

**global summit 2006:
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**Connectivism: Learning and
Knowledge Today**

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Abstract

Our theories of learning and knowing have not kept pace with societal and technological progress. The result is a fundamental mismatch between how we pursue and provide education, and the context and characteristics of knowledge. We are preparing learners for an era that no longer exists, with a skill set that does not enable effective navigation of today's complex, adaptive world. To counter the growing learning and knowledge challenges of educators and business leaders, connectivism is presented as a model of learning and knowing aligned with society's needs today.

Learning

At the end of the last century, knowledge began to become the most valuable currency, like land in a feudal economy or capital in an industrial economy. The new science of learning should tell us that knowledge is not just a prize to be won in some desperate test-taking struggle for places in the contemporary mandarin state. Instead it is, literally and not just rhetorically, our universal human birthright.

J. Brockman¹

Mass education designed for the industrial age meets the needs of neither the pre-industrial village nor the post-industrial future...indeed, all education—has to be totally reconceptualised.

Alvin Toffler²

In *Educating the Net Generation*³ Diana and James Oblinger present an example of today's youth—influenced and changed by technology. Eric (the individual in their introduction), lives a different reality—not because of technology, but because of affordances provided by technology. For Eric, connecting with people and content is a constant, ongoing, daily activity. His learning is a continual, network-forming process. This model is gaining

prominence in both academic and corporate environments.

Learning is more than knowledge acquisition. Often it is a process of several stages with several distinct components. Exploration, inquiry, decision making, selecting, and deselecting are all preparatory activities before we even enter the learning experience (the learning experience being defined as the moment when we actively acquire the knowledge that is missing in order for us to complete the needed tasks or solve a problem).

Our metaphors of thought (and models of learning) over the last century include:

<i>Our mind is a black box</i>	We can not fully know what goes on. Instead, we focus on the behavior—the observable manifestation of thought and cognition
<i>Our mind is like a computer</i>	We accept inputs, manage them in short-term memory, archive them in long-term memory (and retrieve into short-term memory when needed), generating some type of output
<i>Our mind constructs our reality</i>	We engage in active construction of our reality through the ideas and resources we encounter.

These established metaphors fall short in an era defined by rapid knowledge development. Our mind is not like a computer. Neuroscience has revealed that the computer model is wholly inaccurate. Our mind may have been a black box to researchers a century ago, but we now understand many of the functions of different areas of our brain...we are slowly illuminating the box. Construction, while a useful metaphor, fails to align with our growing understanding that our mind is a connection-creating structure. We do not always construct (which is high cognitive load), but we do constantly connect. Much of knowledge today is distributed across networks of individuals, not held only in the mind of one.

Our mind is a network...an ecology. - Where individual points of knowledge are distributed across the entire entity, not housed fully in one centralized area.

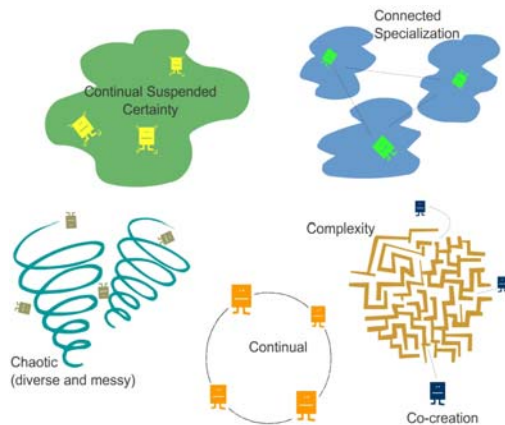


Figure 1 Traits of Learning Today

Learning is defined as:

<i>Chaotic</i>	Diverse and messy, not necessarily neatly packaged and arranged
<i>Continual</i>	Ongoing in development and communication. The model of “go to a course” is being replaced with learning and knowledge at the point of need
<i>Co-creation</i>	Instead of content consumption (or passive learners involved in knowledge acquisition), experts and amateurs are now co-creators in knowledge
<i>Complexity</i>	Learning is a multi-faceted, integrated process where changes with any one element alters the larger network. Knowledge is subject to the nuances of complex, adaptive systems.
<i>Connected Specialization</i>	Complexity and diversity results in specialized nodes (a single entity can no longer know all required elements). The act of knowledge growth and learning involves connected specialized nodes
<i>Continual Suspended Certainty</i>	We know in part. An attitude of tolerance for ambiguity and uncertainty is required. Certainty is for a season, not a lifetime.

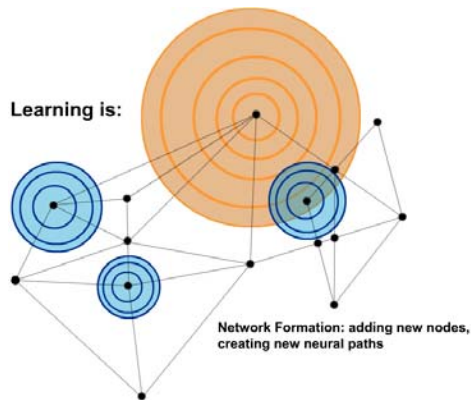


Figure 2. Learning as Network Forming

Learning is the process of creating networks (see Figure 2). Nodes are external entities which we can use to form a network. Or nodes may be people, organizations, libraries, web sites, books, journals, database, or any other source of information. The act of learning (things become a bit tricky here) is one of creating an *external network* of nodes—where we connect and form information and knowledge sources. The learning that happens in our heads is an *internal network (neural)*. Learning networks can then be perceived as structures that we create in order to stay current and continually acquire, experience, create, and connect new knowledge (external). And learning networks can be perceived as structures that exist within our minds (internal) in connecting and creating patterns of understanding.

Connectivism describes how learning happens in a digital age. Research in traditional learning theories comes from an era when networking technologies was not yet prominent. How does learning change when knowledge growth is overwhelming and technology replaces many basic tasks we have previously performed?

Connectivism integrates principles explored by chaos⁴, network, complexity⁵, and self-organization⁶ theories.

Knowledge and learning are processes that occur within nebulous environments of shifting core elements—not entirely under the control of the individual. Learning (defined as knowledge patterns on which we can act) can reside outside of ourselves (within an organization or a database), is focused on connecting specialized information sets. The connections that enable us to learn more are more important than our current state of knowing.

Connectivism is driven by the understanding that decisions are based on rapidly altering foundations. New knowledge is continually being acquired. Drawing distinctions between important and unimportant knowledge is vital. The ability to recognize when new knowledge alters the landscape based on decisions made yesterday is important. When business, or academic, environments change, adjustments need to be made in our own thinking and assumptions to

ensure that we are basing our decisions on an accurate foundation.

Principles of connectivism:

Learning and knowledge require diversity of opinions to present the whole...and to permit selection of best approach.

Learning is a network formation process of connecting specialized nodes or information sources.

Knowledge rests in networks.

Knowledge/learning may reside in non-human appliances⁷, and learning is enabled/ facilitated by technology.

Capacity to know more is more critical than what is currently known.

Learning and knowing are constant, on going processes (not end states or products).

Ability to see connections and recognize patterns and make sense between fields, ideas, and concepts is the core skill for individuals today.

Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.

Decision-making is learning. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

By obsolete, I mean that our high schools--even when they're working exactly as designed--cannot teach our kids what they need to know today. Training the workforce of tomorrow with the high schools of today is like trying to teach kids about today's computers on a 50-year-old mainframe. It's the wrong tool for the times.

Bill Gates⁸

“Know where” and “know who” are more important today than knowing *what* and *how*. An information rich world requires the ability to first determine what is important, and then how to stay connected and informed as information changes. Content is dependant on the right conduit for expression and communication (the internet, a book, a text message, an email, a short video clip).

Knowledge is of two kinds: we know a subject ourselves, or we know where we can find information upon it.

Samuel Johnson⁹

Our changing knowledge and learning contexts are axiomatic. We see it in many forms—from newspapers to radio to TV to the internet. Everything is going digital. The end user is gaining control, elements are decentralizing, connections are being formed between formerly disparate resources and fields of information, and everything seems to be *speeding up*.

The Achilles heel of existing theories rests in the pace of knowledge growth. All existing theories place processing (or interpretation) of knowledge on the individual doing the learning. This model works well if the knowledge flow is moderate. A constructivist view of learning, for example, suggests that we process, interpret, and derive personal meaning from different information formats. What happens, however, when knowledge is more of a deluge than a trickle? What happens when knowledge flows too fast for processing or interpreting?

Once flow becomes too rapid and complex, we need a model that allows individuals to learn and function in spite of the pace and flow. A network model of learning (an attribute of connectivism) offloads some of the processing and interpreting functions of knowledge flow to nodes within a learning network. Instead of the individual having to evaluate and process every piece of information, she/he creates a personal network of trusted nodes: people and content, enhanced by technology. The learner aggregates relevant nodes...and relies on each individual node to provide needed knowledge. *The act of knowing is offloaded onto the network itself.* This view of learning scales well with continued complexity and pace of knowledge development.

The increased complexity of our world today does not permit any one individual an accurate understanding of the entire scope of a situation, field, or

subject. We now rely on *connected specialization*—where we increase our competence by adding specialized functionality to our network. Building an airplane, performing a complicated surgery, or analyzing foreign market trends are involved tasks that require *knowledge to be offloaded to a connected network of specialists.* No one individual has the competence to build an airplane, perform an involved surgery, or comprehend market trends. The network (or web) of connections is the structure which holds the knowledge of individuals in a holistic manner.

Context is central.

Even revolutionaries conserve; all cultures are conservative. This is so because it is a systemic phenomenon: all systems exist only as long as there is conservation of that which defines them.
Humberto Maturana Romesin and Pille Bunnell¹⁰

Relevance is the requirement for adoption or use of virtually anything. If something is not relevant, it is not used (this can be a concern when we overlook knowledge that is not relevant today, but may be a key element in developing our competence tomorrow). Relevance can best be defined as the degree to which a resource or activity matches an individual's needs. The

closer the match, the greater the potential value.

What then does it mean for knowledge to be relevant? Is it a function of being current? Or tightly linked to the task at hand?

A learner must be able to see relevance. If relevance (determined by the individual) is not ascertained, motivation will not be enacted. Lack of motivation results in lack of action.

Relevance, however, is not only about the nature of content. The process of ensuring currency of content/information is critical—to manage knowledge growth and function effectively in a diminishing half-life of knowledge environment.

Some institutions are beginning to explore alternative models of content delivery—for learning and sharing knowledge. Elearning initially focused on simply duplicating classroom activities, so content was generally created in linear, course-sized chunks. In order to learn, an individual needed to be able to devote a large amount of time to exploring content. Alteration in size, manner, and point of content delivery (rather than a course, learning can be delivered in smaller, individual objectives...in a variety of formats—computer, paper-based, cell phone.) enables knowledge to be expressed continuously, rather than in structured courses. The content needs to be *findable* at the learner's point of need,

as compared to learning being provided *just-in-case*.

The more closely the content is positioned to the point of doing/need, the more effective the learning process. Additionally, it is important to acknowledge that learning is much more than exposure to content. Social, community, and collaborative approaches to learning are important.

The second criteria for relevance in today's environment is for institutions to ensure that content is current. This is a significant challenge. By nature, a *course* or training is prepared months in advance of delivery, and is then modified as needed based on new information. Courses are fairly static. Knowledge is dynamic—changing hourly, daily. Content designers require an understanding of the nature of the half-life of knowledge in their field and ensure that they select the right tools to keep content current for the learners

Admittedly, currency of content requires far more thinking and planning than described here. Content management systems, aggregators, intelligent search, and other tools are part of the overall structure of ensuring content is up to date. Current learning formats are antagonistic to the evolving nature of knowledge. We need to augment our view of what it means to be current in our fields...and how we propose to tap learners into a larger structure that continues to provide value well beyond the close of a course.

Our organizational views of knowledge need to be expanded. Knowledge is not only a product-it is also a process. It does not function and flow as physical goods did in the industrial era.

The paths that create knowledge run through valleys of learning. We often equate knowledge acquisition or creation with formal learning. But we find knowledge in many ways: informal learning, experimentation, dialogue, thinking and reflection.

Networked learning answers many questions about how we acquire much of our knowledge (even elements that contradict each other). When we exist in a knowledge climate (or network), we constantly scan, evaluate, and select for use, elements that answer questions with which we are struggling. Some elements of learning will relate to our values, attitudes, and beliefs, others will relate more concretely to how we perform our work.

The learning system in many organizations is still largely based on the schema that the learner is an empty container that we fill. We talk about dynamic, learner-centered instruction. Often those words deny the reality that our institutions are primarily set up to *fill learners*. We promote empowerment for knowledge workers, yet we expect them to function in a manner at odds with how knowledge is created and how it flows.

Our solution lies in seeing the whole. Monochromatic one-model, one-

approach views do not work in complex spaces like learning and knowledge. *Shades, continuums, and blurred boundaries are our new reality.*



Connectivism: Process of creating network

Figure 1. Learning Ecology

We often have a mismatch between tool and process. Learning is not a clear, structured, uni-directional process. Learning is messy and chaotic. As a simple analogy, if our main goal is to travel somewhere fast (our intended function/process) and we opt to walk (even when a vehicle is available), we are being foolish (again, assuming that our main goal is fast travel, not environmentalism). In our organizational technology and learning structures, we often give vendors control of learning—due to their control of tool integration. This creates an environment where the tool drives what we are able to do (rather than our learning and communication goals driving the technology). Universities,

colleges, and corporations often use learning management or e-portfolio systems. The functionality (how employees and students will learn) is driven by the tool selected. Where we desire multiple options, the tool often presents limited functionality. Too often, we bend our pedagogy to the tool.

It is not about controlling. It is about fostering...and guiding.

experience that adapts to learners' needs based on how they interact and learn. The entire ecology of learning is the accurate whole.

Connections provide the greatest value when they generate a certain type of content for the learner. It is not content in general that we want. *We want content that is current, relevant, and contextually appropriate.* Connections are the devices that enable this to occur. Consider an employee who is working on site and needs to access a product manual (current, relevant). The contextually appropriate format (cell phone, laptop, PDA) makes the content more useful. Contrast this with traditional knowledge sharing. A manual (or training classroom) rarely meets the criteria of current/relevant/contextually appropriate. Much of a corporation's knowledge provision to employees occurs in advance of need (which is useful in forming mindsets, but not too effective for skill transfer), and presents content in a static *point-in-time* manner. Knowledge has to be accessible at the

point of need. Container-views of knowledge, artificially demarcated (courses, modules) for communication, are restrictive for this type of flow and easy-access learning.

It is also worth considering what happens when we create connections between content—we create a network or aggregation of different ideas...which adds meaning (pattern recognition) to the individual voices. *Connections change content.* Content is imbued with new meaning when situated in a network (or is it more accurate to say that the network acquires new meaning when new content is added?). Either perspective validates the importance of creating connections over content. When the network is sufficiently large to account for diverse perspectives, it achieves a certain level of meaning that is reflective of the combined force of individual elements.

Our relationship to content has to change when content creation accelerates. We can no longer consume all relevant content items.

The capacity to stay current is more important than any individual content element.

Currency of knowledge is the function of a network, and raising the value of skills of network-making. The network becomes a separate cognitive element—it processes, filters, evaluates, and validates new

information. If content has a short lifespan (as new information is acquired), then it would logically imply that our education and training systems should not be about content in particular—they should specifically be about current content.

In a connectivist approach to learning, we create networks of knowledge to assist in replacing outdated content with current content. We off-load many cognitive capabilities onto the network, so that our focus as learners shifts from processing to pattern recognition. When we off-load the processing elements of cognition, we are able to think, reason, and function at a higher level (or navigate more complex knowledge spaces).

In today's world, knowledge life is short; it survives only a short period of time before it is outdated. Most individuals need to spend an enormous amount of time in continuing education classes to stay current. It is not good for business, and it is not good for an employee's sanity.

Employees can not stay current by taking a course periodically. Content distribution models (books and courses) can not keep pace with information and knowledge growth. Problems are becoming so complex that they cannot be contained in the mind of one individual—problems are held in a distributed manner across networks, with each node holding a part of the entire puzzle. Employees require the ability to rapidly form connections with

other *specialized* nodes (people or knowledge objects). Rapidly creating connections with others results in a more holistic view of the problem or opportunity, a key requirement for decision making and action in a complex environment.

Ultimately, whether online, face-to-face, or blended, learning and knowledge environments need to be democratic and diverse. A critical concept to keep in mind: the network and ecology must both be dynamic and capable of evolving, adapting, and responding to external change. The praxis level ensures that the personal learning network is relevant and current.

Unfortunately, many of our ideas, methods, and theories of learning “impede genuine practice of the attitudes and actions that should constitute lifelong learning”¹¹.

The challenge, and thereby opportunity, for educators and business leaders is the redesign of the spaces and structures of knowledge and learning. Where classrooms and courses fail, ecologies and networks succeed - due to greater alignment with societal changes and needs of learners and organizations. Rethinking learning is required to ensure that our educational system prepares learners for a bright future in complex knowledge landscapes, and prepares our employees for a competitive, constantly changing global workspace.

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- ¹ Gopnik, A. (2002). What children will teach scientists. In J. Brockman (Ed.), *The next fifty years – Science in the first half of the twenty-first century* New York: Vintage.
- ² Toffler, A., & Toffler, H. (2006). *Revolutionary wealth* (p. 313). New York: Alfred A. Knopf.
- ³ Oblinger, D., & Oblinger, J. (Eds.). (2005). Is it age or IT: First steps toward understanding the net generation. In *Educating the Net Generation* Retrieved September 1, 2006, from <http://www.educause.edu/ir/library/pdf/pub7101b.pdf>
- ⁴ Gleick, J. (1987). *Chaos: The making of a new science*. New York: Penguin Books
- ⁵ Santa Fe Institute (2006) is a leading research lab, focusing on complex adaptive systems. Their mandate: “The Santa Fe Institute is devoted to creating a new kind of scientific research community, one emphasizing multidisciplinary collaboration in pursuit of understanding the common themes that arise in natural, artificial, and social systems. This unique scientific enterprise attempts to uncover the mechanisms that underlie the deep simplicity present in our complex world.” (§ 1). Retrieved September 1, 2006, from <http://www.santafe.edu/>
- ⁶ Rocha, L. (1998). Selected self-organization. In S. Salthe, G. Van de Vijver, & M. Delpo (Eds.), *Evolutionary systems: Biological and epistemological perspectives on selection and self-organization* (pp. 341-358). Retrieved September 1, 2006, from <http://informatics.indiana.edu/rocha/ps/ises.pdf> Luis Mateus Rocha presents self-organization as “the spontaneous formation of well organized structures, patterns, or behaviors, from random initial conditions” (p. 3).
- ⁷ The concept of knowledge resting in non-human appliances (mediated by artificial intelligence or directed by intelligent agents) is controversial. As with the discussion on context-games, how one defines knowledge largely determines whether one will accept this definition. As mentioned in the preface, I have largely avoided the use of the word *information* in this text. It could be well argued that all knowledge is simply varying shades of information, and information itself is transformed into knowledge when we have a personal relationship with it (i.e., we internalize information). This discussion, from my perspective, is unnecessary for the purpose of this book. In order to have any practical discussion of information and knowledge, we need to discuss it as if it is something that a) describes some aspect of the world, and b) something on which we can act. This simple definition provides the basis for viewing knowledge as being able to reside in non-human appliances.
- ⁸ Gates, B. (2005). *What’s wrong with U.S. high schools—and how we can make them better*. Retrieved September 1, 2006, from <http://www.eschoolnews.com/news/showstory.cfm?ArticleID=5586>
- ⁹ Samuel Johnson sound bite page. (2006). Retrieved September 1, 2006, from <http://www.samueljohnson.com/twokinds.html>
- ¹⁰ Romesin, H. M., & Bunnell, P. (1998). Biosphere, Homosphere, and robosphere: What has that to do with Business? *Society for Organizational Learning*. Retrieved September 1, 2006, from <http://www.solonline.org/res/wp/maturana/index.html>
- ¹¹ Vaill, P. B. (1996). *Learning as a way of being* (p. 30). San Francisco, CA: Jossey- Bass.