



Focus on: Complexity Education

Complex Learning Frame and evidences

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Ubiquitous and social based learning, connective and adaptive eLearning 2.0 represent innovative approaches (to some extents still experimental) that impact the building of new learning cultures and processes, valorising the interactive, non linear and informal dimensions of the learning processes. At the same time, lifelong learning' policies and practices are sustained by a diversity in delivery channel -mainly mobile based- that integrate the traditional web solutions according to learning needs and styles. The combination of digital convergence and eLearning 2.0 opens new set of research issues and opportunities, with special refer to the potential role of technology to complexity learning.

The Complex Learning Frame proposed in this contribution aims at represent

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an innovative technology enhanced pedagogical frame and system addressing the need of valorising connective, reflective, adaptive and social learning processes supporting the development of individuals and communities competences. We first recall the main framework addressing individual and social learning processes. Then, we deepen the experienced Complex Learning frame. Finally, we present some evidences emerging from research and innovative projects realising Complex Learning experiences.

1 Introduction

In the new vision of the *liquid society*, actual EU programmatic and research debates stress the intertwined links between e-learning and sustainable, competitive and inclusive development with special focus on Learning 2.0 potentials to support personal and social active pathways. Web 2.0 has changed significantly the ways to obtain, share, create and organise information, communicate and participate. The web is no longer just a medium for learning, but a learning playground; with the aid of web 2.0 technologies «people can create, share, exchange, remix their own contents and learn through knowledge and experience exchange and sharing» (Learnovation, 2009). The use of social networks is becoming increasingly relevant for the number of users and for the quality of available tools. Individuals are increasingly learning to learn, putting themselves in a more centred position within the learning processes (Castello *et al.*, 2009; 2010).

Contemporarily, individuals are faced with the continuous challenge of dealing, both in daily life and working contexts, with complex environments in terms of uncertainty, information overloads, social interaction and so on. Complexity calls for a radical change of those linear, unidirectional and sequential educational patterns and for a stronger focus on enhancing:

- the social dimension of learning (as both meaning construction and knowledge connection);
- learning centred processes, meaning, engagement.

What learners -individually and collectively- need is to access *authentic* and *living* learning networks and communities; learning then means creating a network (Siemens, 2004). Many projects have been carried out; however, there are relevant gaps between policies and practices, strategic goals and real effectiveness (Conole, 2010; Redecker & Johannessen, 2013). Particularly, it appears that there is a need to further focus the processes themselves of how individuals and communities learn and grow, and how they identify and develop their resources and competence over time (Castello *et al.*, 2009; 2010; Vettraino *et al.*, 2010; 2012). This means investigating *how* accessing, using, building and sharing knowledge, competences and values through complex cognitive, behavioural and emotive formal and informal learning processes.

The international debate and the literature offer various meanings of complex

learning, differing in the practices and procedures of application, ranging from the mere conceptualization of the term “complex” to express the complexity of the learning process, to the definition of a real educational model (Ferri, 2003; 2005; Guspini, 2008; Kirschner & Van Merriënboer, 2008, McDonald, 2005; Rohse & Anderson, 2006).

The “Complex Learning” model here proposed is the result of studies and experiences practiced in relevant National and European projects. It offers a specific frame of connective, reflective and constructive learning processes, strongly inclusive and able to valorise the organic relationship between formal/informal and individual/social dimensions (Castello *et al.*, 2009; 2010; Vettrai *et al.*, 2010; 2012).

2 Individual and social learning 2.0

Learning takes place inside individual human heads; nevertheless «learning processes are intrinsically social and collective phenomena» (Teece *et al.*, 1997). Learning processes are embedded in social networks, interacting and exchanging content, resources, meanings (Wenger *et al.*, 2002). New practices and competences emerge from the interaction and socialization of individuals engaged (Wenger, 1998). An integrated conceptual view of individual and collective learning starts with the generative learning within “*learningful*” relationships (Senge, 1990); is «the quality of these relationships, and the quality of interaction, which is essential for building the community of practice» (Jörg, 2005).

Networking tools and platforms have the potential to enable individuals to enhance their social networking and, so, learning processes. The combination of media convergence and intermodality can support the creation of semantically and socially enriched contexts to share (Castello *et al.*, 2009; 2010; Vettrai, 2012).

Learning environments can be featured as embedded and open ecosystems, living structures that are developed, discussed and managed by committed communities and where the critical success factor is the active engagement of users that access, share and builds knowledge, competences, values -and, so, identities- in a continuous interaction within the community and the external relevant environments (Castello *et al.*, 2010; Weick, 1995; Stacey, 2003; Vettrai *et al.*, 2012). Traditional approaches can’t adequately address the complex and multi-dimensional nature of learning (Van Merriënboer, 1999; Vettrai *et al.*, 2012).

3 The Complex Learning frame in the international debate

Complex Learning represents a vast and diversified conceptual frame (McDonald, 2005; Rohse & Anderson, 2006; Guspini, 2008; Vettrai *et al.* 2010; 2012). The relevant literature and the international debate highlights that

Complex Learning accepts a vision of learning as a multifaceted processes developing through open and dynamic pathways and producing learning outputs that cannot be foreseen “a priori” (Rohse & Anderson, 2006). A multidimensional environment, reflecting the complexity of real world and the social relations that take place in it (Van Merriënboer, Clark, de Croock, 2002), stimulates multiple interactions among people, technologies, purposes and environments. The social, dialogic (Gunnlaugson, 2011) and connective dimensions are vital aspects of a learning processes connoted by non-linearity (Human-Vogel & Bouwer, 2005), holism and serendipity.

Within this frame we intend Complex Learning as a new pedagogical domain (Harasim, 1989) valorising technology enhanced social learning processes. The proposed frame conceptualizes and analyzes the changing nature of learning, empowering participation in sustainable Complex Learning Communities (McDonald, 2005; Guglielman & Vettrano, 2009; Vettrano *et al.*, 2012). The Learning spaces, made of multiple components (learners, resources, tools) in complex, dynamic and remediated (Bolter & Grusin, 2002; Vettrano *et al.*, 2012) interactions, are social and cultural spaces where learner moves, explores, draws on the surrounding opportunities to create own experience, adapting the acquired knowledge to previous representations (Guglielman & Vettrano, 2009; Vettrano *et al.*, 2010; 2012).

A Complex Learning environment bridges among diverse devices (pc, books, e-books, mobiles, tablet and so on), communication tools (forum, e-mail, instant messaging, chat, wiki, blogs and so on) and real life spaces. It is flexible and ubiquitous: learners builds a personalized space using the web tools and resources for research of information, communication, publishing, collaborating, and acting also in the communities of experts. The virtual non-places are in a constant overlapping to the real places; knowledge and learning resources are constantly produced, used, shared, reused and so on (Vettrano *et al.*, 2010; 2012).

A Complex Learning Community grows in this multidimensional environment, where the learning process reflects the complexity of real world and the social relations that take place in it: multiple interactions among people, technologies, purposes, real and virtual environments where they move and act (McDonald, 2005; Guspini, 2008; Vettrano *et al.*, 2011; 2012). Within Complex Learning Communities the knowledge sharing, the exchange of ideas, of experiences and solutions to real life daily problems, the exchange of knowledge from an individual to another, can happen without losing the collective dimension since the common knowledge and the collective memory can be dynamically stored and accessed.

Individual and social dimensions are integrated in building of new meanings (Dewey, 1961; Garrison & Anderson, 2003); critical thinking is a holistic ac-

tivity, including reflexive and shared actions, and self-directed learning as an emerging conceptual and social model (Vettrano *et al.*, 2012). The “many to many” communication substitutes the typical relationship “one-to-many”; the crystallized tutorship opens to dynamic forms of peer support with learning actors interacting in a dialogic exchange. The common habit is to live the learning experience in a “protected” space – the learning platform – moving in a structured learning environment and regarding knowledge as an individual property rather than a collective and connective asset. Complex Learning, on the contrary promote and push the role of the learner as a co-designer: he must not only repeat and apply predefined knowledge, but he has to discover, re-build, co-build learning (Guspini, 2008; Vettrano *et al.*, 2010, 2012).

Consistently, also the individual role changes continuously. The learning relationships are not linear anymore, from trainer to learner. The learner interacts with peers, project staff, domain experts, stakeholders, individuals and communities sharing his interests at both formal and informal level. In Complex Learning the subjects’ role changes, it’s not fixed once and for all: everyone can express his competence and his tutorship in relation to his expertise. This calls for a radical transformation in the learning culture and attitudes of learners, teachers and tutors as well as for new digital, collaborative and metacognitive competences.

4 Evidences from Complex Learning projects

The proposed Complex Learning frame has been tested in different projects, allowing to further develop it and to define some grounded guidelines to its effective application. The quantitative and qualitative analysis of learning behaviours, messages and interactions among the community members in these large projects allowed to identify some key evidences.

These latter have been highlighted through a systematic observation (along about three years for each one) of interactions of adult learners involved in *inservice training* activities (in a range of thirty to sixty years hold people) and shown by exchanged messages (roughly an average of 4.000 messages for each cited experience) and within three main projects: TRAMPI community, formed by school accounting staff (Vettrano, 2003); COMUNET, third sector operators community network (Guspini, 2007); DEEPER, European community of refugees trainers and operators (Castello *et al.*, 2010). A sequential analysis of messages (Bakeman & Gottman, 1997; Jeong, 2003), based on a preliminary categorization of verbal behaviours, allowed identifying the general attitudes of participants and the verbal behaviours generating relevant learning interactions. Although only a descriptive statistical analysis was enacted, without a bivariate analysis, yet the same sequences and related learning behaviours was observed

in the three experiences, different for target and contents of interaction.

Concerning the *general attitudes of participants*, learners tend to: be initially more passive (mainly interacting only with the tutor); replicate the traditional face to face routines (as one to one reply; focus on questions directly addressed); prefer synchronous planned virtual meeting. Moreover, learners show greater expectation of pre-ordinate learning contents. More proactive behaviours grows accordingly with the development of common identity and community belonging (Castello *et al.*, 2010; Vettraiño *et al.*, 2010, 2012). Learners attitudes actually tend to evolve from a sort of “collective monologue” towards an effective networking learning interaction (Guspini, 2008; Vettraiño *et al.*, 2010; 2012).

The analysis of *meaningful verbal behaviours*, indicative of learning interactions, have shown a major dimension of problem-based learning processes. Interactions mainly focus on issues connected with daily work activities; personal experiences, work tools sharing, experts identification are shared and exchanged. Through the interaction members learn: the application of knowledge to a different context, the creation of connections between contents or situations apparently divergent, the integration and completion of contents, the finding of practical solutions, the formulation of an hypothesis of work, the flexibility in assuming different points of view about the same problem, the adaptation of an existing tool or solution to a new problematic situation.

With refer to the *development of the learning community's interactions*, all the projects have shown a common development scheme at the same time: sequential (progressive phases of learning group lifecycle) and reticular (not linear development of the relationship among the members of the community (McDonald, 2005; Vettraiño *et al.*, 2010; 2012).

The validation of the model has allowed to identify 4 main stages of the Complex learning system (and, so, its design and implementation guidelines within a variety of diverse learning set):

1. **Access:** the critical dimensions are represented by a clear communication to -and training of- the learners on the project aims and activities, as well as of the tools and roles. Learners are also required to present themselves (and their learning aims and attitudes) in order to put the base of the interactions and to allow animators to personalize the community “management” and development process;
2. **Interaction:** learners become more familiar with the use of the diverse learning tools and, generated, supported and enhanced by the animator, with general and focused interactions;
3. **Socialisation:** the community has formed and learners show proactive and connective learning behaviours. Problem-based learning processes are activated by different learners (and not only proposed by the anima-

tor) and shared among members.

4. **Development:** the learning roles (learner, expert, animator and so on) are changing among community members. The community start to interact with other communities, enlarge its membership, exploit, combine and create internal and external learning resources.

Two are the underpinning critical dimensions: time and roles, as described in the following pages.

With regard to the time dimensions, as described in Vettrano *et al.* (2012), one year is the basic time required in order to observe the beginning of typical dynamics: decrease of oppositions and mistrusts; consolidation of membership consolidating; emerging of “cognitive dissonance” dimensions and reciprocity logics; increase of inclination to share experiences and knowledge growing; valorisation of peer to peer support dynamics.

Within two or three years the community tends to consolidate these processes and to start-up new dynamics such as: identification of experts “de facto”; improvement of the autonomy of the community in the problem finding, problem setting, problem solving; development of a dynamic leadership at a variable asset; growing of the networking with other (virtual or real) communities having similar interests and aims; flexible and integrated use of a rich mix of communication devices.

The innovative nature of Complex Learning makes necessary to clearly show and explain its features; both the tutors and the learners must agree this commitment. This is an essential condition for an effective learning experience. To afford a complex learning experience it is necessary to overturn the consolidated learning routines and to “plunge” in a liquid learning environment that goes out of the learning platform’s boundaries. Transition among different environments and especially from the learning environment to the external epistemic communities is a critical node that Complex Learning actors have to cope with. The first change they have to face is a mental attitude change and a radical transformation in the teaching and learning culture. The typical behaviour in students is to be “consumers”: they expect to make a receptive use of ready lessons, resources and training aids; teachers and tutors are bound to a teaching approach based on a didascalical, transmissive model and on fixed roles. In Complex Learning, on the contrary, learner is a co-designer: he must not only repeat and apply predefined knowledge, but he has to discover, re-build, co-build learning in a social interaction.

Therefore a new repertory of competencies is necessary to afford the learning experience: metacognitive competencies (e.g. self-evaluation, self-assessment, self-guidance, attitude to research, problem setting and problem solving ability), collaborative competencies, ability to dialogue through many-to-many commu-

nication models, attitude to recognize that an outcome is always a starting point.

The communication form “many-to-many” substitutes the typical “one-to-many” relationship. The crystallized tutorship opens to dynamic forms of peer support where the tutor’s role is based on the recognition of the informal expert in a logic of “*primus inter pares*”. In this perspective there’s no more a “class” but the whole community members interacting in a dialogic exchange.

The design-inspired approach of Complex Learning promotes and sustains the learner’s responsibility in the control of his learning process. The role of the Complex Learning animator is decisive to this aim. The Complex Learning animator has the task to model the learner’s behaviour through a cognitive apprenticeship acting on the area of proximal development (Vygotskij, 1990). A Complex Learning animator should have key competencies, particularly about social support: emotional, affective and motivational scaffolding necessary in order to face the lurking attitude of participants and to manage the wrong-footing sensation and the cognitive dissonance (Festinger, 1964) encountered by learners; safeguard of a reciprocal trust climate, stimulating collaborative activities, analysis of interpersonal relations and conflicts resolution in order to face the flaming phenomena.

The Complex Learning animator invites learners to contextualize the course contents referring them to their previous learning experience, animates and moderates discussions, sustains participation, gives feedback and motivation, encourages collaborative activities, takes advantage of eventual difficulties as a stimulus to encourage the reciprocal support and the interactions. The Complex Learning animator gives information about the course schedule and deadlines and takes care that the netiquette is respected. It’s important to note that if there is more than one Complex Learning animator in a course, tutors don’t act separately but they must interact each other.

The technical competences are also the core competences of the Complex Learning animator for the effective use of the tools and services of semantic web. Summarising, we can highlight four “field of activity”, sets of specific activities carried out in a concrete operative context, characterizing the expertise of the Complex Learning animator: *Didactic*: competences related to learning/teaching; *Technology*: competences related to the use and mastery of computer, web, social tools; *Communication* and social interaction: competences related to social relationships typical of Computer Mediated Communication contexts, especially regarding collaborative groups and virtual learning communities; *Management*: competences related the organizational and piloting aspects of web learning, delivery and control of the process.

Conclusions

Reality is chaotic, problematic, fluid and organic, new pedagogic visions are featured by ubiquity, liquid contexts, users centred. This framework of *liquid complexity* calls for we need to rethink old pedagogic models and learning environments, not as structured and *packed* places, but as distributed (and social constructed) processes and ecosystems.

The proposed Complex Learning frame aims to addresses these challenges. The term “complex” explains the complexity of the dynamics related to the continuous learning reconfiguration among media, languages and interactions.

The Complex Learning experiences have reinforced its conceptual and methodological frame and allowed to highlight some critical points.

The first one is that the implementation of Complex Learning model requires trainers specific competences and, mostly, time. Not only “time for learning” but, also, time for enhancing and developing the necessary community self-awareness. The blended approach and the digital convergence, with special refer to the mobile dimension, allows to enhance both the ubiquity and the flexibility of the interactions and, so, to reduce the community development time need frame.

The exploitation of the convergence opportunities requires to overcross learning routines barriers, that often lead people to replicate the traditional in presence learning behaviour to all learning spaces. Multichannel learning spaces indeed require new attitudes like self-learning, self-orienting, re-search, collaborative approaches, collective communication strategies, etc. The proposed program setting and the suggested e-tutor strategy give the necessary support to overcross this barrier.

A further barrier to be pulled down is the resistance to carry on collective problem solving processes. Participants have shown a stronger attitude in individual problem solving and a weaker inclination to share problems and solutions. Overcoming this barrier is one of the major learning focus and goal of the Complex Learning model, as it affects its own effectiveness.

Finally there are geographic and cultural barriers. Once again technology can help to trim physic distances. Cultural barriers can be afforded only sharing activities and aims, in a reasonable elapse of time.

The three main critical points are then endogenous to the system and can be effectively addressed within the model design and implementation.

Consistently with the progressive shift from taxonomic learning management system to technology enhanced learning perspective, innovation is not related to the specific learning tool or system but, indeed, to the positive impact on the multidimensional learning process (cognitive, experiential, emotional) and on the social (and informal) competences sharing and building. In this sense, innovation is strictly linked to perceived usefulness, active commitment and

individual empowerment of participation in building its own development as well as in participating to social development.

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