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Emerging learning ecologies as a new challenge and essence for e-learning. The case of doctoral e-researchers.

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Abstract

This chapter discusses the manifold ways in which the notion of 'ecology' and 'learning ecology' are adopted to interpret digitally-mediated educational contexts, to account for e-learning in higher education and to refer to emergent forms of networked environments and related learning practices. Moreover, the chapter provides a brief discussion on a research case focusing on the investigation of PhD students adopting social media in their doctoral journey.

Exploring concepts such as 'resilience','keystone species', and an ecological view of agency enables the researcher to better understand and design learner experiences in a changing digital landscape and subsequentely to assist learners integrate their self-organized digital practices into the academic ecosystem.

Thinking of doctoral students using social Web tools for academic purposes in ecological terms helps to consider the adoption of ICTs as a component in an ecology of resources. Focus is on personal ecologies, emerging from current uses of individualized media, and on the capacity of the individual students to act upon their situated local contexts.

However, there are limitations and risks in the adoption of the lens of learning ecology which the researcher should be aware of.

Introduction

This chapter discusses the perspectives of 'ecology' and 'learning ecology' as lenses to consider e-learning (Andrews & Haythonthwaithe, 2011; Ellis & Goodyear, 2009) in the age of the "social Web" (Boulos & Wheleer, 2007). The metaphor of 'ecology' has variously been adopted to shed light on the entangled facets of socio-cultural activities and educational contexts. Drawn from studies on ecosystems, the notion of 'ecology' refers to the dynamic relationships between individual organisms and their environment (as a whole identified as an 'ecosystem'), characterized by interactions with other living or non-living organisms.

Key attributes of 'ecology' such as 'complex', 'self-organized' and 'adaptive', as applied to digital ecosystems (Louviere, 2012) lead to consideration of the range of conditions underlying the self-organization of learners exchanging information and knowledge in the open Web. The notion of ecology refers to the activities occurring among learners and digital tools and is concerned with the endless cycle of technology change to which users and educational institutions are subject and have to respond. Ecological perspectives "may offer a new 'language' to conceptualise change and stasis in a variety of environments, contexts and spaces of activity, which exist in linked scales or levels, ranging from the global to the local, from the micro to the macro" (Hodgson & Spours, 2009, p. 9).

The ecology metaphor is differently inflected according to socio-technical approaches, focusing on the mutual influence of people and technologies (Andrews & Haythonthwaithe, 2011; Nardi & O'Day, 1999) or to socio-cultural approaches, privileging the exploration of the relationships between the learners and the intricacies of the local environment (Barron, 2006; Luckin, 2010;

Pachler, Cook & Bachmair, 2010). Properly indicated as 'learning ecology', it is adopted to explore learning contexts and processes of communities of learners and individual learners; and it is thought of as 'hybrid' when physical and virtual configurations are considered as competing or blurring.

As applied to e-learning, learning ecologies suggest the need to identify continuities and discontinuities in the adoption of technology-mediated learning practices as an informed basis for the design in any empirical settings of e-learning interventions (Ellis & Goodyear, 2009). It helps to gain a holistic view on the components of the e-learning enterprise (Andrews & Haythonthwaithe, 2011) and on the needs and interests of higher education learners promoting a collaboration culture via digital networks (Mitchell, 2002).

Moreover, the notion of learning ecologies is functional for accounting phenomena related to the informalisation of education (Sangrà & Wheleer, 2013) and finds valid allies in ICTs (Information and Communication Technologies) and online learning. In fact, learning ecologies provide a frame to interpret the manifold learning opportunities enabled by the current complex digital landscape, in which issues such as the integration of formal, informal and non-formal opportunities and needs for personalization are at work to improve lifelong learning and professional development (Sangrà, Guitert, Mateo et al., 2011). Furthemore, this notion highlights the "distributing potential" (Brown, 2012, p. 50) of the Web 2.0 tools across more or less resilient contexts, rather than underlying claims on general, celebrated affordances of emerging digital media. On the other hand, just the versatility of the ecological metaphor and the variety of ways in which it is adopted in literature constitutes both the strength and the weakness of this construct.

This chapter briefly outlines the ways 'ecology' and 'learning ecology' are adopted to interpret digitally-mediated educational contexts, account for e-learning in higher education and refer to emergent forms of networked environments and related learning practices. Moreover, the chapter sketches a discussion on the extent to which an ecological approach and the notion of learning ecologies are applied to a research case focusing on the investigation of PhD students adopting social media in their doctoral journey.

Learning ecology and digital ecosystems

A review of literature discussing ecological approaches concerned with teaching and learning issues in a digital age returns a range of terms and conceptual definitions. For instance, these definitions show a more or less strong legacy from studies on biological ecosystems, variously treat the Web as a new kind of learning environment or as a component in a more complex entanglement among individuals and tools, focus on socio-cultural contexts or on the metaphorical power of specific ecological concepts. This flexibility implies opportunities and challenges for the researcher, who has to define her analytical focus in order to better orientate her choice.

Like other theoretical frames such as activity system and actor-network theory, ecological views draw attention to the "cyclical and emergent nature of human activity" (Andrews & Haythonthwaithe, 2011, p. 159), including learning, as related to broader social and cultural processes (Lave & Wenger, 1991). In the last decade of 20th century the advent of the Web is often examined through the lens of 'learning ecology', in order to explore the extended learning possibilities enabled by the Web and to examine learning environments in a more systematic way.

Seely Brown (2000) views the Web as a learning medium enabling a "new, self-catalytic system" (p. 20), namely a 'learning ecology', to emerge. This 'self-catalytic system' is characterized by a dense fabric of intellectual interactions occurring everywhere and among diverse subjects, and producing and expanding the core competencies of a local context. Seely Brown (1999) focuses on *knowledge ecologies*, defined as "an open system, dynamic and interdependent, diverse, partially

self-organizing and adaptive" (p. 3), and highlights affordances of 21st century modes of knowledge building an educational system should take into account.

Unlike most ecological theory, especially focusing on populations rather than on individuals, Looi (2001) defines Internet as an ecology in which anyone can become an author and contributes content. It is "the first mass media that is becoming product of its audience" (p. 19). The Internet fosters "the growth and richness of learning ecologies"(p. 19), by conveying multiple media formats, providing diversity of participation and information access, enabling new forms of learning communities and supporting links among people, information, tools and artifacts.

Authors such as Davenport (1997) and Nardi and O'Day (1999) draw attention to the ecology approach applied to information technology. Nardi and O'Day develop their seminal conceptualization of *information ecologies*, defined as the interconnected system of "tools, people, values and practices in a particular local environment" (1999, p. 49). In such systems 'keystone species' are organisms playing a crucial role in the functioning of the ecology, even if their work is invisibile and peripheral: they preserve the key functions within the ecosystem, assuring sustainability and "balance found in motion, not stillness" (p. 53). The concept of 'keystone species' was introduced by Robert Paine's (1966) studies on biological ecosystem, where keystone species are said to have a disproportionately large effect on the species assemblage despite the fact that it is low in number of exemplars. The role of a keystone species is analogous to the architectural function of a keystone in an arch and includes organisms which "(I) control potential dominants, (II) act as mutualists, (III) provide critical resources, and (IV) modify the environment" (Payton, Fenner & Lee, 2002, p. 5). Applying this concept to scholarly community, Nardi and O'Day's attribute to librarians a role as keystone species: in fact, they preserve modes of knowledge distribution while introducing new technology-mediated practices, enabling innovative ways to access, create and distribute materials. The interplay of individuals and technologies is interpreted according to the key concept of 'locality', that is related to participants in specific settings who "construct the identities of their technologies through the rythms and patterns of their use" (Nardi & O'Day, 1999, p. 55). In fact, a technological application, for instance a group page curated in Facebook, is located in a network of relationships comprised of people using it and other kinds of related applications and devices.

Focusing on school-based education, Zaho and Frank (2003) develop a relevant analytical framework aiming to integrate the diverse factors affecting the adoption of ICT in the classroom. These factors are often examined in an isolated manner, leading to ill-defined explanations of what the introduction of technology implies in educational settings. Zaho and Frank describe classrooms as ecosystems in which teachers belong to a 'keystone species' and technological innovations are seen as "invasions of exotic species" (p. 9). Interestingly, they liken technologies to living species, said to have a similar evolution. Reaching interdependence (a state of internal equilibrium) among the different factors and living and non-living species plays a key role in the acceptance and adoption of ICT. This view is aligned to a conception of the digitally-permeated classroom as a 'digital ecosystem', in which the interplay between control and chaos is analyzed through the open exchange of information occurring in person-to-person and digital activities (Louviere, 2012).

Within a socio-cultural approach, Barron defines the notion of 'learning ecology' as the "set of contexts found in physical or virtual spaces that provide opportunities for learning" (2006, p. 195) which may include formal, informal, and non-formal settings. She pursues a research interest in fostering 'technological fluency' in her students and in exploring "synergies between participation in technologically mediated informal learning activities and more formal educational environments" (2006, p. 198). She aims at highlighting the conditions enabling boundary-crossing activities and examining the characteristics of diverse learning spaces, intended as specific contexts showing a

”unique configuration of activities, material resources, relationships, and the interactions that emerge from them” (p. 198).

Barab Cherkles-Julkowski, Swenson et al. (1999) suggest context is fundamental in the ecological approach to learning and focuses on learner’s participation in a community of practice. In their perspective the learner (self) is coupled within the learning context (non-self) and “the individual, the task, the intention, practices, meanings and environmental particulars exist as parts of an interrelated system, not as isolated components” (p. 354). A more radical view of context and ecological learning is taken by Frielick (2004), who builds on an emergent ecological philosophy. He suggests the interweaving of individual and universal mind, and on stances attendant to fluid identities in networked environments. He sees teaching and learning as “an ecosystemic process of transforming information into knowledge, in which teacher, subject and student relationships are embedded or situated in a context where complex interacting influences shape the quality of learning outcomes” (Frielick, 2004, p. 328).

Normak, Pata and Kaipainen (2011) set out to provide a universal theoretical framework to structure and enable design of self-directed learning opportunities. To this end they propose an ecological approach to learning processes in which spatial concepts are particularly valued. In their model, a learner develops a learning path within a niche (or between niches) in a learning space, moving from a progressive series of steps towards a final target, whilst absorbing suggestions from the learning community.

Within the interdisciplinary fields of information systems and media studies, the spontaneous combinations of technologies and mixed forms of physical and virtual are named as ‘digital ecologies’ (Girard & Stark, 2007). Crabtree and Rodden (2008) are interested in the socially organized ways a technology-enhanced environment affords collaboration. They discuss the concept of ‘hybrid ecologies’ as a subsystem of digital ecologies, characterized by new kinds of environments merging physical and digital interaction and providing the user with a new fragmented interaction experience.

Given this brief review of terms and approaches, our choice is directed towards a socio-cultural perspective of ‘learning ecology’, in which the transitions of the individuals across a range of contexts providing diverse learning opportunities (Barron, 2006) can improve the understanding of the interdependence of the institutional and the personal level in an educational use of emerging ICTs .

Ecological approaches to e-learning

The ecology metaphor is used to better analyze the entanglement between technology and higher education: from the ‘microsystem’ level, considering the factors influencing the individual’s immediate environment to ‘macrosystem’ level, focusing on the interplay of settings in the wider society (Bronfenbrenner, 1979). Taking an ecological approach to student experience of e-learning in higher education provides a perspective for thinking the ‘new’ and the ‘traditional’ technological means and related learning and socio-cultural practices in educational contexts as a place “in which new and old entities find ways of coexisting” (Ellis & Goodyear, 2009, p. 17). This approach stresses co-operation, relationships and inter-dependence rather than competition and polarisations. Reaching balance and sustainability becomes crucial for embedding innovations, against approaches focusing on technology as a ‘challenger’ and a driver of disrupting change in the pre-existing educational system. Ellis and Goodyear (2009) elaborate on an ecological framework in which learning enfolds the key functions of teaching and learning, research and service in higher education. This ecological approach fosters the self-awareness of the diverse parts against the whole among stakeholders, a systematic collection of feedback about the effectiveness of specific interventions and a recursive self-correction in the effort to respond to rapid change. An ecological

approach suggests a participatory nature of e-learning design, policy and research processes. In fact, it is being applied to reconsider quality and assessment practices in learning with Web 2.0 tools (e.g. Elhers, 2010; Manion & Slefe, 2012).

The ecology-grounded concept of 'resilience' is the ability to learn and adapt, smooth risks and find effective solutions preserving one's own identity and key functions (Walker, Holling, Carpenter et al., 2004). This concept gained an increasing importance in discourses related to the relationships between technology and higher education, challenged by socio-economic disruption (Attwell, 2010; Downes, 2010; Jones, Selby & Sterling, 2010).

Hall and Winn (2010) discuss this concept as applied to university educational systems and to open education practices enabled by digital networks. They endorse a critical view of technology used in higher education, aiming to promote through open education a deeper engagement of all stakeholders in identifying reliable solutions in times of crisis. Open forms of higher education are said to be crucial "in framing spaces for personal and communal resilience" (Hall & Winn, 2010, p. 6), prefiguring more complex learning futures. In their view, despite the range of tensions within universities, technology plays a key role in enabling open curricula for resilience. It improves students' agency; provides diversity of approaches and modes of communication and production; facilitates effective feedback and as a consequence enables students to recognize the impact of their actions.

Unlike ecology approaches endorsing overall perspectives, Andrews and Haythonthwaithe (2011) consider a 'personal' ecological view on e-learning, resonating the current "on-the-ground experiences of teachers and students" (2011, p. 157), in order to better understand expectations and responses to new technologies demands. They refer to 'personal ecologies' as a new way to think about e-learning, since pervasiveness of social media and ownership of personal devices are challenging the conventional view of e-learning as an institution-bounded set of technology-mediated learning practices. They build on Nardi and O'Day's (1999) information ecologies and focus on university students seen as individual actors co-evolving with the academic environment and emergine as new 'species' of e-learners, previously playing a 'peripheral' role. The socio-technical combinations of offline and online communication tools are said to be increasingly complex and prefigure "cyber-local e-learning classes" (Andrews & Haythonthwaithe, 2011, p. 152), in which learners strive to manage control about potentially competing ecologies, in order to design their own learning context (Luckin, 2008). This approach of 'personal ecologies' can be coupled to an ecological view of agency (Priestly, Edwards & Priestly, 2012), in which the capacity of the individual is entangled with contextual factors and can be understood spatially and temporally.

With an aim to design technology-rich learning activities, Rose Luckin (2008; 2010) devises the learner-centric framework of 'ecology of resources'. Focusing on the individual learner in their ecosystem, it "considers the resources with which an individual interacts as potential forms of assistance that can help that individual to learn" (Luckin, 2010, p. 159). The goal is to identify the components (people, technologies, frames) supporting the educational experience of learners and any related adjustment providing learners with the appropriate scaffolding. The learner's intentionality is the axis from which the context can be interpreted as unified lived experience, making sense of the multiple interactions between people, and activities and resources. A context is always "local to a learner", since it consists of an individual's subjective experience of the world, that is always spatially and historically situated (2010, p. 18). In this view, technology plays a mediation role helping "to make these connections in an operational sense" (p. 18). Emerging technologies have a peculiar role as mediational tools: they foster the production of "learner-generated contexts" (Luckin, Clark, Garnett et al., 2010, p. 74), and provide students with the opportunity to achieve "greater agency" (p. 74) in defining goals and boundaries of their learning contexts. This model provides an individual perspective to look at learning ecologies and considers

static and dynamic representations of the interactions occurring among the learner and "potential forms of assistance" (Luckin, 2010, p. 111).

Emerging learning ecologies

The ecological metaphor is specifically used to suggest (Siemens, 2003) and explain the nature of the Web 2.0 phenomenon as "an artifact evolving with the shifting user engagement" (Brown, 2012, p. 50) and enabling open participatory learning ecosystems (Seely Brown & Adler, 2008).

Williams, Karousou and Mackness (2011) point "learning ecologies in Web 2.0" (p. 39) as *loci* in which new kinds of learners are developing their self-directed learning practices. They refer to these pioneer-learners as "*silent experts* in how, where and by whom they want to be educated" (p. 41). These 'silent experts' strive to balance "emergent and prescriptive learning" (p. 55) by coping with "openness and constraint" (p. 55) provided by the open Web and by institution-led educational opportunities.

Likewise, Pata and Laanpere (2011) focus on competing formal and informal digitally-mediated modes of learning in higher education. They provide a vision of learning ecologies as biological systems rather than as metaphors. In their assumption networked learning environments actually function like ecosystems. They build on the construct of "hybrid learning ecosystems" (slide 5) to highlight the tensions between formal educational assets and "open learning ecosystems" (para 1) where digitally literate learners are dwelling in the social Web. Their view stresses the key issues related to the opportunities for learners arising from the open Web and the commitment required to the educational institutions to shape and channel these opportunities.

Finally, working on the emergence of learning with mobile devices, Pachler, Cook and Bachmair (2010) develop a socio-cultural perspective of learning ecology. Learning is meant to be a meaning-making process. They view mobile learning as "an educational response to complex cultural changes in socialization" (p. 155), with a special reference to individualized mass communication. Their ecological perspective considers mobile learning in its interplay with changing socio-cultural and pedagogical contexts. They devise an analytical framework interweaving the dimensions of 'agency' (the capacity of individuals to appropriate mobile devices according to personal relevance), technical and institutional 'structures' and 'cultural practices', linked to the uptake of digital tools for everyday life communication and for educational uses, inside and outside institutions.

It is worth noting that in Web 2.0 literature a sense of 'ecology' is usually cited (but it is sometimes tacit) along with the conceptualizations of the PLE (Personal Learning Environment) which is "related to the use of technology for learning focusing on the appropriation of tools and resources by the learner" (Buchem, Attwell & Torresk, 2011, p. 1). However, in order to gain insights on the individual learner's moves across learning ecologies in formal and informal settings, it seems to be more useful to consider the theoretical stances attendant to the role of the 'social presence' in e-learning settings (Dron & Anderson, 2007; Garrison & Anderson, 2003). In fact, social presence assumes a pivotal role in not only setting the educational climate but also in supporting discourse and creating the educational experience (Garrison & Anderson, 2003). This key role can gradually evolve, according to three different levels of learners aggregation, from Group to Network to Collective. These three levels are characterized by different groupminds enabled by the social software tools: "aggregated groups may move amongst the three models as their collective needs are modified over time and context" (Dron & Anderson, 2007, p. 4). In this view, it can be advanced that 'social presence' could variously affect student agency of, as an example, individual doctoral researchers, striving to tentatively adopt social software in order to build new forms of academic socialization.

An ecological approach in the study on doctoral e-researchers

Given the illustrated review of ecological approaches and concepts, this section sketches a possible application of some ecological stances to a specific case study. This chapter stems from an ongoing research focusing on how the doctoral journey is changing from the impact of new digitally-mediated practices. It makes the case for 'personal ecologies' (Andrews & Haythonthwaithe, 2011) of Italian doctoral researchers, dealing with the learning opportunities provided by their formal research training setting and by the open Web. It is designed to illustrate how alternative or complementary learning spaces and temporal configurations are being utilized and co-constructed by a niche group of PhD candidates – named as 'doctoral e-researchers' - as they are absorbing conventional practices and tacit norms from a defined research department. In an early definition, doctoral e-researchers are PhD scholars using social media to carry out activities such as preliminarily exploring new topics, searching for updated research materials, disseminating early findings, experiencing networking in digital spaces, improving their own personal development, critically discussing relevant issues and collecting and organizing inquiry data and the research project as a whole. The exploratory approach of the study is directed to reveal any tensions occurring between institution-led prescribed learning practices and these self-organised digitally-mediated practices undertaken by the doctoral researchers. Personal ecologies of doctoral researchers are thought as a possible element of discontinuity in academic contexts where digitally-mediated practices are enacted but actually not yet thematized to be integral part in the formation of future researchers.

An ecological view of agency and the concepts of 'resilience' and 'keystone species' are considered useful to frame the case of doctoral researchers working in academic academic contexts comprised of hybrid (physical/digital) spaces that influence each other (Kazmer, 2005).

This study focuses on individual learners rather than on doctoral students as 'population': the suggested perspective of analysis is therefore to be developed at a micro level (Bronfenbrenner, 1979), by examining the contextual factors surrounding and to a degree shaping individual's behaviours. Individual learner is viewed situated in a specific institution-bounded ecosystem and coping at the same time with institution-led and self-organized learning ecologies (Barron, 2006). The doctoral e-researchers strive to develop their own set of interactions (e.g. with supervisors and peers) and "negotiated forms of agency" (McAlpine & Amundsen, 2011, p. 18), dwelling on the opportunities for research training and apprenticeship of their local context, and on a range of knowledge production and exchange practices they found and imitate in the social Web. For instance, some PhD students might use the open Web for an early exploration of a research topic, whereas mines the library databases to subsequentley refine the literature search; in other cases, they might follow the formal channels of the peer-reviewed research journals for the required publications, and in parallel practice academic writing by running a group blog, sharing views and methodological issues with peers. Institutional and self-directed learning ecologies are seen as filtered by the intentionality, motivations and evolving learning needs of individual doctoral students producing unique learning contexts. The attention is therefore directed to an ecological view of agency (Priestly et al., 2012), in which the individual student's ability to adopt social Web for research purposes is seen as grounded in a specific academic context, shaped by different subject-bounded modes of working and ICTs appropriation (Fry & Talja, 2007) and located in the diverse phases of the doctoral journey (Zaman, 2010).

Thus, a doctoral researcher working in a humanistic subject area, where an individualistic modes of ICTs appropriation is common (Fry & Talja, 2007) is likely to show different digital practices with respect to a doctoral researcher working in a techno-scientific area, where the prevalent mode of working is team-based and the technology uses are usually collectively organized. Likewise, a PhD student at the beginning of her doctoral journey is likely to much more rely on well-established academic conventions than a colleague in her final phase, when there are growing concerns about personal development and visibility of one's own academic profile in multiple digital venues.

Considering such a variety, the model of 'ecology of resources' (Luckin, 2010) provides the researcher with a heuristic tool to map out the range of 'forms of assistance' available to doctoral e-researchers in institutional and self-directed learning ecologies. In other words, this tool allows to draw contextual factors shaping the doctoral experience of the PhD students and to ask questions about their motivations. In fact, as a learner-centric model, the ecology of resources provides a perspective to think of learning context as a product and as a process related to a learner and therefore linked to her effort to 'internalize' selected resources and interactions. In this view, the doctoral e-researcher draws 'trajectories' of combinations of people, resources and relationships that give evidence of the boundary crossing activities between formal and informal learning ecologies (Barron, 2006). The capacity of the individual learner to develop original intersections of formal and informal learning ecologies might return the emergent profile of a doctoral e-researcher striving to build own academic identity beyond the models and conventions provided by the local research training setting. The implied question is the extent to which doctoral e-researchers are able to develop resilience in their own research context. Among the observed examples of resilience there are: an individual PhD student able to search in the open Web and harness the opportunities for additional research training to supplement the flaws of their local context; or a group of doctoral students challenging a conservative context by organizing a PhD scholars-led seminar, using a Facebook group page in order to amplify the dissemination of their contributions.

Moreover, the study sets out to reveal if the observed events denoting resilience can support the consideration of doctoral e-researchers as a new 'keystone species' in the scholarly community. In other words, able to create 'niches of co-evolution' (Nardi & O'Day, 1999) both as digital learners and as prospective e-researchers. Thus, to a degree doctoral e-researchers are considered as change agents whose action is likely to have an indirect impact (a 'loose coupling effect' according to Andrews & Haythonthwaithe, 2011) on the related ecosystem, represented by their local research training context. Otherwise, one might wonder if the innovative digital practices of a few individuals are emergent phenomena that remain isolated at a personal level, not shared with other 'species' (e.g. supervisors, senior researchers) and as a consequence not valued.

This leads to consider 'social presence' (Garrison & Anderson, 2003) as a catalytic element to foster student agency in a social media age. Focusing on the strand of the 'networking' activites in the doctoral experience, the PhD researcher might move across different kinds of aggregation: from a behaviour coupled to the model of Group to Network and to Collective (Dron & Anderson, 2007). This would include in-person meetings with peers combined with the use of a password-protected mailing list, to the adoption of a Networking groupmind, through the use of an open and research-based digital network in which building academic reputation. Finally, moving towards a Collective groupmind, in which practices such as updating on new publications and dissemination of one's own work go beyond the 'academic' boundaries in favour of the open knowledge exchange. The question is the extent to which the moves across these different groupminds can be spontaneously and tentatively undertaken by isolated PhD researchers or if these pioneers need to be critically supported by research contexts enabling new forms of academic socialization.

In this inquiry underway, the analysis of learner experience and student agency aims to suggest the interpretation that both prescribed and emergent learning need to be part of an integrated learning ecology (Williams et al., 2011), in a perspective leading beyond the ecological approach as a metaphor, towards a study of local ecologies as a frame for developing resilience and change (Hall & Winn, 2010; Hodgson & Spours, 2009).

Conclusions

This chapter presents an overview of the range of ways in which notions of 'ecology' and 'learning ecology'are applied to approach the impact of the Web on knowledge exchange and to frame different forms of e-learning at institutional and individual levels.

As a whole, ecological approach to e-learning is evolving as a way to think of technological innovations in educational settings as recursive attempts to find balance and sustainability among complementary alternatives, rather than replacing old means and practices with new ones. Furthemore, an ecological perspective resonates with participatory approaches in design and implementations of new digitally-mediated forms of education, combining critical thinking on technology and action to harness its potential. The ecological approach enables a focus on indvidualized forms of appropriation of technologies for specific needs, paying attention to the relationships between peripheral and central modes of ICTs adoption in a local context.

Given this repertoire of opportunities opened up by ecological approaches and concepts, the chapter briefly discusses a research case of Italian doctoral students adopting Web 2.0 tools along with institutional facilities to conduct research activities in their own doctoral journey. Thinking of individual doctoral students using social Web tools for academic purposes in ecological terms helps to consider the adoption of ICTs as a component in an ecology of resources and as a response to changing needs to learn and adapt their behaviour in the academic ecosystem.

However, there are limitations and risks in the adoption of the lens of learning ecology which the researcher should be aware of. Firstly, it is easy to misunderstand findings, for instance attributing a general value to phenomena related to a local context. Secondly, it is rarely clarified what level of human ecologiy is being investigated, in a continuum from a micro to a macro level (Hodgson & Spours, 2009). Thirdly, it is noted (Frielick, 2004) that often the analytical uses of 'learning ecology' are loosely defined and the adherence to a specific ecological view is not made explicit. This leads to the danger of being unaware of one's own epistemological assumptions. For instance, in the instance under investigation, focus on personal ecologies and on student agency underlies a constructivist view of human ecology, in which the individual's capacity, although shaped by environmental factors, is a key to act upon the situated context and create forms of resilience.

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Glossary of Terms

Agency

Collective

Cronotope

Digital Ecosystems/Ecologies

Ecology

Ecology of Resources

Group

Information Communications Technology

Knowledge ecologies

Learner- centric

Learning ecology

Local to Learner

Loci

Network

Personal Learning Environment