TOWARD LEARNING SOCIETIES
AND THE GLOBAL CHALLENGES FOR LEARNING-WITH-ICT

Bernie Trilling

Senior Director, Oracle Education Foundation
500 Oracle Parkway, Suite 886, Redwood Shores, California 94065 USA
Phone: +1 650-506-2611   Email: bernie.trilling@oracle.com

ABSTRACT

The Knowledge Age is at hand, and with it, new worldwide demands for Learning Societies. The shape of learning–with–ICT to come – new lifelong skills, new kinds of learners, new learning theory, new global ways of learning, and new learning tools – are all highlighted. The top ten challenges for using ICT to help invent the Learning Societies of the future are presented.

1. THE KNOWLEDGE AGE

More and more of our world's countries are crossing the threshold into the Knowledge Age – where "brain-power" replaces "brawn-power" and "hertz-power" replaces "horse-power".

Many believe that this shift to knowledge-based societies is as historic and as challenging as the shift from the Agricultural Age to the Industrial Age.

In economic terms, as a country's investments in the "bits and bytes" of information and knowledge exceeds its investments in industrial and manufacturing goods, the so-called "value chain" of work undergoes a permanent shift (see below for the US example [1]).

The Knowledge Age

1991 = Year One of the US Knowledge Age
US Industrial goods spending Š $107 Billion
US Knowledge goods spending Š $112 Billion

Industrial Age:
Extraction *è* Manufacturing *è* Assembly *è*
Marketing *è* Distribution *è* Products (& Services)

Knowledge Age:
Data *è* Information *è* Knowledge *è*
Expertise *è* Marketing *è* Services (& Products)

As this shift takes hold, what each person must do to successfully prepare for life and work – the main focus of education in a society – is also permanently altered. What's more, learning and knowledge-creating, the core mental work of education and innovation, become central pursuits in a knowledge society.

Increasingly, societies must become learning-centered, or "Learning Societies" to empower their citizens to both compete in the global economy and to sustain vibrant social, cultural and governmental institutions.

As one person put it, "Learning is what most adults will do in the 21st Century [2]."

2. THE NEW LEARNING FORMULA

So if learning is the key to life in the 21st Century, what are the essential learning skills, the mastering of which will help ensure everyone's success in our Knowledge Age future?

The basic "3Rs" of reading, 'riting and 'rithmetic, multiplied by the lifelong skills most needed for the times – called here the "7Cs" – becomes the new formula for success in the 21st Century:

$$\text{3Rs} \ \text{X} \ \text{7Cs} \ = \ 21^{st} \text{ Century Learning}$$

The 7Cs outlined below are derived from a number of contemporary efforts to define the essential skills needed for a society's future workforce [3,4,5].

The Seven Cs –
21st Century Lifelong Skills

Seven Cs	Component Skills
Critical Thinking-and-Doing	Problem-solving, Research, Analysis, Project Management, etc.
Creativity	New Knowledge Creation, "Best Fit" Design Solutions, Artful Storytelling, etc.
Collaboration	Cooperation, Compromise, Consensus, Community-building, etc.
Cross-cultural Understanding	Across Diverse Ethnic, Knowledge and Organizational Cultures
Communication	Crafting Messages and Using Media Effectively
Computing	Effective Use of Electronic Information and Knowledge Tools
Career & Learning Self-reliance	Managing Change, Lifelong Learning and Career Redefinition

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Learning achievement in the 21st Century has an expanded definition – attaining and applying the product of the basic 3Rs and the higher-level 7C skills. Measuring and testing the full complement of these skills becomes the new goal of educational accountability in Learning Societies.

3. THE NEW LEARNING CURVE

The history of the use of ICT for learning in most developed countries can be summarized in three words: "*from*", "*about*" and "*with*" [6].

History of ICT-for-Learning

Phase 1: Learning *from* Technology
Phase 2: Learning *about* Technology
Phase 3: Learning *with* Technology

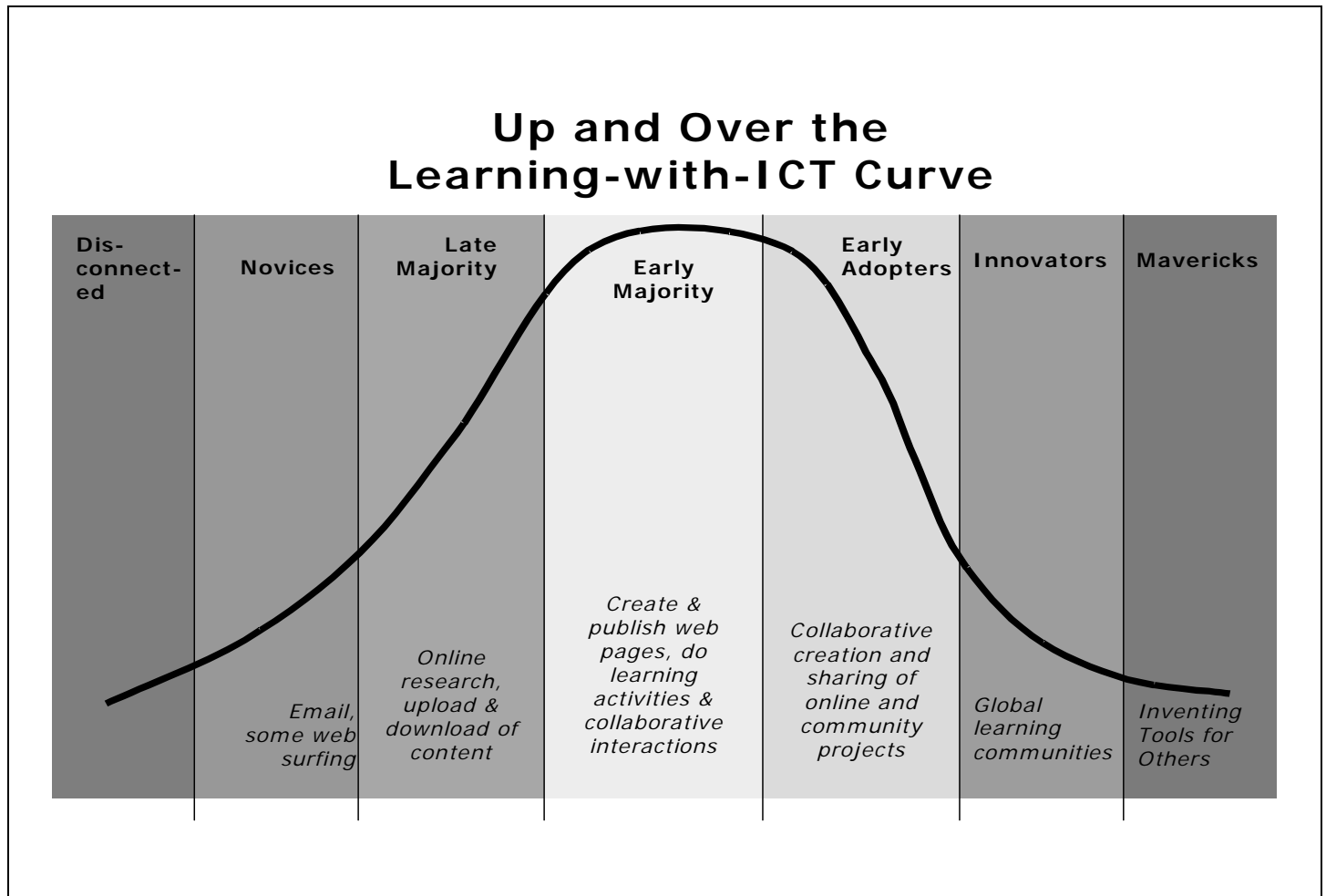Early use of ICT for learning focused on developing basic skills through drill and practice routines, where local computing technology was employed as a tireless, on-screen tutor – learning *from* technology.

As hardware, software and telecommunications networks all advanced; as the numbers of computers in schools increased; and as new jobs were expanding in the technology sectors, a focus on "computer and ICT literacy," with ICT as a subject of study, held sway – learning *about* technology.

More recently, as wider access to a variety of ICT devices and networks grows in developed countries, the focus of ICT for learning is shifting to how best to apply ICT as tools for a broad range of learning needs – learning *with* technology.

Of course all three approaches – learning *from*, *about* and *with* ICT – will persist, as appropriate for a particular set of learner's needs, but it is in the use of ICT as tools for thinking and learning that we will see the most advances in our developing Learning Societies.

Common patterns of learning with technology are now appearing; in the diagram below, the curve outlines the number of users across each stage of progression in using ICT for learning – in this case, the pattern is for a more advanced Learning Society:

Up and Over the Learning-with-ICT Curve

Dis-connect-ed	Novices	Late Majority	Early Majority	Early Adopters	Innovators	Mavericks
	Email, some web surfing	Online research, upload & download of content	Create & publish web pages, do learning activities & collaborative interactions	Collaborative creation and sharing of online and community projects	Global learning communities	Inventing Tools for Others

As learners progress in their use of ICT for learning, they seem to go through some common stages:

- **Disconnected** – use local offline word processing, and possibly one or two other productivity applications if available
- **Novices** – the above plus email and some web surfing
- **Late Majority** – the above plus online research, upload and download of online content, online form-filling and transactions, and simple online games
- **Early Majority** – the above plus create and publish documents and web pages, interact and share ideas online, participate in standards-based online learning activities, and collaborative interactions, forums, groups, communities, etc.
- **Early Adopters** – the above plus create, collaborate and share in online projects including group multimedia productions and websites, collaborate with asynchronous and synchronous tools, take facilitated courses and seminars, and use online simulations and multiplayer games
- **Innovators** – the above plus active in global learning community projects, learning with mentors, share journals, blogs, and portfolios of projects and work, create and share databases and data-based websites
- **Mavericks** – the above plus create online tools and environments for others to create learning games and simulations, to collaboratively build complex interactive media productions, and to build highly interactive communities of learners that can work together on learning projects and knowledge-building activities

This categorization is based on diffusion of innovation research as well as recent studies of the patterns of uses of ICT for learning in developed countries [7,8]. Each country, region, province, district, school or even classroom has its own distinct curve. As populations of learners progress, the curve shifts to the right. If effort is made to track these or similar categories of learning-with-ICT use, a much clearer picture of the progress a Learning Society is making will emerge.

4. THE NEW "DIGITAL NATIVE" LEARNER

The global primary, secondary and tertiary (K-16) student population is rapidly becoming a new breed of learner as they become ever more digitally connected. They are "digital natives" that speak "technology" without an accent, having grown up with computing and telecommunications devices as a natural part of their world [9].

In more developed countries like the US and the UK, the patterns of technology use among these digital natives are astounding; by the time students exit school and join the workforce they will have experienced:

- 10,000 hours of video games
- 250,000 emails
- 10,000 hours of cell phone use
- 20,000 hours of TV
- 500,000 commercials
- <5000 hours of book reading

Digital natives think and act differently from "digital immigrants" (those born before ICT prevalence, who speak "technology" with an accent, such as printing out emails to read or not being adept at typing with thumbs).

Many digital natives have a very rich online life:

- *Searching* – multiple search engines, info sites, "Googling" people & interests
- *Collecting* – graphics, animations, MP3's, videos, sensor data
- *Creating* – stories, websites, avatars, games
- *Sharing* – web pages, blogs, drawings, music, videos, webcams, humor
- *Communicating* – email, IM, chat, cell phone calls, text messaging
- *Coordinating* – projects, travel plans, workgroups
- *Meeting* – forums, chat rooms, online multiplayer games, dating sites
- *Socializing* – wide variety of socializing methods learned online
- *Evaluating* – reputation systems, rating systems, online advisors,
- *Buying & Selling* – auction sites, forums, online markets
- *Gaming* – solo, 1-on-1, small & large groups
- *Learning* – online research on things of personal interest

As more and more of the world's children are born into "digital nativehood", their demands for a new style of learning and a more developed Learning Society will grow; they will want to learn [10]:

- Through engaged doing, creating and sharing
- About things they care about
- With others in frequent social interactions
- Through rich, multiple media representations
- Through varied methods of communicating that provide rapid feedback
- Through fast switching between multiple media channels of information
- Through random access explorations of multiple sources of information
- Through tackling complexity incrementally, building skills as needed
- Through play and by creating ways for others to play to learn new things
- Through creative problem-solving and answer-finding strategies

Evidence is already mounting that the gap is rapidly widening between the learning demands of these digital native learners and what they're actually receiving in the more Industrial Age forms of schooling and education still prevalent throughout the world [11]. As global student access to learning-with-ICT increases, pressure for more appropriate "digitally native" Learning Societies will mount day by day.

5. NEW LEARNING THEORY

The last three decades have brought a real revolution in our understanding of how people learn, and the new principles of learning are surprisingly in tune with many of the new demands of our digital native students. The following "5Cs of Learning Theory" summarize these findings:

The Five Cs of Learning Theory

Context: *Authentic learning*

Construction: *Mental model building*

Caring: *Intrinsic motivation*

Competence: *Multiple intelligences*

Community: *Learning socially
    in groups*

Each of these summary findings underscores the need for very different approaches to learning than the ones we've had – and they also seem to match many of the new demands of our new Knowledge Age [12]:

❑ **Context:** *Authentic learning* - Context plays a very significant part in learning – the environmental conditions for learning (people, objects, symbols, and their relationships) are much more influential than we've previously thought; the transfer of knowledge from one context to another is not often successful. The demand for more "authentic" learning tasks that match real world conditions comes directly from these findings, as well as the desire to have rich learning environments that offer a wide variety of in-context opportunities for discovery, inquiry, design, practice, instruction and constructive exploration [13].
This approach coincides with the need to become proficient in solving real world problems and to exercise critical thinking-and-doing in the Knowledge Age.

❑ **Construction:** *Mental model building* - A great deal has been learned about how we build mental models, assimilate new experiences, accommodate changes to our models as we confront experiences that don't quite "fit", and even hold important misconceptions about the world as necessary bridges to more "accurate" models. These findings underscore the importance of constructing external models, both physically (with wood blocks, *LEGOs*, etc.) and "virtually" (drawings on paper and computer screens, simulation modeling with *The Sims,* etc.). These "visceral and virtual" modeling activities provide strong external supports for the internal model-making going on inside our heads [14].
We now can see just how important design, simulate and construction activities and projects are in learning, for they match the constructive modeling and designing aspects of how we learn, and they also prepare us for the constructive methods we will use to do our future knowledge work.

❑ **Caring:** *Intrinsic motivation* - We can rely on a rich literature of "emotional literacy" studies and reports from practice that clearly demonstrate the advantages of intrinsic over extrinsic motivation in learning and the development of deeper understandings. Recent project-based and problem-based learning programs where learners define their own projects (with guidance) and help set the criteria for which they will be evaluated, have shown just how much learning can happen when students genuinely care about their work [15].
This fully supports the Knowledge Age need to develop self-reliant and self-motivated learners and workers who have the persistence to creatively solve difficult problems and find answers to tough, complex questions.

❑ **Competence:** *Multiple intelligences* - Though there remains some lively debate over what exactly are the inherent "modules of intelligence" in the brain, there is now no question that competence comes in a variety of flavors and intelligence is exhibited in a wide assortment of behaviors. Whether it is Gardner's eight intelligences (Verbal-linguistic, Logical-mathematical, Kinesthetic, Visual-spatial, Musical, Naturalist, Interpersonal, and Intrapersonal) or other models, we know enough now to encourage multiple learning approaches to match diverse learning styles and multiple ways of expressing understanding [16].

This corresponds with the Knowledge Age need to benefit from multiple talents in the creative solving of problems in diverse teams, and in the sensitive design of services and products for diverse audiences.

□ **Community:** *Learning socially in groups* - A strong case has been made in the last decade for the importance of the social and cultural aspects of learning and the significance of learning from groups with common interests and practices.
This is an extension of the value of learning in-context to the social and cultural realms of group interaction, peer and mentor relations, group culture, community interactions and the need for social tools, settings, and techniques to support socio-cultural learning [17].
This matches the Knowledge Age need to use team approaches to problem solving and to learn from a variety of communities of practice and expertise.

6. GLOBAL COLLABORATIVE LEARNING WITH TECHNOLOGY

Once students are on the World Wide Web, learning becomes global. And once students begin interacting with each other on the web, the opportunities for global collaborative learning, cross-cultural sharing and understanding, and astonishing learning projects, all truly blossom.

To help turn these opportunities into real, everyday powerful learning experiences, safe, well-designed online environments with a wide variety of tools to support an even wider range of learning activities and projects are needed.

Two significant global online environments that support 21st Century learning are Oracle's ThinkQuest and Think.com programs, which this author has the great pleasure to help direct.

ThinkQuest is a global competition where student teams from around the globe create websites for learning in a variety of topic categories. The winners of this biannual international competition have their websites entered into the ever expanding ThinkQuest library of over 6000 award-winning websites all created by students (see: www.thinkquest.org/library). This library is an internationally celebrated source of great online learning content, all created by students, and all accessible without cost.

Oracle's Think.com environment represents a real breakthrough in providing easy-to-use, protected learning and collaboration spaces for primary and secondary students. Spam-free email, simple yet powerful web page creation tools, and a variety of interactive tools to communicate and collaborate across the globe – including the electronic version of those ubiquitous yellow "sticky notes" – are all a part of this free-to-join, global school-based electronic community (see: www.think.com).

As both of these global, collaborative learning-with-ICT programs grow and evolve, new demands arise as students move "up and over the learning-with-ICT curve". New tools and support are needed to grow these communities into even more compelling and nurturing learning communities. The following "wish list" is offered to encourage software developers, educational technologists and philanthropic organizations to help build the online (server-side, browser-accessible) components needed for a freely available, global online 21st Century Learning infrastructure that will truly support the learning needs of our digital native students [18]:

□ **Collecting and Organizing –** dynamic outline creation tools; visual concept maps; timeline creation tools; a variety of information table templates; simple data modeling and database creation and publishing tools; project management tools for tracking milestones, tasks, roles, and project work

□ **Modeling & Simulating –** simple spreadsheet tools; basic decision support system building tools; student expert systems development tools; dynamic multimedia modeling and simulation environments; tools for creating and sharing learning games microworlds; virtual reality creation tools

□ **Searching & Exploring –** free, online libraries of educationally reviewed and appropriate content; search engines that can search across these educational libraries; blogs and social network tools appropriate for learning; simple intelligent agents that can harvest needed information; basic data visualization tools

□ **Creating & Constructing –** basic presentation creation tools; video and multimedia authoring tools; hypermedia authoring tools; databased website development tools

□ **Conversing & Sharing –** asynchronous bulletin boards, forums and conferencing environments; synchronous and teacher-hosted text, audio, whiteboard and video conferencing; online journals and collaborative notebooks; shared project workspaces

7. TOP TEN GLOBAL CHALLENGES FOR LEARNING-WITH-ICT

So how do we continue to invent our Learning Societies together? The following ten-point "challenge list" is offered to all who want to dig in and lend a hand in shaping a better future for all 21st Century learners and workers in our new Learning Societies:

1. **Personalized and Universally Designed Learning**
With the most diverse populations of learners in

history, we must go from "one size fits all" to "the right size for each one" using technology to help personalize, differentiate and deliver a more flexible, universally designed curriculum. We must move what we've learned at the margins to the mainstream and treat each learner as "special", giving each student a profile-based version of learning resources that best matches the individual student's sensory and cognitive abilities, learning styles, level of competence, interests and preferences.

2. **Online Collaborative Learning Environments**
We must make the web a great place for learning with spam-free email; easy web-page creation and sharing; and rich messaging and collaboration tools for discussion, debate, research and collaborative learning projects for students and teachers across the globe. Thnk.com and ThinkQuest are great examples of the type of learning environments needed for 21st Century Learning Societies.

3. **Encyclo-medias, Learning Games and Simulation Libraries**
The time has come to get serious about creating a global online library for learning that would provide universal access to rich assortments of online multimedia encyclopedias and simulation libraries for any subject imaginable.

4. **A 21st Century Balanced Approach to Learning**
With all of our new choices in learning technology comes the weighty responsibility of using it appropriately and effectively. This is where we need a new balance in our learning methods – a balance of online and hands-on, on-screen and off, virtual and visceral, instruction and construction, teacher-initiated and student-led. We especially need more models of learning programs that effectively combine on-screen activities and simulations, with hands-on projects, construction kits, authentic design challenges, probeware, discovery labs, and real world explorations.

5. **The Mobile Learning Toolkit**
The time is right to design, from the ground up, an integrated set of mobile handheld/tablet devices that has learning as the number one design objective, and to assemble the integrated online services suite that would fully support all the tasks a student or teacher encounters in the day-to-day learning process: research, messaging, composition, data collection, multimedia publishing, collaborative learning, simulations, etc. Most of the puzzle pieces are already here; they now need to be integrated, web-enabled, and made super easy to use.

6. **Digital Portfolios and Embedded Assessments**
As we move toward doing more and more of the daily business of learning and teaching onscreen and online, it makes great sense to be able to capture snapshots of this digital work in an electronic portfolio, for review, assessment, parent conferences, and for students to see their capacities grow. It also makes sense to embed within the daily onscreen work, electronic diagnostics and assessments that provide the feedback needed to keep learning on track.

7. **Leadership Development for Digital Educators**
The speed and level of success of the transformations in learning and teaching outlined in this paper are totally dependent on the capacity of educators to lead and sustain transformative change. The role of technology in stimulating, supporting and sustaining this change must be included in all educators' training. Here is where successful business leaders could help educators, understanding that the worlds of education and business have some very significant differences.

8. **21st Century Learning Spaces**
New learning methods and technologies and a new mission for education demand a fresh look at the physical environment necessary to enable and support a new learning and teaching model. The 21st Century schoolhouse will have to provide students personal spaces for their digital equipment as well as their books; group areas for computer-supported teamwork on projects; places to project electronic work on big screens; electronically-supported studios for art, music and media productions; science labs with handheld electronic sensors and probes feeding data into laptops for analysis and display; portable electronic field packs for collecting data, taking digital photos and videos, and for studying local environments.

9. **The Integrated Learning Utility**
We've heard a lot about data warehouses and integrated portals for education, and there's been much progress with initiatives like the School Interoperability Framework. Given the financial woes that have swept across states and countries recently, we may need a fresh strategy to move this integration effort along. It's time to look at creating an integrated, open source, hosted web services approach to running all the administrative systems of a school district, province, or state, and connecting this, in the same data repository, to a standards-based comprehensive library of learning resources. The efficiencies gained here could free up dollars to invest back into instructional programs too. This may

be the holy grail of educational computing, but it's time we get serious about the quest.

10. **A Global United Learning Alliance**
Once students are learning online, they become global learners. So it becomes necessary to begin to tackle students' 21st Century learning needs from a global perspective. We need an international alliance of education, business, health and government to take up the challenge of preparing as many learners as possible to join the knowledge workforce of our times. Through distance learning programs, online mentoring, and collaborative learning projects, the opportunity to learn can be extended farther than ever before. A Global Learning Alliance with the appropriate world-class leadership could attract and invest the resources necessary to build a successful global initiative.

8. TOWARD GLOBAL LEARNING SOCIETIES

We have seen some of the important work that must be done for ICT to continue being a powerful partner and catalyst in the transformation of learning and education. These are just a few of the needed pieces in a much more complex, global, educational jigsaw puzzle of social, political, economic, infrastructural and human components.

The challenges that our newly arrived Knowledge Age brings to learning and education are great, but the promise of a renaissance of learning in 21st Century Learning Societies is even greater. There is important work to be done in helping turn this vision of a global network of Learning Societies into a Knowledge Age reality.

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