Towards a Federated Framework for
Self-evolving Educational Experience Design on Massive Scale (SEED-M)

an expanded and updated version of the draft submitted
to the Knowledge Federation 2010 workshop,
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Abstract

If humankind is to pass its evolutionary test by meeting its global crises, (Nautilus Institute, 2009) also referred to as the "world problematique" (Meadows, 1972), it needs to grow competence in collective sensemaking, self-reflexivity, and meaning-sharing, which are essential conditions for awakening its collective intelligence and ultimately, its self-awareness and sentience.

The art and sciences of knowledge federation (KF) are pivotal enablers to accessing the lower levels of that ladder. Before we can step on rungs of collective sensemaking and self-reflexivity, KF has to help meeting the challenge of the fragmentation of knowledge relevant to the global crises. We can transcend that fragmentation only by the massive cooperation of all concerned. Given the scope of the crises, we are all concerned parties. In these conditions, for the scope of a knowledge federation project to be commensurate with the scope of the challenge, it has to transcend academia and include it in a social learning journey with mass participation.

In this paper, we propose to outline a framework for prototyping a federated, Self-evolving Educational Experience Design on Massive Scale (SEED-M). In section 2, we introduce the SEED-M distinction, and in sections 3 to 8 situate it in the context of social learning theory. Sections 9 and 10 are focused respectively, on issues of collective self-reflexivity and what it will take to prototype a SEED-M. The final; chapter is an outline of some issues for further research.

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The structure of the paper consists of the following sections.

1. Motivation and Contexts

The motivation of writing this paper and the contexts to which it intends to contribute are two-fold. They are to:

(1) Enhance the pedagogy of educational programs that involve social learning on a massive scale, and the methodology of designing such programs
(2)   Outline a framework for prototyping a program designed to improve collective sensemaking and self-reflexivity in organizations and social movements (as pre-requisites to a global learning society)
(3) Start mapping critical issues in the Innovation Architecture of designing a collective intelligence portal

2. What Is in the SEED-M Meme?

A "Self-evolving Educational Experience Design on Massive Scale" is pretty mouthful and needs to be unpacked to let us appreciate its richness. We define a SEED-M as an educational program, but not an instructor driven course. "Self-evolving," in our context, refers to the fact that "fresh strategic and design thinking is periodically brought to bear in a way that opens up unforeseen opportunities and benefits," (Veltrop, T.) within an action-focused collaborative learning experience.

"Self-evolving" is also a member of a family of distinctions that collectively describe "generativity", a term used in organization design, as well as in community development strategies. Other members of the family will be introduced in the prototyping section.

When the "self-evolving' distinction is applied to Educational Experience Design, it also implies learning that is transformational, not simply adding new information to our knowledge but transforming and evolving our capabilities and consciousness, individual and collective. A SEED-M involves massive participation, up to thousands or tens of 1000 people who may or may not belong to the same organization or community, but whose measure of success includes the augmentation of their collective intelligence capabilities.

3. Collective Intelligence

Just as any complex phenomena, "collective intelligence" (abbreviated as CI) can be looked at through many lenses and doing so, we will discover different meanings defined by their discipline-specific context or scope. The scopes that are particularly relevant to the intent of this writing are the evolutionary, socio-semantic, and cognitive. The sections below are an updated version of the corresponding sections of the Working Paper on Collective Intelligence and Collective Leadership: Twin Paths to Beyond Chaos (Pór, 2008).

Evolutionary scope of collective intelligence

"Collective intelligence" refers to the capacity of human groups of any size to evolve towards higher order complexity and harmony, through such "innovation mechanism" triads as variation-feedback-selection, differentiation-integration-transformation, and competition-cooperation-coopetition.

Evolution may not have a goal, but its direction towards higher order complexity is widely observed and popularized by systems theory and the sciences of self-organization and complex adaptive systems in biology, economics, politics, language and management. Evolution is the unfolding of social holons in that direction, thanks to the innovation mechanism mentioned earlier. Thus, the evolution of any social holon— be it an organization, a social system or movement, or humankind itself—entirely depends on its capacity to harmonize its innovation mechanism triads.

One can also look at evolutionary CI as a repertory of high-level, compound capabilities. Through that lens, this is what can be seen: "The capability of a collective/social system to hold questions and language too complex for any individual intelligence to hold, and to work out strategies, visions, goals, and images of a desired future, etc." (Voldtofte, F. 1997)

The evolutionary scope is our broadest context for understanding CI. Continually increasing its evolutionary CI is vital to the sustainability and thriveablity of any social holon in the conditions of accelerating changes in its habitat. Future-responsive governance systems steers adequate attention and resources to boost the group's evolutionary CI, which is needed to match the increasing complexity in its social environment.

Socio-semantic scope of collective intelligence

The concept of socio-semantic CI is derived from the Social Semantic Web that "subsumes developments in which social interactions on the Web lead to the creation of explicit and semantically rich knowledge representations. The Social Semantic Web can be seen as a Web of collective knowledge systems, which are

able to provide useful information based on human contributions and which get better as more people participate." (Gruber, 2006)

Based on the above, we define the socio-semantic scope of collective intelligence as the one, in which social, conceptual, and technological systems co-evolve over time. When their interaction is designed for high synergy, it can power up the cognitive scope of CI.

To realize that possibility, the commons (and other social holons) interested in boosting their CI need to develop collective sensing and meaning-making organs and processes. For example: Mahatma Gandhi, discovered and appreciated that one cannot build a social movement without a newspaper that acts as a mirror and a catalyst to its collective consciousness. His visionary genius today, would inspire the creation of socio-semantic web platforms for the commons to grow collaborative problem-solving and co-creation capabilities.

Cognitive scope of collective intelligence

"The expression 'collective intelligence' relates to an extensive body of knowledge and thoughts concerned with several objects that have been diversely labeled: distributed cognition, distributed knowledge systems, global brain, super-brain, global mind, group mind, ecology of mind, hive mind, learning organization, connected intelligence, networked intelligence, augmented intelligence, hyper-cortex, symbiotic man, etc. Notwithstanding their diversity, these several rich philosophical and scientific contemporary trends have one feature in common: they describe human communities, organizations and cultures exhibiting 'mind-like' properties, such as learning, perceiving, acting, thinking, problem-solving, and so on." (Lévy, 2003a)

"Intelligence refers to the main cognitive powers: perception, action planning and coordination, memory, imagination and hypothesis generation, inquisitiveness and learning abilities. The expression 'collective intelligence' designates the cognitive powers of a group." (Lévy, 2003a)

The cognitive scope of CI outlined in those quotes describes a model of CI, which is, in reality, never acting alone, without the collective emotional and spiritual intelligence.

"[E]mphasis on cognition does not intend to diminish the essential roles of emotions, bodies, medias, sign systems, social relations, technologies, biological environment or physical support in collective intelligence processes. The study of collective intelligence constitutes an inter-discipline aspiring as much to a dialogue between human and social sciences as with the technical, artistic and spiritual traditions. Its goal is to understand and improve collective learning and the creative process." (Lévy, 2003b)

Seen through the evolutionary, socio-semantic and cognitive scopes, augmenting CI calls for meeting different requirements in each three of them. In this paper we use the term mostly in its socio-semantic and cognitive scopes

4. Social Theory of Learning

The social theory of learning and theories of social learning are two different but inter-related scopes. The first is generated from the examination of the sociological contexts, in which learning and education happen. The second is more practice focused. It includes how groups adapt their learning practices to, or drive changes.

The exploration of a social theory of learning has to precede the theories of social learning, because the scope of the first can illuminate the issues, and help identifying gaps, in the second. A particular social theory of learning, developed by Etienne Wenger, describes the emergence such trends as the "horizontalization of learning" and "partialization of learning imperatives." Understanding both of them seems to be crucial to the success of design thinking about massive social learning.

"Horizontalization of learning: a shift in our a view of knowledge communication that emphasizes less the vertical relationship between a producer and a recipient and more horizontal interactions required for the negotiation of mutual relevance.

Partialization of learning imperatives: the complexity of knowledge domains creates relationships of interdependence so that learning increasingly means being part of broader systems and learning to participate productively rather than mastering everything oneself." (Wenger 2004)

We can observe the first trend in-action in the various forms of peer-to-peer learning, knowledge networks, communities of practice, and collective self-education in contemporary protest movements. The second trend, the partialization of learning imperatives, is expressed in the functional alignment and requisite complementarity of knowledge domains in modern organizations as much, as among the working groups of the General Assembly in the big cities of the world, where the Occupy movement is active.

Wenger's theory postulates a "curriculum of meaningfulness," of which he identified the following 7 dimensions. (Wenger, 2004) We quote below all 7 of them because each can serve as a useful, generative starting point to the design conversation. To encourage that conversation, we inserted some starter questions under each dimension of meaningfulness in the group members' experience, in italics.

"**Experience of localized depth.** Going deep into some learning, into the practice of a specific community and get a good sense of what full membership is. Experience learning with others in the context of a community. Get far enough to experience peer-to-peer learning with masters of the practice."

How to map the depth of knowledge available in and to a specific epistemic, professional, or activist community, without diminishing its richness or getting lost in its details?

"**Experience of boundary crossing.** Interaction across a boundary through engagement in a shared task that forces cross-boundary negotiation."

What knowledge federation tools can support communication, collaboration, and coordination of action across working groups of dissimilar working style and taxonomies?

"**Experience of time depth.** Reach an experience of "flow" by being fully present and creative in an activity."

What structural and interface characteristics of KF tools and processes are required to facilitate the "flow" experience of the group members?

"**Experience of time dislocation.** Engage in a substantial contact with a different generation as a vista onto history or onto the future."

In which ways can KF promote intergenerational learning in professional and political settings?

"**Experience of cultural dislocation.** Immersion in a different culture with a different discourse of the self."

How can KF mediate the negotiation of meaning across individuals and groups of dissimilar culture?

"**Experience of agency and power.** Make a personal difference somewhere; not necessarily a great success in abstract terms; have an effect on the world that is experienced as personally significant."

Can KF be used for the collaborative development of common indicators and metrics for assessing successful completion of action in complex situations that involve multiple parties?

"**Experience of scale**. This may be the most difficult to imagine and to achieve in practice. Hence its place last. Gain an appreciation of a full learning system in which one is personally involved by traversing the fractal at multiple levels of scale. Learn to find the community structure. Understand in as direct a way as possible how the levels constitute each other and how the various functions are effective across these levels (performance, governance, institutionalization, social fabric, personal trajectories)."

What tools and methods can KF offer to support the visibility and intelligibility of all parts of a social whole to each other to gain a global view of events while engaged in intense local action?

It will not be possible to answer all those questions in the scope of this paper. Their function is purely to stimulate further design conversation of researchers with organizational professionals and movement activists, and inform/enrich the perspective we hold to the KF-enhanced design of massive educational experience.

Wenger's *social theory of learning* has in its center of gravity the individual's learning experience. A *theory of social learning* would postulate that social learning cannot be subsumed by or reduced to the sum of individuals learning.

If a SEED-M is to boost the *collective* intelligence of social actors/learners, we need to transcend the 7 dimensions of individual meaningfulness and include them into what is a deeply meaningful learning experience for a community, an organization, or a social movement as whole. It is that shift of perspective that our questions above intended to promote.

We can even put the bar higher and aim for a SEED-M that represents a meaningful learning experience for society itself. (We will further explore that possibility when exploring the "runaway object" experience in wildfire-type social learning.)

5. Biomimicry-inspired Learning Theories

The delivery of federated SEED-M, as any breakthrough innovation, will face non-trivial challenges. To make them more manageable, we will turn for guidance and inspiration to the design principles and strategies of nature and her 3.8 billion years of brilliant track record in ecosystem design.

We hold the task co-creating SEED-M in the broader perspective of designing biomimicry-inspired knowledge, social and technical ecosystems to augment collective intelligence in human communities at increasing scale. The study of biomimicry helps discovering ways, in which the common features of biological and social complex adaptive systems can provide guidance to augment collective intelligence in the latter, based on biological patterns worth repurposing.

"Biomimicry follows Life's Principles. Life's Principles instruct us to: build from the bottom up, self-assemble, optimize rather than maximize, use free energy, cross-pollinate, embrace diversity, adapt and evolve, use life-friendly materials and processes, engage in symbiotic relationships, and enhance the bio-sphere. By following the principles life uses, you can create products and processes that are well adapted to life on earth." (Biomimicry Guild)

Each and every one of the life principles enumerated by biomimicry contains significant guidance information for the development of SEED-M, which need to be paid attention to and unpacked during the prototyping.

So far, biomimicry has been used primarily in industrial design and the development of new materials, based on biological patterns that can be repurposed in industrial contexts. As biomimicry expands from product and process design to affect the design of social, knowledge, and technological ecosystems, a new question arises: What can we learn from nature's ecosystems, which would provide useful metaphors and models for the federation of knowledge in the co-creation of SEED-M, as social and learning ecosystems?

That question and the following ones are to be addressed to systems biology. Systems biology is a biology-based inter-disciplinary study field that focuses on complex interactions in biological systems and modeling and discovery of their emergent properties. The systems studied range from cells to ecosystems and the Earth's biosphere as whole. It is systems biology's discoveries about the living ecosystems, which is of particular interest to SEED-M research.

"Systems biologists expect progress in the field to yield explanations of biological systems exploitable for applications in ecology, ethology, medicine, agriculture, business, the environment and technology — and to a considerable extent it has already done so." (Systems biology, 2011)

That's the basis, on which we can expect that an inter-disciplinary collaboration between systems biologists, on one hand, and knowledge federators and others engaged in Seed-M work, on the other hand, can generate explanations exploitable for applications in knowledge ecosystem design.

What kind of **metadata** about the knowledge ecosystem of a SEED-M will have to be recorded and represented so that it can support the collaborative intuition and meaning-making of the participants? To what extent is prediction in emergent social and learning systems possible?

What type of **predictions** can be made about the SEED-M ecosystem's likely behaviors in response to particular conditions?

To start exploring those questions, we will review two social learning frameworks inspired by systems biology: connectivism and wildfire learning.

6. Connectivism

6.1 What it is

"Connections are to learning as atoms are to the physical world…" (George Siemens)

Connectivism is a learning theory or "only" a pedagogical view, depending whether we consider the position of his proponents or critics. The latter ones argue that "learning theories should deal with the instructional level (how people learn) but that connectivism addresses the curriculum level (what is learned and why it is learned)." Connectivism (learning theory). In: Wikipedia.

There are various definitions in the literature of what is a learning theory. However, on the basis of the one above, we classify connectivism both as a learning theory, and a pedagogical view because the "how" (learning patterns) became intricately interwoven with the "what" (curriculum) and "why" (motivation).

That closely coupled interdependence is largely due to the impact of the new means of learning and teaching, which help turning the learning community become both the inventor of learning patterns and an important source of educational innovation.

"Connectivism is the integration of principles explored by chaos, network, and complexity and self-organization theories. Learning... is focused on connecting specialized information sets, and 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 information is continually being acquired. The ability to draw distinctions between important and unimportant information is vital." (Siemens, 2005)

In the context of networked learning, of which connectivist learning is a specific case, the ultimate decision about what is important to learn rests with the individual learner. However, her ability to decide that question in a future-responsive way is contingent on the richness of her relationship with the network. That's because the more alive and meaningful that relationship is, the better chances she has to learn from her future learning trajectory, as it is emerging from the combination of her motivation and changing pattern of learning paths available to her.

In a sense, KF researchers are networked learners, and the story of writing this paper illustrates that point. We have a dozen or so questions about connectivism, but we've picked those to work with her, which promised to make my contribution to the KF workshop in Dubrovnik (2010) more valuable to our collective learning. In addition, our decision about what is important to include in the paper was strongly influenced by another field-dependent factor: our perception of what may stimulate some form of a self-reflective action research in the field of KF.

6.2 Rhizomatic education: community as curriculum

One of the philosophical roots of connectivism is in the postmodernist theory characterized by skepticism towards any global cultural narrative. The possibility of augmenting global-scale collective intelligence, of which KF is a critical enabler, is part of such narrative. That shouldn't prevent SEED-M from engaging postmodern educational theories, transcending their limitations and building on their achievements. Below, I provide some examples for the later.

"A botanical metaphor, first posited by Deleuze and Guattari in A Thousand Plateaus (1987), may offer a more flexible conception of knowledge for the information age: the rhizome. A rhizomatic plant has no center and no defined boundary; rather, it is made up of a number of semi-independent nodes, each of which is capable of growing and spreading on its own, bounded only by the limits of its habitat." (Cormier 2008b).

The limits of habitat for a federated SEED-M are represented by requirements of the institution offering the program whether for-credit or not. Within those limits, the rhizomatic organization of a federated SEED-M may seem to be an oxymoron but it is not. The skillful combination of the two approaches can be accomplished, using polyscopic design methodology (Karabeg, 2003), wherein the rhizome and knowledge federation represent two different but compatible scopes of SEED-M.

"It's a connection of intertwined roots underground, with big leafy stalks that pop up wherever it might be convenient to grab the sunlight. There's no precise centre, no 'central' plant that you can kill to get rid of it all… just a network of leaves and roots that suck up nutrients where available and deliver them to the rest through whichever root/stalk is nearby. It's an incredible survivor and very much has a mind of it's own. (Cormier, 2008a).

"Knowledge seekers in cutting-edge fields are increasingly finding that ongoing appraisal of new developments is most effectively achieved through the participatory and negotiated experience of rhizomatic community engagement. Through involvement in multiple communities where new information is being assimilated and tested, educators can begin to apprehend the moving target that is knowledge in the modern learning environment." (Cormier, 2008b)

What if we considered that the more educators participate in multiple professional learning communities, the more they become federated knowledge products? What new questions could that statement give us access to about the process and relationships of federated pedagogy?

We construct our professional identity through belonging to various communities of practice. That multi-membership belonging is especially important when it comes to the designers and participants of SEED-M. Observing how we federate our knowledge and scopes in developing and participating in such educational

program (and comparing notes about them), is a good example of experientially grounded connectivist learning and teaching.

6.3 Principles of connectivism

The tenets of connectivism are outlined in a George Siemens seminal paper of 2005. Here we recap only the ones that seem to be the most directly relevant to the development of federated SEED-M.

"Learning is a process of connecting specialized nodes or information sources... Nurturing and maintaining connections is needed to facilitate continual learning." (Siemens, 2005)

Transformational learning, as an evolutionary experience defined earlier is about upgrading our mental models of reality, which can be served by discovering or creating patterns that connect the nodes, the building blocks of connectivist learning. If learning is connecting, in that sense, then the federated SEED-M should provide the learners with ample opportunities to map nodes and links, as well as to observe and interpret the pattern of connections emerging from those maps.

"Ability to see connections between fields, ideas, and concepts is a core skill." (Siemens, 2005)

More than a skill, it is a complex and compound ability comprised of at various similarly complex competences such as situational awareness, mental modeling, and sensemaking. The ability to see connections between fields, ideas, and concepts is central not only to connectivist learning but also to develop and participate in SEED-M programs. Therefore the designers of such programs must be fluent in using the distinctions, tools, and methods for enhancing the learners' competences making up that ability.

In the next sections, we'll examine some relevant patterns of enrollment, teaching and learning in connectivism.

6.4 Enrollment

Open Online Course

One of the favorite and most publicized enrollment models in connectivist education is the "open online course" (OOC) "considered to be a special type of OER [open education resource], which solves the problem of the lack of interaction that is typical of most OER initiatives. While OERs are merely content, OOCs are live courses, which include direct participation of teachers and rich and valuable interaction among participants." (Fini 2009)

Neither OER, nor OOC is addressing the scope that KF inhabits, namely to bring together sources of knowledge that pertain to a subject and coherently organize them. Yet, OOC seems to be an appropriate enrollment model for federated SEED-M because its open character would let the learners create and access a larger pool of shared knowledge needed for a KF leaning agenda than what would be possible under more traditional, academic-only enrollment.

Massive Open Online Course

A special case of OOC is the Massive Open Online Course (MOOC), where the very large number of learners changes some of the course's characteristics, including what is provided by the instructors and what the learners themselves are supposed to provide for themselves.

The MOOC that attracted the largest enrollment, at the time of writing this paper, was the "Connectivism and Connective Knowledge" credit course offered by George Siemens and Stephen Downes in 2008 at the University of Manitoba, which was also offered for free to any person interested.

"We believe that the connectivist model employed in this course might offer a unique approach to the problem of scalability. We could not, nor did we try, to provision everything that was needed for 2200 students. Rather, we created conditions, and encouragements, where participants would provide additional resources for themselves. The role of the instructors and facilitators is essential in this model, but this role is not to provide solutions but rather to establish a basic structure." (Downes, 2009)

Given that SEED-M stands for "Successful Evolutionary Experience Design on Massive Scale," the lessons learned from MOOC courses can be a useful source of information in creating the infrastructure and teacher/learner relationship in our knowledge federated programs, too.

6.5 Curriculum

"Though there may be a central theme or structure offered by the facilitators, there is no particular body of knowledge or information expected to be acquired by learners; rather, learning occurs as a result of interaction and participation in the distributed community, completion of authentic tasks within that environment, and the growth and development of the learner's own capacities as a consequence. The course design, therefore, is that essentially of a community of learners who are learning to learn." (PLENK10 Consent Form)

The "no curriculum" structure of the connectivist course in question still had 10 weekly themes and corresponding resources and two web-conference sessions per week, to which any course participants could sign up. What is different from a content-driven e-learning course is the large extent, to which learners must be self-directed to succeed in that learning environment. It is well suited to professional learning networks and communities of practice but we don't expect it replacing more traditional forms of adult education anytime soon.

In the context of of SEED-M, the learning community itself being the only curriculum would not be acceptable given that measure of success in that type of programs includes the augmentation of the participants' collective intelligence capabilities, which is not a concern of MOOC. A SEED-M transcends the "community as curriculum" approach and includes it in a broader curriculum that also borrows from learning units from the arts and sciences of collective intelligence.

"Courses provide context that makes us more 'disciplined' then we would be by ourselves: pushing to learn things we would never consider important, doing assignments to articulate silent ideas or connect loose ends, initiating brainstormings that should lead to some tangible results and not only random thoughts. Courses provide structure to make learning about complex things easier." (Efimova, 2003)

Depending on the target audience of the federated course, its curriculum design and pedagogy have to take into account how much its participants are anticipated to be self-directed learners vs. needing more guidance to the choice of materials to study. In addition, SEED-M recognizes and leverages the transformational potential present in MOOC as an accidental side effect.

6.6 Connectivist learning patterns

Connectivist courses are, typically, based on four main patterns of learning activity labeled as Aggregate, Remix, Repurpose and Feed Forward. (Downes, S.: 2010) They will also serve learners of federated SEED-M, along with a number of other activities.

Aggregation is about the learners' picking and choosing content of interest to them from a large volume of heterogeneous content sources provided by the learning facilitation team. In the context of a federated SEED-M, this pattern should be accompanied by guidance information about the federation process itself.

Remixing refers to the learners' keeping track of what they accessed, by some kind of private or public record of it, which can be a Word file, a blog, a wiki page, a forum post, or even a series of tweets. The

heterogeneous nature of the wide variety of accepted recording formats and media fosters the use of what the learners feel the most comfortable with.

While that is convenient to the participants as content providers, it makes more cumbersome their experience and content receivers, unless a large team of content curators creates superstructures of indexing and summarizing of the content residing in the heterogeneous recording formats. To overcome that challenge in a SEED-M, participants are encouraged, and supported by a sophisticated, contextual help system, to use the program's knowledge ecosystem, including its community knowledge garden and fora, as their primary device for content creation and access.

Repurposing is the label chosen for the learners' creating new content based on the materials they accessed and listed, using the tools demonstrated by the learning facilitators. That's the most creative act of the learning process. In a SEED-M, it is played out continually so that one person's or working group's re-purposing output becomes input to other participants' and groups' aggregation.

The "Aggregate-Remix-Repurpose" cycle is consistent with the "reversed e-lecture" concept that we presented to the Program on Social & Organizational Learning at George Mason University, in 1997, in the syllabus of a suggested learning expedition into "Collaborative meaning-making in virtual communities:"

1. Instructor "seeds" the knowledge ecosystem with initial content, a large number of carefully selected online references relevant to the students' chosen inquiry-focusing questions.

2. Building on their finds, students develop their own e-lectures, in solo or with colleagues. Unlike a conventional e-lecture posted by the instructor, this "reversed e-lecture" will be comprised of: (a) a large set of quotes from a wide variety of sources, pertinent to the territories and goals of the suggested hypertextual learning expedition, and (b) invitations to the students to discover and identify web-like patterns of meaningful connections in the seed content

3. Students post their lectures. Students share their discoveries by: (a) posting their e-lectures that contain hyper-trails and webs of quotes, that they built in the knowledge ecosystem, complete with their annotations and commentaries, and (b) engaging in conversation about them.

4. Instructor provides a menu of focusing questions; Students choose and organize themselves for collaborative inquiry. The focusing questions will be provided from the perspective of evolutionary social science and "emergence" frameworks. They will be oriented towards 'real world' applications of the students' findings. The instructor will make available, through the expedition's web pages, a small, initial set of electronic and conceptual tools and methods for collaborative meaning making.

5. Students gather around an electronic campfire of the virtual base camp to share the "bounty." The "bounty" is the meaning (new purpose) emerging from the network of conversation that made up the Expedition.

In 1997, that "reverse lecture" process design was still out of line even with an innovative academic program's "collaborative learning" orientation, and the syllabus did not get accepted by the faculty. However, only three years later it was already recognized: "Students, acting as co-initiators and organizers of their knowledge acquisition, have more profound learning experiences than are possible through conventional teaching approaches." (Scharmer & Käufer, 2000)

Feeding forward is providing the repurposed materials, including the learner's refection about them, to other learners (current and future) and the world at large. It is an optional activity but encouraged in MOOC programs.

In a federated SEED-M, the "feeding forward" pattern will need to be generalized as to enhance learning knowledge federation by doing it, and also, to contribute to the transformational learning of the participants and their groups, by fueling their co-evolution with the larger organization, community, or social movement, in which they are embedded.

7. Wildfire Learning

Connectivism is not the only approach to social learning that builds on botanical metaphors. A close but noteworthy cousin of it is what's known as "wildfire learning" inspired by the work of Yrjö Engeström. Writing about the mycorrhizae, he described it and his reason for differentiating it from the rhizome as the key metaphor of his social learning theory, as follows.

7.1 The mycorrhizae metaphor

"I use it much in the same general sense in which Deleuze and Guattari (1987) proposed the concept of 'rhizome'. They wanted to highlight the importance of horizontal and multidirectional connections in human lives, in contrast to the dominant vertical, tree-like images of hierarchy. Originally a biological concept, rhizome refers to a horizontal underground stem, such as found in many ferns, where only the leaves may stick up into the air. As such, I find the implications of 'rhizome' too limited. I am more interested in the invisible organic texture underneath visible fungi. Such a formation is called 'mycorrhizae' (see Allen, 1991, Sharma & Johri, 2002). It is a symbiotic association between a fungus and the roots or rhizoids of a plant... Mycorrhizae can be dormant for a long time and then get active and live again, like 'wildfire'." (Engeström, 2007a)

If the plant represents the vertical dimension, or the "tree-like images of hierarchy" and the mycorrhizae as the "invisible organic texture underneath the visible fungi," then their symbiosis suggests interesting possibilities for the combinations of more and less formal ways of learning in organizations and communities or networks.

We experience the dormant mycorrhizae each time when we stumble upon a passionate online exchange that happened a couple of months or even years ago, then died down for whatever reasons, but still inspires us. Adding to it our ideas may reignite the dormant conversations with the same or different participants. Enabled by HTTP, RSS, and other connectivity protocols, such re-activated conversations can, indeed, spread like the wildfire, particularly if the conditions for spontaneous combustions are present. (Pór, 2010)

The wildfire-like re-ignition of dormant webs of conversations doesn't depend only on the chance of stumbling upon them. For re-ignition to happen and the subject to go viral, it has to hit a nerve in the collective nervous system of the netizens, in their loosely coupled webs of conversations. If the participants in a SEED-M happen to be connected by shared purpose, the spontaneous combustions of interests necessary to such re-ignition is more likely to occur.

Knowledge federation, the systemic build-up of all relevant knowledge pertinent to a subject, will benefit from the power of mycorrhizae if it finds a way to marry the seeming opposites: the uncontrollable creative energies of wildfire-like mycorrhizae communities and the architectural structures and processes needed to make relevant knowledge easily findable and navigable. The key to that, we assume, is in the polyscopic methodology of the design. That key can be best understood with the help of the concept of "designing for emergence": the art of sustaining a dynamic balance of deliberative design and self-organizing emergence, by consciously building the conditions in the SEED-M, which are the most favorable for fostering emergence.

7.2 Wildfire activities

 Wildfire activities can be characterized by the following 10 traits (compiled from the writings and presentations by Yrjö Engeström:

• **Mycorrhizae communities** blaze embodied and lived cognitive **trails** and social bonds that make the terrains knowable and livable, using the mechanism of **stigmergy.** (Stigmergy, 2011) Activities that seem to cease in a given location may reappear somewhere else.

• **Swarming** crosses boundaries and ties knots between actors operating in fractured and often poorly charted **terrains.**

• **Multi-directional pulsation** refers to star-like patterns of movement where the participants disperse outward to pursue their various trails and to expand the scope of the mycorrhizae, but also return and come together in various ways to contribute to the forging of a runaway object.

• **Collectively constructed concepts** stabilize the trails and may serve as platforms for expansive restructuring of the activity.

• Actors experience **high-stake personal involvement**, risks, critical conflicts, and shifts of identity.

• Co-configuration is negotiated by **knotworking** — tying and untying knots. Collaboration between partners is vital but takes shape without rigid predetermined rules or central authority... Such a formation typically does not have strictly defined criteria of membership. But its members can be identified by their **activism** .

• Combining quick **improvisational** adaptation and long-term **design** occur in real-time.

• **Holoptic monitoring** [the visibility of the whole to all parts and vice versa] is oriented toward gaining a global view of events while engaged in intense local action.

• A mycorrhizae formation resembles to the ''**flow architecture** ' described by Knorr-Cetina (2003, p. 8) as "a reflexive form of coordination that is flat (non-hierarchical) in character while at the same time being based on a comprehensive summary view of things – the reflected and projected global context and transaction system."

• **Runaway objects** typically have the potential to escalate and expand up to a global scale of influence. They are objects that are poorly under anybody's control and have far-reaching unexpected side effects.... They can also be powerfully emancipatory objects that open up radically new possibilities of development and well-being, as exemplified by the Linux operating system... (Engeström, 2007, 2009) (- boldface added - GP)

Similar to the relationship of SEED-M and the life principles identified by biomimicry and quoted earlier, here too, each and every one of the wildfire activities sketched out above has to be taken into account for getting the best results when designing a large-scale transformational learning experience with collective learning outcomes.

7.3 The SocialLearn Project

Open University in the UK has been experimenting with incorporating some elements of wildfire learning in formal academic education. In his update on OU's SocialLearn project, Simon Buckingham Shum introduced it as "learning that motivates digital support for shareable, improvable, conceptual artifacts." The KMI at OU, in collaboration with Google and the Drupal community, is prototyping a technical platform that is intended to support wildfire learning.

What is an equally promising development is the beginning outline for the pedagogical framework that can be tested on that prototype. It is taking into account such constructs of wildfire learning as inquiry, trails, history, consolidation, argument, landmarks, places and exploration.

The SocialLearn Project's pedagogical framework builds on such educational primitives as learners and

educators engaging in:

1. asking and answering questions, posting a supportive or challenging comments, and adding resources to enhance contributions

2. building a learning path to help answer a question, by: adding resources to enhance any step, adding activities to build/assess learning, adding reflection points to help consolidate learning, forging new paths from existing paths, forging meaningful connections between any question, step, and path.

Adding learners to that the network of concepts, Shum was pointing to a socio-semantic space and approaching it from the direction of the conceptual/semantic space.

The same space can be also described in terms of two layers of the Innovation Architecture (Pór, 2005), which integrates social, knowledge, wealth-creation and technology layers. The Innovation Architecture can accommodate and build on Shum's social-conceptual network, and as a conceptual framework for creating a the community knowledge garden of SEED-M, as a modern-day version of the Dynamic Knowledge Repository (Engelbart, 1992)

8. Crowd-Accelerated Innovation

8.1 Turning up three dials: crowd, light, desire

There's a new social learning theory is emerging, as we speak, based on the social learning practices of the global Technology, Education, Design (TED) community. We call it "Crowd-Accelerated Innovation" theory, using the term introduced by Chris Anderson, the principal Curator of TED. The essence of its "crowd - light - desire" model of globe-spanning learning collaboration is presented in the following quotes and images from Anderson's video talk.

"There are just three things you need for this thing to kick into gear. You can think of them as three dials on a giant wheel. You turn up the dials, the wheel starts to turn." (Anderson, 2010)

"And the firs thing you need is ... a crowd, a group of people who share a common interest. The bigger the crowd, the more potential innovators there are. That's important, but actually most people in the crowd occupy these other roles. They're creating the ecosystem from which innovation emerges. (Anderson, 2010)

More than a faceless "crowd," the TED ecosystem is a global community that organized hundreds of local and regional TED conferences organized in more than 80 countries, besides the annual, official TED events attended by 1000s of participants from a very wide diversity of disciplines and cultures. The common values of that community is seeking a deeper understanding of the world, and wanting to turn that understanding into a better future for all.

What is remarkable in the crowd-accelerated learning is the importance of the various roles played in its ecosystem. The roles repertory and nomenclature are still evolving but, there are already some that can be discerned as played by a growing number of learners, such as: conference organizers/hosts/facilitators, connectors, and amplifiers. We can understand them better by looking at them from a conceptual framework for online identity roles (Miemis, 2010).

Some of those roles are also present in and around TED events, others will predictably gain more weight as the community is getting better connected to its parts through online means. The further study of various functional roles in the learning ecosystem of crowd-accelerated innovation will contribute to our understanding of this new type of division of labor in other social learning modes as well. Unlike the classic division of material labor that defines social actors by their fixed roles, this new distribution of roles is self-assigned and fluid.

"The second thing you need is light. You need clear, open visibility of what the best people in that crowd are capable of, because that is how you will learn how you will be empowered to participate. And third, you need desire. You know, innovation's hard work. It's based on hundreds of hours of research, of practice. Absent desire, not going to happen." (Anderson, 2010)

Thinking of SEED-M in terms of the three dials of Crowd-Accelerated Innovation, the "crowd" is a present in the "M," the "light" or visibility is brought into play by its holoptical pedagogy, and the "desire" is provided by the participants, who wouldn't have signed up for the program without it.

The second "dial" that this approach is turning up, light, is a metaphor for holoptic quality of the learning ecosystem, in which learners can see each other and the whole of the ecosystem. A holoptical space is a space in which each participant gets a live perception of the 'Whole.' Each player, thanks to his/her experience and expertise, relates to this "Whole" in order to adjust his/her actions and coordinate them with others' moves. (Noubel, J-F, 2011)

Turning up the "light" dial, increasing the global visibility of knowledge and practices worth replicating, in the TED's system of crowd-accelerated innovation, happens primarily through web video. The cycles of skills improvement and innovation is well illustrated with the story of Li'l Demon, a 6-yr old, who ignited a revolution in free-style solo dancing: http://www.youtube.com/watch?v=LnQcCgS7aPQ .

"Dancers have created a whole global laboratory online. Kids in Japan are taking moves from a YouTube video created in Detroit, building on it within days and releasing a new video, while teenagers in California taking the Japanese video and remixing it to create a whole new dance style." -- Jonathan Chu, quoted in (Anderson, 2010b)

Those dancers are a community of practice that spans continents, grown out from the love for their shared domain of practice. In a SEED-M, design of the experience and its enabling platform should be very attentive to the needs of easy formation and cultivation of domain specific communities of practice in the population of all participants, whether they are professional knowledge networks in an organization or and a free association of working groups of social movement, which are working on the same domain. E.g. the Economy Working Groups of the occupy movement General Assemblies in various cities.

Communities participating in crowd-accelerated innovation are held together by their shared passion to improve their practice. It's not unlike the medieval guilds, except that in a SEED-M nobody is from excluded, aspirants don't have to travel to far away lands to find a master. The secrets of their "craft" are wide open to anyone who can visit the TED site to pick a video from a collection of over 700, or search YouTube for clips of interest. The later is still a daunting task; the designer and facilitators of SEED-M will have to budget sufficient time/attention to curate video channels dedicated to the driving interest and common focus of program participants.

8.2 Is Crowd-accelerated innovation a social learning theory?

The scope we choose to look from at the world will define what we can see. What is the scope worth choosing in response to such a question as: where to look for components to federate in a conceptual framework for designing federated SEED-M? One of the possible scopes comes from the distinction "theory." In pedagogical and other scientific contexts, it refers to "a comprehensive explanation of an important feature of nature supported by facts gathered over time." (US National Academy of Sciences, 2005)

The "crowd - light - desire" model does provide a comprehensive explanation of an important feature of the nature of social learning taking place in the global TED community. That explanation is not only comprehensive but, in Chris Anderson's presentation, expressed with beauty, eloquence, drama, suspense, dynamism, and engaging stories, qualities that are typically associated more with the arts than theory building.

We consider his presentation about crowd-accelerated innovation a case of polyscopic information, a postulate of which "stands for the 'artistic' value of information. It says that we need to apply the criteria which

are traditionally reserved for art and literature to all information." (Karabeg, 2004)

Including crowd-accelerated innovation as a social learning theory in federating those theories in the framework of SEED-M, we can enhance its polyscopic character. "It is also suggested how art and science are combined: Art expresses the high-level views, science justifies them. Art gives information a perspective, science gives it credibility and precision." (Karabeg, 2000)

The "three dials" of crowd-accelerated innovation provide a high-level view of how social learning is taking place in the TED community, and a perspective to look at it. The "three dials" conception's true potential for SEED-M can reveal itself only through using it in the design.

"This is a model that pretty much any organization could use to try and nurture its own cycle of crowd-accelerated innovation. Invite the crowd, let in the light, dial up the desire." (Anderson, 2010) In the right conditions, that cycle can represents a self-reinforcing feedback loop, i.e. a community, organization, or social movement, equipped with potent memes, can create visibility and fuel the desire to participate and, in turn, it can attract more people to the itself, which contributes to the same cycle at increasing scale.

When that happens, the conditions for wildfire learning and its "runaway object" are present. We know that "positive feedbacks do not have to lead to a runaway effect, as the gain is not always sufficient." (Wkipedia, Runaway greenhouse effect) However, the many-to-many platform of SEED-M also includes a variety of social media-based communication and collaboration tools, capable to trigger the runaway effect.

9. Federating Social Learning Theories

How can we federate the various social learning theories into a framework to guide the development and facilitation of knowledge-federated SEED-M? Not a simple question given that KF is not yet a well-rounded theory with an associated methodological base, so using it for organizing pedagogical approaches to benefit the design of federated SEED-M would be a challenge. This paper will not meet it but, at least, it will scope out some issues for preparing the terrain, on which a subsequent collaborative inquire may succeed.

9.1 Strong and weak social learning

All learning is social but when we talk about social learning we mean something more specific in a sense of a weak and a strong case. Weak social learning occurs in communities or networks of learners, strong social learning is a result of communities or networks that learns. In the first case, we talk about a collection of intelligences, where the individual is using the shared resources for the benefit of his own learning and development. In the second case, we talk about collective intelligence, where the result aimed for is capability development not only at the individual level but also at the scale of a group, organization or social movement.

Strong social learning is a co-creative quest for meeting problems or opportunities that affect a group or society, which requires collective sensing, intuition, meaning making, and other qualities of collective intelligence. "Intelligence refers to the main cognitive powers: perception, action planning and coordination, memory, imagination and hypothesis generation, inquisitiveness and learning abilities. The expression 'collective intelligence' designates the cognitive powers of a group." (Lévy 2003)

Strong social learning improves all of the above at the collective level, but cannot happen without weak social learning also occurring and benefitting the individuals. Only then will they develop the sense of 'ownership' of the learning process and its results, which is required for self-organizing action. That's why we explore in the next sections some of the social learning theories focused first on the individuals and the connections among them, rather then on learning by whole systems.

Having said that, it is also important to emphasize that the best chance for a SEED-M to yield multiple outcomes is, most likely, if it draws on and federates both kinds of social learning.

9.2 Holding a "federated SEED-M" lens to connectivist and wildfire learning

When educational technologists look at wildfire activities, they tend to ask, what tool set we need to develop to make that happen online? It's a good question but the response would have a longer shelf-life if it was preceded by some other questions that SEED-M designers, learning community facilitators, and knowledge gardeners may ask, such as:

• Can a SEED-M still be designed if the learners are self-organizing **mycorrhizae communities** ? How can the institutional context of a university marry and support large-scale innovation in social learning?

• How can proven "social process" technologies (e.g.: Appreciative Inquiry, the art cultivating communities of practice, Delphi Survey, World Café, Theory U) strengthen learning by **swarming** that crosses boundaries?

• If the typical learning in mycorrhizae communities is through a **swarming** engagement with **multi-directional pulsations**, then what tools and practices could effectively assist community members in identifying patterns that connect the meaning of their discoveries made in those different dimensions of leaning?

• What happens at the points of transition between a network architecture (connectivism) and a flow architecture (wildfire) of **learning process coordination**? What challenges could be anticipated if a SEED-M wanted to create a porous interface between them?

• What methods of software-embedded attention training can help **quick** improvisational adaptation **and long-term** perspective practiced concurrently?

• What social, epistemological, and technological factors foster and hinder the capacity of all participants in a SEED-M to see each other and the whole (**holoptic monitoring**), and to "gain a global view of events while engaged in intense local action" (Engeström, 2007a)?

• Given the heterogeneous nature of the wide variety of recording formats and media fosters that learners can use in connectivist courses, what federating architectures, tools, methods and practices would make **remixing** them in a federated SEED-M not only possible but also scalable and optimized for **repurposing** ?

• Under what conditions could the social value generated by the **feeding forward** cycle create the economic value needed to make sustainable the infrastructure, knowledge mapping and gardening, and facilitation services that the learning communities may need to evolve?

Those questions were inspired by two social learning theories: connectivism and wildfire. The systemic exploration of the questions and their underlying assumptions, in the context of prototyping a SEED-M, will pave the way to federating the two theories in an educational action drawing on them.

9.3 Designing for emergence: the role of living centers

Designing for emergence is the art of creating a dynamic balance of deliberate design and self-organizing emergence. Social learning frameworks tend to emphasize bottom-up, self-organizing construction of the learning experience, which is at odds with the pedagogical and organizational culture of most educational institutions. There is a creative tension waiting to be resolved and turned into a breakthrough, based on federating the principles and practices of deliberative design and self-organizing emergence.

"Bottom-up construction ... can be massively parallel, because the objects construct themselves... While bottom-up approaches have been extremely useful in biology, they haven't played as significant a role in technology, because we don't have a great grasp on how to design systems that build themselves... To understand how complexity can be programmed into bottom-up molecular fabrication processes, Winfree and his colleagues study and understand the processes--or algorithms--that generate organization not just in computers but also in the natural world... The DNA tiles will only form crystals if the process gets started by a seed, upon which they can grow." (News Staff, 2009)

What will be the equivalent to those seed crystals in the reconciliation of the connectivist or wildfire-like self-organization of learning communities with the more structured requirements for a SED-M??

One approach that holds some elements of the answer comes from Open University's socio-conceptual framework and its educational primitives, the simple, "atomic" acts, from which complex, shared learning processes may self-organize. Therefore, a research collaboration between the KF community and the OU's SocialLearn Project could be mutually beneficial, providing the first with an enabling tech platform and wildfire inspired pedagogy, and the second with direct access to advanced tools and methods for large-scale collective intelligence, as they emerge.

Another way to look at what can reconcile the creative tension between design and emergence is through the lens of what Christopher Alexander calls a living center. "The primary entities of which the wholeness structure is built are centers, centers that become activated in the space as a result of the configuration as a whole. Centers typically have different levels of strength or coherence. The coherence of a configuration is caused by relationships among centers... The life that a center has is a function of the configuration of centers that surround it and of the degree of life that these surrounding centers have. In slightly different language, a living center is a center which is unusually dense in other living centers." (Alexander, 2009)

Alexander's pioneering work on pattern language in architecture inspired pattern language initiatives in many other disciplines and social practices, including KF. However, the very heart of that work, his "living center" distinction remained elusive to most of them. The limits of this paper cannot do justice to the importance of the collaborative inquiry needed to discover how that distinction can open new possibilities for KF as a post-disciplinary theory and practice. In the next paragraphs, we shall explore the possibility and implication of repurposing "living center" distinction in the context of prototyping SEED-M.

"The hypothesis is that *it is the "wholeness" of the given environmental reality which brings latent centers to* life, and which each living center enhances . The wholeness always preserves the centers that are already strong, and, for some reason, it always strengthens and enhances latent centers in remarkably similar ways..." (van Eerden, 2010)

It is the very same thing that happens also in the example of over 20 KF researchers meeting in a workshop, where they "knot a tie" (in wildfire-learning parlance) on a shared conceptual object: knowledge federation. The center that is already strong among them is their shared interest in the KF meme, regardless the nuances of difference in what that means to each person. The latent centers are where smaller knots of shared interest are tied by smaller groups of them, as they discover common scopes. They were latent but real, even before they meet or read each other's papers. It is the emergent field of KF, as shared reality, which can bring those latent centers alive.

The research community as an example shows that growing socio-technical systems out from living centers does not start with detailing them out from a master plan, but simply, giving room and creating conditions for the life-giving forces to manifest, which are already present as the participants' attention, creative passion, and urge to learn and create knowledge value together. What can that mean for reconciling the creative tension between design and emergence, in prototyping a federated SEED-M?

The full meaning of the "living center" distinction for educational design practice can reveal itself only in that practice. What seems already clear is this: The path to presencing a SEED-M needs to start with the self-organization of a small team committed to the prototyping process and ready to embark on a design journey without a master plan.

10. Prototyping a Multi-Stakeholder SEED-M

10.1 Initial conditions

Theory U, also labeled as a "social technology for learning from the future as it emerges," (Scharmer, 2007) is a process methodology well-suited to prototype SEED-M. Its "5-cycle" flow provides a coherent frame from the co-initiation of the prototyping project to its self-propagating phase, when it starts getting copied in other situations and contexts.

The "co-initiation" team or design team should include both researchers and members of the prototype's target population. The initial vision of the prototype, emerging from the co-initiation cycle, will help the design team identifying the capability gaps in that population, which need to be filled if they are to reach a common, transformational aspiration.

To ensure the large-scale enrollment needed for the full embodiment of SEED-M, the prototyping process must be iterative and involve increasing circles of participants. That can happen only if the prototype is designed so that it gives them a chance to experience as many of the "7 dimensions of meaningfulness" (Wenger, 2004) as possible. That will require:

- The participants' early involvement in the presencing of the prototype
- Collaborative drafting of an "issues list" that reflects the domains, which will need to be mapped, and forces cross-boundary negotiation
- Opportunities for learning by making a meaningful, even small, difference
- Gaining an initial overview and appreciation of the learning, social, and technology architectures of SEED-M

10.2 The Innovation Architecture of a SEED-M portal

The methodology of designing any self-evolving educational experience on a large scale must take into account for the need to be responsive to potentially rapid changes in the project's knowledge domain(s) and the participants' learning needs. Such a methodology is the Innovation Architecture (Pór, 2005).

Why do we need an architecture as portal design methodology? "The science and art of architecture lie in skillfully relating parts to a greater whole, creating a form uniquely appropriate for the exercise of a specific set of functions." (Helgesen, 2005)

A well-designed architectural framework allows the design and prototyping team team to:
- Foster the co-evolution of self-organizing "emergence" and deliberative "design."
- Focus attention, first, on the high-leverage segments of the design's critical path.
- Evaluate choices and tradeoffs among numerous design options, guided by a small set of generative design principles.
- Use architectural layers as a checklist for achieving the coherence and completeness of the design, by cycling through them in multiple, re-iterative loops.

The Innovation Architecture is a research-based and comprehensive methodology, developed by CommunityIntelligence for designing complex adaptive social systems. Its 4 layers represent a systemic, scalable and robust framework for designing portals for multi-stakeholder, collaborative learning and work:
- Learning Architecture
- Social Architecture
- Technology Architecture
- Wealth-creation Architecture

The last two layer deals with issues related to the attraction, generation, budgeting, and allocation of the financial and material resources. In this paper, we address only the first two layers. The third, the technology layer can be to be described more meaningfully in response to the clearly articulated and needs of an actual

learning and social architectures of an embodied prototype. The forth layer, Wealth-creation Architecture, is outside the educational focus of this paper.

Those layers interact, cross-fertilize, and feed one another. The sustainability of the whole depends on how well designed and integrated are the four layers. The prototyping team must strive to optimize the design for feedback and positive cross-impact across the 4 layers.

Addressing the key questions of each of the 4 domains can be valuable in itself but the most significant results will appear only when we hit their sweet spot, their synergistic impact, through attending all 4 in iterative spirals..

Using the Innovation Architecture, we intend to: a) move the edge of innovation in each of its layer; b) map and leverage the synergistic connections across them; and c) the sweet spot, the area where the 4 dimensions of innovation meet, gets focused attention from the "participatory design" collective.

What follows is only a high-level indicator of some of themes of each architectural domain. The detailed, actual 4-D Innovation Architecture will be the product of the SEED-M design team, which has to be developed in conversation with key stakeholders.

10.3 The learning architecture layer

The primary concern of the learning architecture for the SEED-M portal is the capability repertory (individual and collective) that needs to be augmented for activating the power of the participants' CI. It is framework for a system of developmental activities and interventions designed or achieving that. There are many models of learning architecture and the one that is the most resonant with the tasks of prototyping SEED-M was developed by Etienne Wenger (Wenger, 1998) Two of the scales introduced by the author are particularly pertinent to the learning architecture of SEED-M.

The **Designed-Emergent** axis presents the polarities if prescriptive design and self-organizing, emergent learning practice. Wenger posits, "there is an inherent uncertainty between design and its realization in practice, since practice is not the result of design but rather a response to it." While that is true, the learning practice in a self-evolving educational experience is more autonomous than that, not merely a response to design. The prototyping of SEED-M, as an act of design, must focus on the deigning the condition that can be the most favorable to the emergence of self-organized (connectivist or wildfire) learning.

The **Local-Global** axis is about between the dynamics of learning that takes place in a small community and the learning happening in the larger, encompassing communities or networks. There are two key ideas to retain from this axis of the learning architecture. (a) It takes a small community (of learning facilitators) the design the hold space for and design the learning architecture of a larger community, but "no community can fully design the learning of another." (b) For learning to occur across community boundaries communities of practice, there should be a boundary-crossing artifact, a tool or shared content, taxonomy or narrative that evokes new meaning in the new context.

The learning architecture of a CI-boosting portal of a SEED-M should account for the evolutionary, socio-semantic, and cognitive dimensions of collective intelligence, as three distinct scopes with different sets of capabilities that need to be augmented. Only then can the portal be optimized for supporting the self-evolving educational experience of its users. Understanding the specific nature of dynamic inter-relatedness in and across the repertories associated with the three scopes of CI is essential to efficient design. That's because different capabilities selected for augmentation have different impact on the whole repertory of capabilities. Some of them may hardly affect the others, while certain others may have a fishnet effect, i.e. augmenting their node pulls up the whole fishnet.

10.3.1 The cognitive scope of the learning architecture

By "cognition" we mean ensemble of mental processes, attention, remembering, producing and understanding language, solving problems, and making decisions. The task of the SEED-M learning architecture is to enable the boosting of those faculties as well as their version in "distributed cognition" that "proposes that human knowledge and cognition are not confined to the individual. Instead, it is distributed by placing memories, facts, or knowledge on the objects, individuals, and tools in our environment.

"[E]mphasis on cognition does not intend to diminish the essential roles of emotions, bodies, medias, sign systems, social relations, technologies, biological environment or physical support in collective intelligence processes. The study of collective intelligence constitutes an inter-discipline aspiring as much to a dialogue between human and social sciences as with the technical, artistic and spiritual traditions." (Lévy, 2003b)

The Innovation Architecture was conceived to facilitate that inter-disciplinary dialogue. Its learning architecture layer, in its cognitive scope, will provide a framework and methods for the individual and communal versions of such faculties as "quiet mind" skills, sensemaking, self-reflexivity, and situational awareness.

Quiet mind skills

"The 'quiet mind skills' represent a domain of powerful mental functions that are complementary to and essential for the effective use of the 'active mind skills.' Quiet mind skills are primarily attentive or receptive mental functions that gather information through the faculty of mindful attention, sensing, and feeling. These involve the qualities of receptivity, 'being,' or presence, in contrast to the creativity, or 'doing' nature of the active mind skills." (Levey, 2006)

Our capacity to cultivate our quiet mind skills is foundational to enhance the whole repertory of the cognitive and socio-semantic faculties of our intelligence, individual and collective. While traditionally associated with the individual, practicing quiet mind skills are equally essential to the collective mind. Examples for the later include shared "attention training" of 5-minute before meetings, online meditation rooms, and "chaordic chat" (Pór, 2009).

Quiet mind emerges from (individual and/or collective) practice but the processes and tools fostering it can and should be designed into the SEED-M prototype if it is to deliver on its CI-boosting promise. On the local-global axis of the learning architecture, we notice an upward propagation of the quiet mind skills. The more they prove to be effective on the local level, the more likely will their take up be on the global level. Cultivating the quiet mind skill of intuition is also crucial to the temporal aspect of "global", which is the "long view." Quieting the (individual and collective) mind is needed to discern what is the wise decision that the future is asking us to make now.

Sensemaking

The properties of sensemaking the most pertinent to prototype a SEED-M are enactment, sociality, and feedback.

"People enact the environments they face in dialogues and narratives. As people speak, and build narrative accounts, it helps them understand what they think and organize their experiences..." (Wikipedia).

Speaking as a form of enactment is also a way of making sense out of our experience. Depending on whether the speaking is oral or written, the prototype should include different tools and methods for connecting and comparing local and global enactments.

There's also "data frame" model of sensemaking, which is worth applying to prototype SEED-M (Attfield, Blandford, de Gabrielle (2008):
- Recognize and construct a frame
- Perform cycles of elaboration on that frame, adding and filling slots, seeking, inferring and discovering data
- Ask questions of the frame, detecting inconsistencies, judging plausibility, analyzing data quality
- Perform cycles of refactoring, where the process is to seek a new frame that better describes the situation

An essential function of the SEED-M platform is to enable the development and functioning the learning community's collective sensing and meaning-making organs and processes. Mahatma Gandhi, discovered and appreciated that one cannot build a social movement without a newspaper that acts as a mirror and a catalyst to its collective consciousness. Today, webportals can play similar roles.

Self-reflexivity

The action/reflection split and the lost opportunities for learning, which ensues it are the single biggest obstacle to augmenting our intelligence. Without the individual and collective self that reflects on its identity and aspirations, no conscious evolution can take place in human groups. Therefore, creating time and space for the participants' computer-supported individual and collective self- reflection should be part of SEED-M's prototype. For enabling it, the cultivation of self-reflexivity should start with the prototyping team itself.

The collective self-reflexivity practices that allow participants to think, sense, and make meaning as group, also grow their capacity to absorb/attenuate more complexity, thus play a key role in its evolution.

How well can collective self-reflexivity scale? For self-reflective conversations to sustain organizational, communal or social systems or movements at increasing scale, they have to be able to absorb the increased complexity involved with those systems (Pór, 2008). The larger is the social holon engaged in collective self-reflexivity, the better conceptual and technical equipment it requires for attenuating (incoming) complexity and amplifying (outgoing) complexity as the situation requires.

Situational awareness

"Situational awareness is the perception of environmental elements with respect to time and/or space, the comprehension of their meaning, and the projection of their status after some variable has changed, such as time. Situation awareness involves being aware of what is happening in the vicinity to understand how information, events, and one's own actions will impact goals and objectives, both immediately and in the near future." (Wikipedia)

The learning architecture of the prototype has to support as complete, accurate and up-to-date awareness of the participants as possible about their learning tasks, the changing terrain of their study, and the learning community itself. For example, the right set of indicators, presented in a visual language and dynamically updated, can and should help participants and their teams/communities discovering patterns that connect learning strategies and resources in a constantly shifting, kaleidoscopic environment.

10.3.2 The socio-semantic scope of the learning architecture

The socio-semantic scope of the learning architecture gives access to the collective intelligence faculties that, using the prototype, the participants of SEED-M will be able to evolve together. They include: holoptical perception, learning by co-blogging, and forming learning teams.

The socio-semantic scope of the prototype's learning architecture encompasses the Social Semantic Web but is not limited to the technology. "Socio-semantic networks involve agents creating and processing information… The dynamics of these communities can be adequately described as the co-evolution of a social and a socio-semantic network." (Cointet, Roth, 2009) Given an enabling infrastructure, that co-evolution may pick up momentum as more people participate.

Holoptical perception

We mentioned holopticism (the visibility of the whole to all parts and vice versa) in the context of both wildfire learning and the three dials of Crowd-Accelerated Innovation. For optimizing the access to resources available in every social learning system, including a SEED-M, its socio-semantic scope has to include tools and methods for enhanced holoptical perception,

For instance, connectivist courses tend to provide the learners with good indices, navigation structures, and other learning aids to see the whole of the initial content and each other's relations to it. Yet, they struggle with making the growing volume a learner-generated content visible to all. For a self-evolving educational experience on a massive scale, to be successful it has to be designed for dealing better with that challenge.

Two factors that will help making that possible are (a) the intermedia synergy, and (b) the special attention given by the hosting team to the support of community leadership roles associated with journal keeping, concept mapping, knowledge gardening and online dialogue facilitation. While second factor is self-explanatory, the first is not. The term "intermedia synergy," in this context, refers to "the social, knowledge, and (potential) business value emerging from the right combination of two or more modes of communication, including real-time and asynchronous (Pór, 1986)

Designing the SEED-M prototype for allowing the free flow of output from blogs, forums, and wikis (asynchronous) into input to face-to-face meetings, audio, text or video conferences (real time) is a critical requirement for making the learning community and its emergent themes, concerns, and aspirations visible to itself.

Learning by co-blogging

Co-blogging can generate not only more fulfillment and a better blog, but also a process of transformative learning through the co-authors' mutual exposure to each other's perspectives, mental models, and experience, and their need to negotiate shared meaning. Other benefits to learning and evolving include:

"Research workload halved - if you are going to seriously cover a niche there is always lots of research to do. Everything from keeping up with the news to detailed investigation. We can't all know everything that is going on in our niche or have the depth of knowledge on every topic required. With someone else on hand you can split the subject matter between you." (Garret, 2005)

The edge of innovation in the learning architecture's socio-semantic scope is in the artful integration of its social and semantic layers, supported by the right mix of tech tools. The shared clarity of roles and accountabilities, the ease of conducting generative conversations between the co-auhors, in the social layer, have to be combined with the co-creation of shared taxonomy (explicit or implicit) and the a project management blog, in the semantic layer. They all have to be supported in the SEED-M prototype with the affordances provided by the platform.

If the prototype is to support very large learning communities, it raises the question about maximum number of people, which can be useful and viable in a co-blog? The answer depends on the robustness of its multi-vocabulary taxonomy system, the richness of navigation tools, as well as, the skilfulness of the hosting team facilitating the social and group processes of learning collaboration.

An example of learning by co-blogging is its use in peer matching for learning team formation.

Forming learning teams

Peer matching is a feature of both the social and the learning layers of the Innovation Architecture. It's about enabling learners to find partners to their learning quest.

This idea was inspired by Ivan Illich, the visionary social innovator, whose Deschooling Society is quoted, decades later, in Open Source Learning: "Another idea from Illich was that of the "Learning Partner Initiative". This would involve some kind of directory where people can input the title of an article, film, book etc., which they would like to discuss with someone else. People could then match themselves up, through a search system. Illich saw these initiatives as valuing "the unpredictable outcome of self-chosen encounters above the certified quality of professional instruction." (Merry, 2004)

The fields of the structured blog's entry form designed to support that task will include, among other:
Keywords - labels for the areas in which one wants to learn/discover/research
Key questions - one's cutting edge of "not-knowing," what drives the interest in any of the keyworded area, what's the driver/focus/target of one's learning/discovery/research

The tool will make it easy to:
Find colleagues with high degree of (semantically computed) overlap in the pool of keywords and key questions, free from the constraints of geography and time.
Foster the emergence of collective intelligence at increasing scale, through the learning expeditions (facilitated rigorous inquiries) into the driving questions shared by many people.

10.3.2 The social architecture layer

The social architecture includes the roles, accountabilities, principles and guidelines, and agreements needed to make SEED-M operational and sustainable. It also deals with such questions as what practices and structures of engagement will strengthen authentic and productive connections in the learning community. The main issues of this layer are: group formation, community cultivation, and generative action.

Group formation and community cultivation

Why did groups form more slowly in the past? Because when you add more people to a group, there are disproportionately more connections (a group of 5 has 10 connections, a group of 15 has 105.) For this reason groups broke down. Now, maintaining these links is easier to produce. This is known as "ridiculously easy group formation," a key attribute of the Internet.," said Clay Shirky at Harvard.

While technically, group formation became easier than ever before, preventing the groups from fizzle out, didn't. Effective groups requires human facilitation, large communities need facilitator teams. In the different phases of the prototyping cycle, they will have to fill the functions of a co-initiation team, co-sensing parties, hosting team, and learning facilitators.

The SEED-M community will be an ecosystem of various groups, and the ecosystem's thriving will depend on the relationship between them. The hosting team, together with the learning facilitators, are membership advocates, working for the participants best experience of the platform and the community.

Generative Action

Thee social production of collective intelligence is a generative process. The characteristics of generative are outlined in Appendix A. A specific model designed to support the development of the SEED-M community's collective intelligence, at increasing scale, is the Generative Action.

Generative Action (GA) is a change-management and innovation-boosting methodology designed for growing strategic capabilities, such as collaboration of Quad-E quality: Effective, Efficient, Effortless, and Enjoyable. GA is built on the disciplines of generative learning, action research, and appreciative inquiry. GA is designed to discover ways to meet a driving challenge or opportunity in collapsed time, by mobilizing the collective intelligence of teams, organizations, and social movements in increasing circles of involvement.

When applied to innovating the innovation cycle, GA excels in complementing the formal innovation management processes with the power of communities of practice, knowledge networks, and other forms of grassroots initiatives.It is cyclic, emergent, and participative.

Cyclic — Action and understanding go through cycles of deliberate and spiraling intervention and reflection. The "Plan" phase of Cycle 1 starts with discovering the most compelling questions1 that— when combined with the rigorous GA process—can trigger the desired changes.

Emergent — The design is not detailed in advance to allow its cycles to respond to relevant knowledge emerging from the previous one. Thus, when specific outcomes cannot be predicted, the process remains flexible and is allowed to develop on its own.

Participative — Key stakeholders of the project are actively involved in advising the process, reviewing and commenting its purpose and design, and shaping its outcomes.

Each cycle represent a new turn of an expanding spiral of value creation. For example, if Cycle 1 (the launch workshop) had 15 participants, then there might be as many as 100 or 150 who will be involved with or benefit from Cycle 2. The expanding cycles expand also the innovation and collaboration capabilities of all involved, individually and collectively.

"Generative" refers to the properties of self-sustaining, self-improving, co-evolving, and self-propagating, outlined in Appendix A. When using GA in a CI-boosting, this methodology will let the results of the project:
• Sustain themselves after the completion of the initial cycle
• Enhance their value continually, by becoming the target of ongoing improvement conversations in the community
• Co-evolve with a changing environment, grow into patterns of higher performance

A well-designed GA initiative can produce breakthrough results by fast-tracking the collective intelligence of the participants and freeing the flows of value, knowledge, and trust among them. "Fast-tracking" is a key distinction in our process. It means that productive insights from the Observation and Reflection phases are fed back into the next phases (Plan and Act) of each cycle, thus fostering better results in shorter time.

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Generative Capabilities

Generative capabilities equip an organization, a community, or a social movement, to reinvent itself, in a way that permits it to continuously improve its ability to evolve. The four generative capabilities that seem essential in a rapidly changing world are:


Self-Sustaining-- **Balancing change and continuity** in a way that supports the life-giving forces of the organization.
• Creating a robust, agile **collective "nervous system:"** a foundation of org. innovation and sustainability.
• Developing and using **shared memory** and **collaborative intelligence** as strategic advantages and **conditions of sustainability**
•

Self-Improving--

The "Mastery Curve"

Intentionally and continuously **improving individual** and **collective effectiveness** by:
• Setting the commitment/measurement/feedback /learning loops provide supporting infrastructure.
• Learning to be a "G x G" organization that first Generates new capability, then Generalizes it throughout the organization

Self-Evolving --
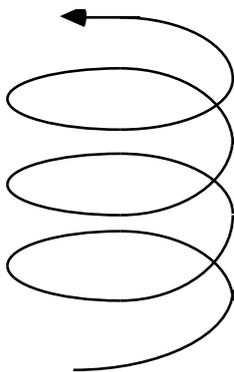
Consciously searching for and choosing higher purpose and form, e.g.,
• • an organization dedicated to serve all its stakeholders (including future generations) has a **higher purpose** than one which focuses only on stockholders and customers
• • organizing forms designed to foster trust, love, truth-telling, collaboration, service , respect and creativity are **higher forms** than those that perpetuate patterns of fear, shortage, secrecy and control over people
•

Self-Propagating --

Embodying one's vision and performance standards in a way that **inspires others** to awaken new possibilities within their lives, relationships, and organizations, e.g.,
• Actively seeking and providing coaching
• Being a source of learning and experience for others; consciously spreading best practices

This framework is developed in collaboration between Bill Veltrop of the International Center for Design and George Pór