places for students to create knowledge, and for which parents may provide domestic, volunteer, civic, and fiscal forms of support | Schools are viewed as <i>one of many</i> innovation venues for continuous innovation by students, teachers, parents, etc. |
| Teachers are... | Licensed Professionals | Licensed Professionals who team with students, parents and others to (gradually) create more interesting class experiences | Everybody, Everywhere, backed up by wireless devices designed to provide information raw material for knowledge production | Everybody, everywhere, is an innovation production source backed up by intuitive software “partners” and human collaborators |
| Hardware and software in schools... | Are purchased at great cost and ignored | Are open source and available at lower cost, permitting open access “on the cheap” and beyond school premises and time frames | Are available at low cost and are used purposively, for the selective production of knowledge | Are innovated daily, since virtually all software is person-specific as an unqualified expressions of familiarity and partnership |
| Industry views graduates as... | Line workers who must be trained and from whom little created is expected | A workers marginally or ill-prepared for the knowledge-producing economy | As knowledge-producing co-workers and entrepreneurs who can support the development of focused knowledge construction | As innovation-producing co-workers and entrepreneurs who can sustain focused innovation construction |

[Chart based on Moravec, J. W. (2008). Moving beyond Education 2.0. Retrieved March 18, 2008, from Education Futures Web site: <http://www.educationfutures.com/2008/02/15/moving-beyond-education-20/>]

We assert that Education 3.0 and Education 4.0 are qualitatively different incarnations that build upon Education 2.0 information sourcing capabilities and, to a lesser extent, the memorization habits of Education 1.0. We realize that most of the world's education is at the 1.0 level, and that only a fraction of world education is "officially" moving toward Education 2.0 despite the fact **that** students often attempt to Leapfrog beyond 1.0, if only – and often by necessity - outside the classroom. *For our purposes in this paper, Education 3.0 and 4.0 are the focal points of Leapfrog education.*

The Leapfrog Principles

Within and beyond education, Leapfrogging means to get ahead of the competition or the present state of the art through innovative, time-and-cost-saving means. One example of Leapfrogging is Finland's 3.0-4.0 leap to wireless phones, saving that country the cost of deploying an expensive copper wire system. Another example is present in some of the Kent, Washington (USA) public Institutes, which now permit students to use wireless Web devices to help them access information to better pass tests. Leapfrogging has become a major 3.0-4.0 strategy of developing countries wishing to avoid catch-up efforts that otherwise portend a high likelihood of continued followership. A similar approach to gaining the lead rather than assuming a persistent runner-up role has been adopted by many industries, institutions, and individuals.

Education 2.0 is a necessary foundation for Education 3.0 and Education 4.0. World-wide, productivity through 2.0 "open sourcing" creates "pushes" toward involvement in innovation. An example of open sourcing is a participatory democracy, in which everyone communicates with elected representatives. Another is the company suggestion box (Toyota has one every few feet along the assembly line). While the concept of open sourcing has largely been associated with Web 2.0, the idea is obviously transferable to Education 2.0 structures, leadership and management. Previously innovation-averse schools can be unfrozen through the involvement of new information and knowledge within the framework of Education 3.0 applied to Education 4.0. A promising approach to this connection is "innovation cells" or "Leapfrog cells," which are low-cost, voluntary micro-cultures devoted to focused knowledge production and innovative knowledge applications.

To partner adults with children and youth in solving problems of the emerging future, and to create desirable alternative futures, means that problems must be re-thought as Education 3.0-4.0 opportunities. There are a handful of initial approaches to this transformation that we regard as workable for children, youth and adults at any level from pre-k through 16 and beyond. We believe that these approaches, the 3.0-4.0 Leapfrog Principles, should be initiated by teacher training institutions in partnership with selected pre-k/12 and tertiary institutions. The Leapfrog Principles are:

-The use of advanced technologies to emulate leading edge work forces, including a shift from 1.0 memorization through chaotic 2.0 open sourcing to 3.0 knowledge production and 4.0 innovations

-Pre-k/16+ Education 3.0 knowledge production and 4.0 innovation, developing beyond 1.0 students who are simply able to recall knowledge and 2.0 students who randomly “surf the Net”

-Leadership vs. followership, demonstrating the potential and capacity to drive new genres of Education 3.0 knowledge and 4.0 innovation production in the 21st century

-Raising staff productivity as Education 3.0 knowledge and 4.0 innovation workers, utilizing the strengths of pre-k/16+ institutions as diverse learning and action organizations

-Innovative Education 3.0 modes of knowledge distribution, identifying, creating, and utilizing new and future-oriented formats for sharing school-produced knowledge, and the selective applications of knowledge to 4.0 innovation projects

-Globalism and internationalism, fostering development of inter-culturally competent and socially responsible cosmopolitanism among students, staff and faculty who practice 3.0 and 4.0 education

-Innovative Education 3.0 creative learning and research environments that better facilitate the creation and sharing of new knowledge, together with its 4.0 innovation applications

-Proaction vs. reaction, anticipating and building preferred new 3.0 and 4.0-based futures, rather than simply responding to current challenges and trends

The mandate for change falls, in our judgment, on administrators, faculties and parents, who must provide the mission and organization for bold actions such as those permitted by the formation and use of supportive “Leapfrog Practices” based on 3.0 and 4.0 Leapfrog Principles.

The Leapfrog Practices

We assert that children and adults have been kept apart from meaningful collaboration in solving problems and contributing to new and more desirable futures at all levels of society, particularly within pre-k/16+ education. Our recommendation is to move forward with revised social software for reframing curricula of virtually any kind, with the intention of teaching and demonstrating practical liberal skills to children, youth, and their adult collaborators. Below are the “Leapfrog Practices”, which provide 21st Century-appropriate liberal skills for Education 3.0-4.0 pre-k through 16+. The Leapfrog

Practices are applications of the liberal arts and higher-order thinking skills derived from many disciplines and fields. They are:

1. Thinking systemically: perceiving existing patterns and constructing alternatives to them
2. Thinking simulationally: conducting “what if?” thought experiments and mental rehearsals using controlled imagination and projections
3. Thriving in the midst of changes, challenges, and unknowns: developing perspectives, knowledge, and choices to cope with and leverage complexity and uncertainty
4. Creating and manipulating alternative pasts, presents, and futures: creating and managing virtual time; developing flexible definitions of social and personal time; selectively associating alternative pasts and futures with multiple presents
5. Developing and responding to goals and challenges: setting goals and objectives; detecting and anticipating impediments to success; designing solutions to impediments
6. Understanding and effectively utilizing existing information: accessing and selectively employing information in pursuit of opportunities and problem resolutions
7. Constructing and utilizing personally applicable knowledge: selectively transforming information into personally usable knowledge; building a personally styled capability to add intellectual and other forms of variety to the world; enhancing decision-making options
8. Constructing and utilizing knowledge related to contexts, processes, and cultures: perceiving, designing, and constructing real and virtual contexts suitable for specific tasks; compiling and utilizing many perspectives on given subjects; enhancing decision-making options
9. Utilizing current and emerging ICT systems: staying atop the technologies that permit modern learning and economies; being first in the adoption and effective use of hardware, software, and net-working technologies
10. Acquiring and assessing knowledge of selected global trends: constructing “big pictures” of the world using different resources for each picture; becoming a global thinker and citizen; employing big pictures to help contextualize relatively localized problems, opportunities, goals and means

11. Writing, speaking, and using media through a unique voice: developing and utilizing personal uniqueness; applying uniqueness alone and with cohorts, groups, and teams; developing identity and character

12. Taking personal responsibility for intentions and performance quality: ethically accepting accountability for personal actions and inactions; accepting personal and social assessments of performance quality

In our opinion, the Leapfrog Practices offer a starting set of guidelines for structuring pre-k/16+ education to take maximum advantage of the imaginations, knowledge production, problem solving, and opportunity generating potentials of children and youth, together with their adult collaborators. We realize that modifications to the Leapfrog Practices are to be expected in actual working situations, and hope that such modifications would be made available as quickly as possible through widely distributed Leapfrog Institutes in the furtherance of Education 3.0 and Education 4.0.

The roles of Leapfrog Institutes

How can Leapfrog Institutes function as centers for the collaborative development of Education 3.0-4.0?

First, a new emphasis on students as Education 3.0 “knowledge creatives” is required. This will be no small task. It will require a great deal of creativity and innovation, not just variations on Education 1.0 legacies or lunges toward uncritical involvement in Education 2.0 “open source” randomness. Second, a hugely new emphasis on innovation must be embodied in the evolution Education 4.0. While Education 3.0 represents its own paradigm shift, Education 4.0 represents another. Taken together, they are the 1.0-2.0-supported backbone of 21st Century human capital development and application.

Our ideas and interests can be summarized in terms of the following: a) an emphasis on initiative and proaction rather than reaction; b) policies that foster Leapfrogging activities instead of catching up; c) reconsideration of the balance between disciplinary and interdisciplinary programs; d) recognition of the relationships between internationalization and globalization (especially the need to synergistically integrate these two concepts); e) an emphasis on innovative knowledge production, distribution and utilization; and f) development of lifelong learning programs that reach larger numbers and varieties of students and stakeholders.

For these tensions to become creative and productive, Education 3.0-4.0 alternatives to current education development must be energetically put into place.

To get things started, and to take maximum advantage of the imagination and creativity of children and youth, together with their adult partners, we propose the establishment of numerous locally designed and controlled Leapfrog Institutes. Such Institutes may become “parallel” to conventional education contexts, either permanently or as a developmental step. The mission of the Leapfrog Institutes is to equip children and

youth, working with their teachers, parents, and volunteers, to study, assess, and develop experiences intended to increase awareness of change and the shared ability to cope with it.

Each of the Leapfrog Institutes will provide a context for children and youth, with the assistance of prepared faculty, parents, and public/private volunteers. The Institutes will present role models and techniques for examining the natures of alternative Leapfrog experiences and the forces which affect these. The Institutes will help children and youth, their parents and their communities to discover Leapfrog experiences that are worth imagining, planning, and living for.

The cultures of Leapfrog Institutes can offer services that help teachers, students and other stakeholders understand:

- how past education systems viewed their *in situ* Leapfrog experiences
- how new Leapfrog experiences are -or are not- being created
- how Leapfrog choices made now can affect experiences ten, twenty, or more years into the future
- how to conduct strategic and applied thinking and research
- how to forecast trends in several interactive ways
- how to design logical and plausible alternative Leapfrog experiences
- how to formulate "virtual policies" aimed at concretely implementing Leapfrog experiences
- how to shape learning, living and working around "best case" Leapfrog futures for self, family, community, and nation

These steps are designed to promote innovate practical, real-world 3.0-4.0 opportunities for children and youth and their families and communities. The primary professional means for accomplishing these steps is through involving children and youth in Leapfrog research and development experiences applied to the changing world they share with their teachers and parents. The goals are the development of new knowledge and its innovative applications to local, national, and global opportunities.

However, we must temper our overall enthusiasm with some necessary and daunting questions:

How can individual learning units Leapfrog beyond choking rules and regulations?

How much creative chaos can be permitted and tolerated in Leapfrog Institutes?

How does a Leapfrog Institute create suppleness, initiative, and much faster reactions to threats and opportunities?

Do Leapfrog Institutes require expanded forms of variety, such as interdisciplinarity, transdisciplinarity, and even post-disciplinarity (individual learning contracts)?

How much “requisite variety” (the variety required to succeed as a Leapfrog Institute) is needed to avoid sluggishness, brittleness, and decline?

Our concern is that run-of-the-mill 1.0 schools may not easily engage these questions, leading to the probability that selected sectors of schools may develop Leapfrog capabilities while others may not. Even schools with strong 2.0 cultures and practices may fail to Leapfrog to Education 3.0-4.0. Under these circumstances, as we have written, it will be necessary for Leapfrog Institutes to co-exist in the same locations as “parent” conventional schools. One way to accomplish this juxtaposition is to establish “innovation cells” within schools, with the help of volunteer teachers, administrators, students, parents, and volunteer consultants.

Evolving toward Leapfrog Institutes, many of them based on innovation cells, could increase many times the numbers of creative minds involved in knowledge production and innovation. It is our belief that no society can afford to ignore its youth -a largely untapped human capital resource- if it is to become or to remain globally competitive.

Organizing and networking the Leapfrog Institutes

Every Leapfrog Institute can have its own local board of directors, community and school support base, administration and budget. In turn, the support network will have its own board and will include representation from member Institutes. It is envisioned that both the Institutes and the support network would be not-for-profit entities.

In addition to children and youth and their families, individual Institutes will be comprised of teachers already employed by Institutes, and of volunteers, consisting of consultants, retired teachers and professional people, and interns.

Every Leapfrog Institute should belong to at least one support network. We believe that immediate opportunities exist to establish interactive Leapfrog Institutes in Asia, North and South America, and Europe.

The primary role of the support networks will be to foster communication among Institutes, to provide services to institutions, to encourage and assist the establishment of

new Institutes, and to further the examination of Leapfrog experiences applied to the development of desirable futures.

The support networks will "publish" the results of many projects, ideas, plans and position papers developed by the Institutes, including designs for improved Leapfrog techniques. The support network will permit individual Institutes to sponsor and participate in seminars and workshops.

Each Institute will be encouraged to define its role and its programs in ways that are consistent with basic commitments to the notions of improved opportunities for children and youth, community service, inter-generational and inter-cultural cooperation, and exploration of alternative Leapfrog experiences leading to desirable futures. Each Institute should emphasize local involvement and control.

For Leapfrog Institutes to properly support knowledge producing innovation societies, attention must be paid to the use of appropriate technologies. The Institutes must flexibly and rapidly adopt, incorporate, adapt, and discard ICT technologies as needed. Since a vigorous provision for Leapfrog experiences requires access to the most up-to-date information, the Institutes will use modern communications to provide access to real-time information. Such access can and will be provided by today's handheld wireless devices and by other forms of hardware and network.

Ray Kurzweil's ITC future is one that we have chosen to accept as a reality for knowledge-driven innovation societies. We believe it is already in an early stage of development, and has already strongly impacted the workforces of advanced societies. Such impact produced the knowledge industries, but rapid change is already demonstrating a growing capacity to automate or off-shore much codified knowledge and the means to produce it. Continuous innovation societies are a natural outcome of these processes, already long demonstrated in the automation and off-shoring of white collar information, industrial, and agricultural work, and now moving rapidly into knowledge and innovation work.

[The evolution of technologies appropriate for Leapfrog activities are reviewed in another article within this publication.]

Supportive contexts for Leapfrogging and Education 3.0-4.0

Concrete employment of the Leapfrog Principles and Practices allow us to proactively and creatively construct Education 3.0 contexts. This will require rapid change and a commitment to innovation among all levels of living, learning and working communities. We believe that Leapfrog Institutes can employ the Principles and Practices to almost immediate effect in local context. Selectively focusing on outcomes such as these can immediately convert the Leapfrog Principles and Practices into Education 3.0-4.0 tools:

- Through globalism and internationalism, foster development of interculturally competent and socially responsible cosmopolitanism among students, faculty and staff
- Through learning to innovate, create learning, research, and development environments (such as innovation cells or Leapfrog cells) that better facilitate the creation, innovative application, and sharing of new knowledge
- Through proaction vs. reaction, anticipate and build for preferred futures rather than respond to current challenges and trends
- Through leadership vs. followership, demonstrate the education's potential and capacity to drive new genres of knowledge production in the 21st century
- Through knowledge production and innovation develop students who are not simply able to recall knowledge, but are also able to create new framings, meanings and innovative applications of knowledge
- Through raising staff productivity as knowledge workers, utilize the strengths of Leapfrog Institutes as diverse but Institute learning organizations, and build value for internal and external markets
- Through innovative modes of knowledge distribution, identify, create and utilize new and future-oriented formats for sharing the knowledge constructed by Leapfrog Institutes

We are not offering snake oil or predicting miracles. The road to 3.0-4.0 could be long and very often hard. Many students, instructors, parents and stakeholders will choose to stay within the familiar bounds of Education 1.0 “download” learning; others will be satisfied with Education 2.0, which focuses on knowing but not knowledge production. Our experiences in China, the U.S. and Mexico suggest that there is a logical basis for locally tailored Education 3.0-4.0, the incarnations specifically intended to support human capital development and applications within creative innovation economies and societies.

Coda

Involving teachers in the formation and operation of Leapfrog Institutes will be essential for the success of the teaching profession as well as the Institutes. The world is changing too fast to permit the legacy functions of worldwide teaching cultures to hold back children and youth, and thereby adults, from understanding, shaping and managing legacy futures while striving to create intentional ones.

While we hope that the messages in this paper will contribute to the future successes of all societies, we are concerned that some may not respond, or else will not respond soon enough. The worldwide disparities in human capital growth and applications already are stunningly wide. This is especially concerning, as the future of well-paying work is intimately associated with intellectual imagination, creativity, knowledge production, innovation, and systems designs.

To contemplate further separations is to court tragedy conforming to the dimensions of cultural speciation. If at all possible, this is simply not to be tolerated. Clearly, bold

distributed leadership on the parts of educators around the world is required to begin and to evolve the Leapfrog Institutes and other innovations of similar kinds.

It is exciting to contemplate the intellectual capital productivity of hundreds of thousands of students, teachers, and adults collaborating to deal with the problems and opportunities inherent in such topics as these. With the exceptions of productive Ph.D. programs and occasional pre-k/16 educational experiments, this transition from memorizing curricula to producing useful, innovatively applied knowledge is perhaps the greatest change –and challenge– in the history of formal and informal education. All of this has to start somewhere, and for this purpose we suggest the earliest possible development of widely distributed, interactive, and locally autonomous Leapfrog Institutes.

Using the Leapfrog Principles and Practices as tools, a worldwide revolution in Education 3.0-4.0 can, and should, occur within the first quarter of the 21st Century.

Resources

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