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A DIGITAL LEARNING ECOLOGIES CONCEPTUAL FRAMEWORK IN THE MICROSYSTEM OF ONLINE HIGHER EDUCATION

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Summary

The field of online and distance learning (ODL) has expanded exponentially in the networked society becoming part of mainstream higher education practices and a catalyst for both reform and educational transformation, ushering in new pedagogical models of open and distance learning through the affordances of networked information and communication technology. The guiding research problem recognizes an urgent need to think more holistically and critically about online learning across a variety of contexts, and deliberately consider the interconnections between institutionalized learning and the informal, incidental and tacit learning that happens in contexts outside of formal environments.

This paper presents a conceptual framework that contributes to the literature base on student experiences of learning in online higher education, seeking to broaden understanding of ecological approaches and student experiences of online learning. A digital learning ecologies conceptual framework is introduced as an organizational scheme, extending from Brofrenbrenner's (1979) ecosocial system model, that can be used as a guiding heuristic and analytical model for researching and conceptualizing student learning in virtual contexts across a continuum of learning formality. It presents conceptual findings useful in examining the role of emerging digital learning ecologies in online higher education, analysing the individual microsystem dimensions of students in relation to their digital learning ecologies that offer opportunities for learning.

Introduction & Research Context

At the beginning of the 21st century, far-reaching technological, social and pedagogical shifts have taken place in higher education (HE), accelerated by the adoption of new media and digital technologies across all sectors of society. More fundamentally, as higher education has had to prepare for the transformation toward the digital university (Siemens et al. 2016), so to have students had to navigate increasingly digital, collaborative and globally networked learning scenarios. The objective of the current study, therefore, is to analyse the contribution and potential of the digital learning ecologies of online graduate students in order to provide recommendations and guiding heuristics for improving pedagogical practice in online HE. The context for the current study, accordingly, is the microsystem of student learning rooted in an ecological model in online higher education, influenced by the work of Brofrenbrenner (1979;

1994). The purpose of the research is to examine student's experience of online learning using a Digital Learning Ecologies analytical framework, understanding how learners approach and conceive of learning across a continuum of learning formality.

In this context, several notable authors (Guitert et al, 2015; Castells, 2009) agree on the fundamental role that the university plays as an institution in the network society. Consequently, the context of innovation in online higher education responds to the changing requirements for learning in a globally networked society that sees education, training and learning as lifelong and lifewide processes (Jackson, 2016; Ito et al., 2013). In this context, new teaching and learning frameworks, as various authors (Guitert et al., 2015; Harasim, 2000) have argued, should be founded in flexibility, interactivity and networked collaborative learning.

Emerging digital pedagogies have offered the possibilities of facilitating novel and innovative teaching methodologies that foster the opportunities of digital technology including active and collaborative knowledge construction, collective intelligence, ubiquitous interactivity, and multimodal representations (Cope & Kalantzis, 2017), however there remains an unresolved debate about how ICT should be applied and used in supporting pedagogy and learning. There appears to be a tension between traditional transmission approaches to ICT and learning, with newer conceptualizations that promote a radically different vision of pedagogy based on digital age holistic approaches focused on competencies and literacies (Livingstone, 2012; Cope & Kalantzis, 2017) as well as lifelong and lifewide learning. It is clear that we will continue to see new modes of learning and advances in technology pushing the boundaries of online higher education into the future, particularly as research of communication, interaction, and collaboration continue to dominate the micro-level research agenda in online higher education.

Theoretical Framework

Learning in the Digital Age

Important developments in the sciences of learning, particularly in the last 30 years, offer evidence based principles for how people learn, grounded in cognitive and constructivist theories and a learner-centred approach. For example, Bransford et al. (1999) offer compelling empirical evidence that the most effective learning environments are framed within four overlapping dimensions, arguing that successful learning is community-centred, knowledge-centred, learner-centred, and assessment-centred. Consequently, authors such as Anderson (2004) have incorporated these overlapping dimensions into robust and impactful theories of online learning, contributing to the re-conceptualization of learning from new perspectives to include emerging understandings of how, where, when, why and with who individuals learn mediated through digital technology. Many argue this process can begin through ecological or holistic approaches with a focus on life-long and lifewide learning that recognizes the interactive nature of learning across a continuum of contexts, relationships, activities and intentions (Jackson, 2016; Ito et al. 2013).

There is, however, an abundance of evidence in the literature that the conversation about learning is changing and important, new questions are emerging that aim to offer solutions to

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the educational problem of how to serve the needs of both individual learners and society today (Cope & Kalantzis, 2017). Dron and Anderson (2014) argue that the university in the digital age should be built on the learning affordances of Web 2.0, social software and emerging technologies founded on social interaction, connectivity, social knowledge construction and collaboration. Similarly, Becker et al. (2017) argue that advancing innovative pedagogical approaches requires cultural transformations focused on student-centred models as well as integrating digitally-mediated formal and informal learning as the essential constituent of higher education. Consequently, the convergence of the modern university, the social Web 2.0, digital media and participatory culture is redefining higher education in the digital age toward student-centred models that focus on collaborative, active and deeper learning approaches.

Lifelong and Lifewide Learning

The concept of lifelong learning has an essential position in redefining the critical skills and abilities needed for citizens and learners today. A broad view of the core characteristics of lifelong learning include; open and universal access to learning opportunities for citizens; an acknowledgement of learning in a variety of settings beyond institutionalized formal education; learning throughout the lifespan; a diversity of approaches to teaching and learning; and a shift from teacher-centred to student-centred learning (Kehm, 2015). Lifewide learning is an allied concept to lifelong learning, although less commonly found in educational discourse and less commonly applied within educational institutions. Jackson (2016; p.4) defines lifewide learning as "all learning and personal development that emerges through activities in the multiple contexts and situations we inhabit contemporaneously at any point in our life". The attributes of formal and informal learning are particularly important for a lifewide perspective, however many have noted (Sefton-Green, 2012; Malcolm et al., 2003) that there is a lack of agreement in the literature about what informal, non-formal and formal learning are, as well as what the boundaries between them might be. Malcolm et al. (2003) examined a range of learning contexts in a compelling literature review and concluded that attributes of formality and informality were present in all circumstances of learning and offer what they call a continuum of learning formality, which will be used in the current framework of this study.

A Learning Ecologies Conceptual Framework

In recent years, a growing yet diffuse literature on "learning ecologies" has emerged (Brown, 2000; Barron, 2006; Jackson, 2016) with an interest in the possibilities of new technologies in facilitating self-sustaining, interest-driven, boundary crossing, as well as lifelong and lifewide learning. Despite the contributions of various researchers, a learning ecologies framework is not yet a standardized or stable concept in the literature. Learning ecologies have been studied from a variety of perspectives, however most approaches seek to develop sociocultural and situated approaches to human learning and development that originated in the work of Vygotsky (1978) and in the ecology of human development from Brofenbrenner, (1979; 1994). Brofenbrenner's ecosystem view on learning and development offers a conceptual system that can assist in guiding research design and data collection, laying the analytical groundwork allowing for the construction of a Digital Learning Ecologies conceptual framework. This perspective emphasizes the interacting role of culture, social interactions, practices and

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resources in individual learning and development mediated through tools and technology (Barron, 2006; Sefton-Green, 2013; Ito et al., 2013). Derivative sociocultural theories such as communities of practice (Wenger, 1998) and situated learning (Lave & Wengner, 1991) as well as emerging theories such as connectivism (Siemens, 2005) have all been linked to the conceptualization of learning ecologies.

Barron (2006) defines a learning ecology "as the set of contexts found in physical or virtual spaces that provide opportunities for learning. Each context is comprised of a unique configuration of activities, material resources, relationships, and the interactions that emerge from them" (2006; p.195). Formal education, however, often overlooks new contexts and spaces of ubiquitous educational interaction (Buckingham, 2007) that is now generated through virtual environments that support expansive learning networks and communities, where knowledge is exchanged and co-constructed through digital technology in both virtual and face-to-face contexts. At the same time, formal curriculum boundaries disappear and become blurred (Cope & Kalantzis, 2010), presenting a series of both challenges and opportunities for higher education in the digital age.

Research Methodology

In the first phase of a constructivist, exploratory qualitative study, a literature review has been conducted in order to construct an organizational scheme and guiding heuristic of the digital learning ecologies of online higher education students. As Brofenbrenner (1979; p.41) proposes, ecological research on learning must recognize that "the properties of the person and of the environment, the structure of environmental settings, and the processes taking place within and between them must be viewed as interdependent and analyzed in systems terms". Correspondingly, the methodology followed for the first phase of the research involves building interrelationships between conceptual frameworks appropriate for examining student learning in online higher education, and will be used as a guiding heuristic for the design of research instruments as well as data collection and analysis.

Research Findings

Using an ecological metaphor for learning involves viewing society "in terms of whole systems that contain many interacting components" (Jackson, 2016; p.33). Although Brofrenbrenner's ecological approach has been influential in human and family development studies, it has only been marginally used in higher education, and less so in online higher education. Brofenbrenner's ecological paradigm for interpreting human learning continues to be valuable and, particularly in the digital age, can advance conceptual frameworks for researching and constructing new knowledge about learning across the physical and virtual, as well as the formal and informal environments of online higher education. Brofenbrenner's conceptual framework provides an integrated and nested way to see learning through an ecological lens, from the configuration of activities, relationships and resources that interact to offer opportunities for learning in virtual contexts. It also offers the opportunity to fuse Brofenbrenner's conceptual thinking with advances in the learning and pedagogical sciences, and in particular, with sociocultural orientations on learning.

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Ecosocial Systems in Online Higher Education

Specifically, two levels of Brofrenbrenners ecosocial systems model are critical for a digital learning ecologies framework (see Figure 1), namely the microsystem and mesosystem (Jackson, 2016). The microsystem is understood as the level of lifewide learning experiences and activities that include the immediate environments of home, work, school and community life, in essence the everyday situations in the world. The microsystem is the level we engage and interact with in everyday situations and experiences and in which we respond to these situations with our capability and competencies. The microsystem is the direct level of our digital learning ecology, that encompasses the configuration of activities, interpersonal and networked relationships as well as digital resources that offer opportunities for learning. The mesosystem encompasses the interrelations between two or more systems, representing lifewide experiences across a variety of contexts and settings, including the influence of mass media and the broader digital culture. The influence of the mesosystem on the microsystem is particularly important, as activities, relationships and resources at this level can support and amplify opportunities for learning and engagement, particularly through informal processes.

The Chronosystem encompasses change and consistency over time both in the ecosocial systems of the networked individual (including variables such as age, health, education or labour position, motivation, physical access to networked devices, digital competencies and digital usages), as well as in the virtual contexts in which learners interact, communicate, participate and collaborate (e.g. advances in technology, innovations and capacities of the Internet, artificial intelligence, software design, A.I., and connectivity etc.). The technosocial subsystem, where learners and technology merge to work as heterogeneous but functional wholes, is critically relevant in this framework, as the transformative technological advances in society offer valuable learning resources, unthinkable to learners just one generation ago. Examples of the technosocial subsystem are highlighted in Figure 1.

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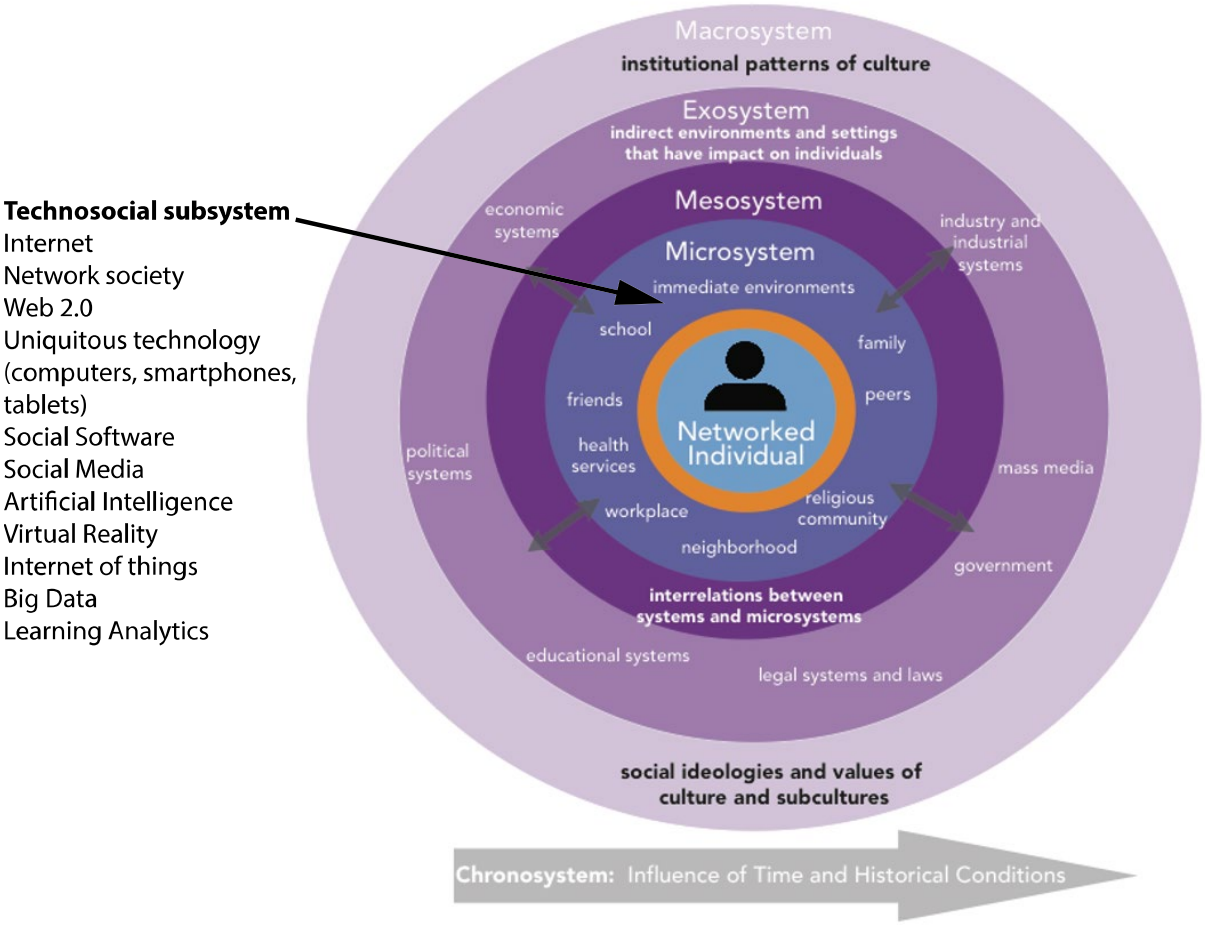

Figure 1. Ecosocial Systems Model (adapted from Brofenbrenner (1979))

A Digital Learning Ecologies Conceptual Framework

Bronfenbrenner's ecosocial systems model can be extended to the context of online higher education, interrelating with an individual's digital learning ecology that is in constant change, adaptation and in search of an ecological balance (Ellis et al., 2013). An individual's digital learning ecology, correspondingly, operates within the ecosocial systems (micro, meso, etc.) that an individual inhabits. In this context, all learning will be both online and situated in ever-shifting contexts. Equally important is that attributes of formality and informality will likewise be present in all circumstances of learning across a continuum of learning formality (Malcolm et al., 2003). Informal learning will occur in institutional spaces, and formal learning may take place in informal spaces such as cafes or bars. Thus, situated physical and virtual contexts are the de facto scenarios for all learning.

To advance our understanding of learning in the digital age, we need conceptual frameworks and organizing schemes that can not only advance theory but also guide data collection for empirical research in fields such as online learning. A digital learning ecology, therefore, is defined as the set of situated and ever-shifting physical and virtual contexts that provide opportunities for learning, mediated through digital technology. In a digital learning ecology, learning emerges through the interactions between an individual's interpersonal and networked

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relationships, the activities they engage in, and the digital resources they seek out or those that are introduced by a teacher, peer or knowledgeable other.

The digital age requires an organizational scheme to make sense of the myriad forms of networked social relations that are present in digital culture. A digital learning ecologies framework can use two broad categories of social relations, namely *interpersonal* and *networked* relationships across both academic and non-academic settings. This dimension includes a range of relationships encompassing individual, peer or dyadic relations, as well as group and network relations, where many of these social forms may include common learning scenarios such as communities of practice and virtual communities of interest or affinity groups.

A learner activity is often a combination of both physical and mental activity performed with mediating tools and resources in a situated environment. In online HE, the learning activity is central to student achievement and significantly impacts student learning outcomes. As Ellis and Goodyear (2013; p.120) argue, "the learner's mental activity is the thing that changes what they know: any changes in competence or understanding are dependent on what the learner does". Learning activities are therefore the essence of any pedagogical design in formal education. Thoughtful activity design, planning and development often determine the success or failure of any learning initiative or process. It is the interconnectedness of learner activity across formal and informal virtual contexts that is essential in building self-sustaining, interest-driven and meaningful learning.

In an ecological sense, resources "are anything that is of value to the organism and the sustainability of the ecosystem" (Jackson, 2016; p.49). In the context of higher education, resources are the material objects, expertise, knowledge or tools that are sought out by the learner or introduced by an instructor that support learning. In relation to the social nature of learning, especially underpinned by the theoretical framework of socio-constructivism, the dimension of digital resources will focus on mediating digital tools that include social software and Web 2.0 technologies as well as digital resources, that focus on digital content.

Conclusion

The objective of defining a digital learning ecology conceptual framework has been to create an organizing scheme that will support future lines of research and data collection in the field of online learning using an ecological approach. This conceptual framework will be used in further case-study research to analyse the attributes of learning offered by the various components that configure the digital learning ecology of online HE students. This guiding heuristic will be used to analyse the strategies students use to connect the different components of their learning ecology across a continuum of learning formality. More fundamentally, a digital learning ecology conceptual framework will be used to support the identification and analysis of student experiences and conceptions of online learning in relation to student development as lifelong and lifewide learners. The objective of using such a framework is to analyse the contribution and potential of the digital learning ecologies of online university students in order to provide recommendations for improving pedagogical practice in online HE.

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As the majority of all learning in present and future settings will be both online and situated in ever-shifting physical and virtual contexts, it is the argument of this research that an ecological perspective in online higher education, represented through a digital learning ecologies conceptual framework, will prepare students for the demands of a complex, dynamic and interconnected global society. Finally, supporting sustainable, lifelong and self-directed learning in online HE demands an ecological approach that can respond to the complex interrelations between student learning across a continuum of learning formality in self-organizing, adaptive and open digital systems, presenting implications for the holistic design and delivery of online higher education.

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