

Web 2.0 and Higher Education: Pedagogical Implications

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New cultural, educational and inter-personal phenomena are clearly emerging from the use of technologies capable of enhancing social networking (O'REILLY, 2005; OBLINGER & OBLINGER, 2005), but little research has been made addressing the psycho-pedagogical foundations and implications of this new technologies. Departing from an analysis of the Social Web from diverse theoretical perspectives, namely Social Constructivism, Connectivism, Distributed Cognition, Situated Learning, and Collective Intelligence, we intend to address those challenges, in order to explore and clarify the potential and limitations of the so-called "Web 2.0" in Higher Education, from a psychological oriented perspective.

1. Introduction

In our society, knowledge is a major component of any activity, and the driving force of change and innovation (UNESCO, 2005). Colleges and Universities have a key role in promoting high quality and reliable education and the development of knowledge, but are far from being the only (or even the main) source of information and knowledge nowadays, due to the expansion of new forms of communication (most notably the Internet). From the use of Information and Communication Technologies (ICT), a global society arouse, and knowledge is now shared without constrains of geographic proximity.

In places like Europe and the United States, there is a new generation of students entering Higher Education institutions who have grown within an environment where information technology has opened unprecedented opportunities of social interaction and peer-construction of knowledge. Also, the emergence of social software has enabled people to connect and collaborate throughout computer-mediated communication and to easily form online communities. Furthermore, projects like the One Laptop per Child (NEGROPONTE, 2005), allied with the exponential growth of computer and internet capabilities makes any debate about the impact of ICT in

Education extensible to countries that have been so far deprived of this kind of technology.

Our main goal is to address such challenges in this paper.

2. The University and the *Social Web* Challenge

2.1. Community, Participation and Higher Education

Higher Education Institutions (HEIs) are facing strong pressures to adjust their methods of knowledge creation, sharing and preservation (and even the way the knowledge evaluation process is conducted), due to the technological changes of the past years. Many of the major HEIs are already testing new forms of accomplishing their social mission. We can state, as examples, initiatives like the MIT *OpenCourseware*, Berkeley's *Webcast.Berkeley* initiative or the Open University's (UK) *OpenLearn*"project, only to name a few leading schools that are adopting forms of communication that were unforeseen a mere decade ago.

The generalized use of the Internet, and specially the World Wide Web, is only less more than a decade (as of early 2008), and yet the nature of communication on the Web has been deeply transformed recently, with the introduction of tools and services which allow for a much greater participation of people in the generation of online material. There is a new generation of students who are accustomed to these technologies and who use them to share knowledge and information outside the strict context of the traditional classroom. Navigating the Web, we can see people of all ages taking active roles in geographically disperse communities, collaborating and building knowledge through interaction and self-regulatory social dynamics.

Furthermore, the worldwide development of knowledge societies offers a unique chance for less developed countries to catch up with industrialized countries, taking advantage of technologies that allow a widespread dissemination of knowledge (UNESCO, 2005). At the heart of the effort to build knowledge societies is the understanding that knowledge can be a decisive instrument of development, empowerment and capacity-building. The MIT OpenCourseWare (OCW) initiative's motto is precisely "unlocking knowledge, empowering minds", and this program was initiated to provide the dissemination of knowledge and collaboration among scholars around the world. Although only 1% of OCW traffic since 2004 came from users on sub-Saharan Africa,

this represents about half a million visits, and projects like OpenAfrica (2006) or African Virtual University (2005) were started to enhance the use of ICT in this region. Most importantly, MIT's initiative was followed by a number of other institutions making their courses available as open educational resources, available for use to students and educators all over the world.

Tim O'REILLY (2005) coined the term *Web 2.0* to refer to the *revolution in the computing industry caused by the move to the Internet as a platform*. It is difficult to define concisely what this concept means, since it covers such a wide range of applications, including *Blogs, Mashups, Wikis, feeds to social bookmarking, social networking and media sharing sites*. Although few people use all of these tools, many use one or more. We can say that, in its essence, Web 2.0 is a *participatory Web*. By lowering the barriers to participation, the Web 2.0 concept goes beyond the idea of opening software code to developers: it states that content production of online information must be opened to all users, who must be allowed to re-use and *mash up* data as they want and need (O'REILLY, 2003).

A key feature of Web 2.0 services is what O'REILLY (2003) calls an *Architecture of Participation*, i.e. through normal use of the application or service, that service appears, to the user, to become better. Web 2.0 software is designed so that the user interactions have the *side effect* of improving the service (e.g. Del.icio.us tags, Yahoo Answers user points, BitTorrent sharing protocol).

Most Universities today still use a centre-staged model of teaching, in which discipline experts transmit theoretical knowledge that passive learners receive and consume. In a model of this type, collaboration is discouraged, and students who engage in collaborative learning strategies have to so removed from the official lecture hall, as if they were carrying subversive or illicit methods in their learning (HERRINGTON & HERRINGTON, 2005). Many teachers follow a traditional approach to teaching because they are just reproducing the way they themselves were taught, ignoring recent theory and research on human learning. Traditionally, the University is a place where theory can be learnt devoid of its originating context. In many cases, this potentially leads to *superficial* learning of theoretical materials by the student (e.g. textbooks) who then regurgitates the information on exams (HERRINGTON & HERRINGTON, 2005).

It is imperative to take advantage of the free and open educational resources, opencourseware and open software that is available and to promote a participatory learning culture in which learners build, explore, share and collaborate together online.

The use of Web 2.0 technologies in the context of Higher Education could lead to the implementation of a model of learning centred on the concept of *Community of Practice* (LAVE & WENGER, 1991), in which learners are seen as participants of a framework that has social structure, rather than being passive elements that acquire models of a static world. Peer-pressure to enhance performance and to participate in collective activities is a factor that promotes the building of ethical relationships between people involved in a Community of Practice.

In the wider community, there is a need for a dynamic and adaptable workforce, but employers and governments now realize that in many cases the learning outcomes they need from university graduates are lacking. Nations, employers and governments require graduates who are able to build communities, and to communicate in innovative ways, in the realm of their profession (HERRINGTON & HERRINGTON, 2005).

The growing influence of constructivist ideas in learning (VYGOTSKY, 1978), has prompted many educators to research and implement more *authentic* (real world) learning environments, in which teaching and learning takes place in settings closer to real-life scenarios, and thus adjusting better to the concrete needs of students and Society (e.g. MCLELLAN, 1996; COBB & BOWERS, 1999). Nevertheless, the adoption of new methods of teaching and assessing knowledge must be preceded by a careful analysis of their pedagogical justification, educational advantages and practical implications. There are persistent complains about the use of information and communication technology in educational contexts without a solid psycho-pedagogical foundation (e.g. ATTWELL, 2004; BARONE, 2005; STAGER, 2005). But even seemingly “obvious” assumptions, like taking for granted that students value the use of Web 2.0 tools in the context of their college education, have been disputed by some, based on empirical data. KVAVIK (2005), for example, found that although students value the moderate use of technology in their classes (providing conveniences such as syllabi, class readings, online submission of assignments), they also ranked face-to-face interaction at the top of their list of educational preferences. According to OBLINGER and OBLINGER (2005), colleges and universities should not assume that more technology is necessarily better. For instance, in a campus where wireless

communication has been implemented, its main use may be outside the academic realm. In order to take advantage of this technology to promote collaboration and harness collective intelligence, the whole community of learners and teachers must work together in creating an adequate architecture of participation.

2.2. Collective Intelligence, Collaboration and the University

The idea of *Collective Intelligence*, despite being around for more than a decade (e.g. LEVY, 1997), is now giving rise to new insights on educational processes (DOWNES, 2006), and emergent phenomena like *Wikis* (e.g. *Wikipedia*) are a good demonstration of the power of collaboration through technology.

In the context of Web 2.0, O'REILLY states that there is an implicit *architecture of participation*, a built-in ethic of cooperation, in which the service acts primarily as an intelligent broker, connecting the edges to each other and harnessing the power of the users themselves. (O'REILLY, 2005).

Social-cognitive competences are being more valued each day, and they can also be developed through the use of the Internet (MONEREO, 2005). Social Constructivism emphasises the negotiation and the co-construction of meaning with others (BONK & CUNNINGHAM, 1998). VYGOTSKY (1978) and the followers of social constructivism view learning as a social process: the learner benefits from the support of a teacher or colleague who is at a higher level of development, in order to advance in her learning.

With the availability of Web 2.0 tools, publishing information becomes easy, and several studies (and the empirical experience of many teachers) have demonstrated that when the student knows that his/her work will be available on the Internet, they do it with much greater interest and effort (CRUZ & CARVALHO, 2006; EÇA, 1998). This effect is even more enhanced if there are channels through which the student can receive direct commentary on his/her work (e.g. via a Blog).

Collaborative learning involves the making of meaning in the context of joint activity. This learning is not merely acquired through interaction: it consists of the interactions that occur between participants (STAHL, KOSCHMANN, & SUTHERS, 2006).

We need, therefore, to understand how the cognitive processes are influenced by the social interaction and how learning takes place in the interactions between participants.

Recently, SIEMENS (2004) has been applying ideas similar to those of the sound theoretical framework of Connectionism (RUMELHART & MCCLELLAND, 1986) into the realm of Education, under the term *Connectivism*. Although connectionism as proved to be a very productive theory to explain distributed cognition at the individual level, SIEMENS' *Connectivism* is an emergent perspective on how knowledge can be distributed through networks of people and appliances (and not just distributed in the individual's brain, as in the case of classic Connectionism).

Essentially, a Connectivist view of knowledge postulates that (SIEMENS, 2004):

- A. learning and knowledge resides in the diversity of individual perspectives
- B. learning is a process of connecting information sources (i.e. connecting nodes in a network)
- C. learning may reside in non-human appliances (e.g. a database, but also a community, a network, etc): organizational and personal learning are integrated tasks.
- D. the capacity to know more is more critical than what is currently known: learning is a knowledge creation process
- E. the ability to see connections between fields, ideas, and concepts is a core skill, since the individual is *participating*, as a node, on a *network that learns*
- F. accurate and up-to-date knowledge is the intent of all connectivist learning activities
- G. maintaining and enhancing connections is needed to facilitate continual learning
- H. since reality is dynamic, the process of decision making must be also subject to the laws of learning and self-actualization.

Web 2.0 fits well into a connectivist model of learning, comprising a panoply of tools that could lead to an Education directed to the needs of a Society that requires skilled workers, and critical and creative thinkers, even if terms like *Wikis*, *Blogs*, *Podcasts*, *RSS*, *Mashups* might sound like hype and complex jargon to the general public (including many educators). In this respect we cannot restrain ourselves from totally agreeing with SIEMENS (2007) opinion that the tools are not central for an understanding of the potential impact that an idea like Connectivism may have in

Higher Education: what is central is the *change* that this tools would allow if they were used in its full transformative potential.

3. The New Public(s) of Higher Education

3.1. The *Net Generation*: A Psychological Profile

According to STRAUSS & HOWE (1997), current traditional-age (18-24) university students belong to a generation they call *Millennials*. This is a group of people that have grown up with networking technologies (from the Internet to Mobile Phones), and have thus gain unprecedented multitasking capabilities, allied to expectations of fast interactions with information channels and an intrinsic desire for connectivity. TAPSCOTT (1997) and OBLINGER and OBLINGER (2005) call this students the “Net Generation”, thus emphasising the importance of information and communication technologies when searching for a generational taxonomy that fits well with these students. Back in 1998, when the Internet was less developed and today’s university students were children, the term employed to describe them was *Nintendo Generation*, a classification that allow us to understand how these students developed their multitasking and rapid information processing abilities, although being insufficient to explain their tendency towards networking and social participation (STRAUSS & HOWE, 1997).

Even if people of all ages live surrounded by technology (in the western world, lets not forget, for this is not irrelevant, of course), authors like PRENSKY (2002), distinguish between *Digital Natives*, i.e. people for which current technology is as familiar for them as their mother tongue, and *Digital Immigrants*, older people who have not been exposed to the new tools since they were very young, and therefore use present-day IT in a less instinctive way. A *Digital Immigrant* compares to a *Digital Native* in the same way a native English speaker compares to a person who starts using English in his/her adolescence or adulthood (PRENSKY, 2002). Of course, we see many learned adults becoming more proficient in a foreign language than some of its native ill-educated speakers, but there is a tendency for natives to learn the competency effortlessly, and in a much more intuitive way.

People who are now in their late teens or early twenties have never known a world without computers with large, trustable mass-storage, cyberspace, and multimedia capabilities. For them, Iraq was always a Country at war with the West, and Europe has

always been a place without borders. There are many differences between individuals within this generation (dictated by socio-economic class, gender, geography), but there is also much communality. It is the part of their personal history they share with each other, and the fact that they all passed by global historical events at about the same age, that allow psychologists to talk about *cohort effects* (SANTROCK, 1998). STRAUSS and HOWE (1997) even refer to the concept *Personality of a Generation*. Although the use of the term “personality” is debatable when applied to a group of people, we can see it as an extension of the concept of an individual’s personality, i.e. the characteristics possessed by a person that uniquely influences his or her cognitions, motivations, and behaviors in various situations (RYCKMAN, 2004).

Students belonging to the *Net Generation* (also labeled *Millennials*, or more controversially *Generation Y*), have been exposed to digital technology in virtually all facets of their lives. This had, and still has, a profound impact in their individual personality, in the way they relate with other people, and in the way they see the world. As a group, they also show some distinctive psychological characteristics. In particular, young people belonging to this generation tend to exhibit (TAPSCOTT, 1997):

- 1) Well developed multitasking capabilities
- 2) Active preference toward knowledge construction, rather than following instructional pedagogical designs
- 3) Little tolerance for delays: technology taught them to expect immediacy
- 4) Easiness in interactive settings, were they are not just viewers, but also actors.

3.2. Non-traditional Students and Lifelong Learners

Education is mentioned in the Universal Declaration of Human Rights of 1948 has a fundamental Human Right (UNESCO, 2005). The ubiquity of Web 2.0 tools in schools, at work, and at home may have a profound impact in the realization of the lifelong learning agenda, allowing the establishment of *Learning Networks*: networks of people and organizations that create, share, support and study learning resources ('units of learning') in specific knowledge domains. (KOPLER & SLOEP, 2003).

Life-long learning emphasizes that it is never too late to learn. In an increasingly demanding world, where each person may need to have more than one profession in the course his/her working career, lifelong learning becomes indispensable.

According to ASPIN & CHAPMAN (2000), the goals of lifelong learning are: 1) to enhance economic progress and development; 2) to contribute to personal development and fulfilment; 3) to promote social inclusiveness and democratic participation.

Web 2.0 tools can contribute to a type of lifelong learning well suited to the characteristics of older students and the needs of society as well: these technologies allow students to participate in activities they enjoy, and learning may then come as a by-product of participation. According to MASON (2006), this is a “lesson” about lifelong learning that educators need to learn.

4. Learning in a Connected World

4.1. Learning, Society and Psychological Development

Psychologists such as PIAGET (1960/1995) and VYGOTSKY (1978) emphasized the social nature of learning, particularly in situations in which learners are faced with challenges they cannot solve alone, without the resources of a group. *Discussion*, a process by which members of a group present their ideas to others and receive feedback, provides the cognitive scaffolding necessary for higher-level thinking (VYGOTSKY, 1978). This type of activity is inherent to Web 2.0, allowing us to expect major potential impacts in Higher Education if these technologies are integrated in teaching practices at this level. A good example of a concrete, real world application of the somewhat abstract principles mentioned above can be seen in the community-driven website *Yahoo Answers*, where users can ask a question, and then receive answers from others. Everybody receives bonus for participating (both asking questions and answering them), but the person whose answer is considered the best receives more points: this ensures wide participation, since there’s a tendency for new questions (and answers) to appear, and also tends to promote quality, since the best answer is given extra points.

The dynamics and exchanges that take place in virtual communities like Yahoo Answers have clear resemblances with those that HUTCHINS (1995) considered to be typical of a *Learning Society*. The author popularized this term to denote the new kind of society in which the old limits on *where* and *when* knowledge could be transmitted no longer apply. In this society, the “human actor” must be put at the heart of the process of knowledge acquisition and communication.

Continuing to analyse Yahoo Answers as a concrete paradigmatic example of a typical Web 2.0 service, another important aspect deserves to be emphasized: the typical person who asks a question is actually facing a personal, educational or professional difficulty related to his/her life. Therefore, in Yahoo Answers we can see a clear realization of the concept of *Community of Practice* referred earlier (LAVE & WENGER, 1991).

This example serves also to reinforce that what is at stake, in the case of the concept of Community of Practice, is more than just *learning* (and certainly much more than a didactic conception of learning as a measure of teaching effectiveness). Rather, the main focus is the relationship between learning *and* the whole social and personal spheres (RODRÍGUEZ ILLERA, 2007). Community appears as the centre of social life, and the main reference framework for each individual. Learning is not a goal in itself, but rather one feature more on the full experience of participating on a Community of Practice.

4.2. Social Web Technologies and Learning

Simply adding technology to previously existing activities in the classroom does not produce positive results in student learning, if the habitual teaching practices remain the same (JONASSEN, 1996). Many times, teachers are not at ease with the IT tools they use in their practice, and the integration of Web 2.0 tools in teaching and learning requires a modification on teaching strategies and methodologies. Education Media, *per se*, will never be determinant of student performance (CLARK, 1994). The benefits of using a given technology in teaching only arises when a “wholehearted” approach is used, in which teachers fully take the technology into the centre of the educative process, and explore the full potential of the new tools in allowing challenging and creative activities. This also agrees with the Vygotskian perspective on teaching and learning: VYGOTSKY (1978) postulated that true education must come from life, and that the teacher must exemplify the relevance of the learning material by using it herself as a productive member of Society. Since the concept of Web 2.0 comprehends tools that allow individuals to participate in socially mediated activities, the relevance of Vygotsky’s Social Constructivist ideas cannot be overstated.

On the light of Social Constructivism (VYGOTSKY, 1978), it can be predicted that, as the use of Web 2.0 enhances social interactions, it will have a profound impact on the course of development of students: These are IT tools that are expected to exert a

radical change in the way in which people perceive both the world and themselves. For example, the development of cognitive structures depends largely on the ability of *cognitive decentration*, which can be exemplified by being able to cooperate with others, and to argue and counter-argue in Blogs, or in the making of a Wiki.

The participatory, dynamic and collaborative nature of Web 2.0 is where the promise of the new tools resides. The move toward read/write connective technologies is changing the way in which goods and services are being produced (TAPSCOTT & WILLIAMS, 2006). In Education this change can take the form of a style of interaction in which students can alternate with their teachers in the role of being active and leading the processes of learning and knowledge construction (ROBERTS, 2005).

5. Final Remarks and Recommendations

Web 2.0 services allow the harnessing of the power of groups. In order to take advantage of the *network effects* of these tools in Higher Education, open, participatory architectures for ICT systems must be in use. Students must be allowed and encouraged to produce their own content. Social networking technologies have the potential to enhance the dynamics of communication between life, work and school, thus creating meaningful educational experiences, adapted to both students' expectations and Information Society's requirements, taking into account that we are now in a true global society, and thus Higher Education Institutions must provide the knowledge to develop a global citizenship. This also leads to an emotion-related type of learning.

What remains the core challenge of the adoption of Web 2.0 in Higher Education is the balance that must be made between the necessary conservative part of Education, which is necessary to preserve past human effort and talent, as also traditional skills and knowledge legacy, and the possibilities that technology introduces in terms of students' self expression and co-construction of knowledge.

Bibliography:

ASPIN, D.N., & CHAPMAN, J.D. (2000). Lifelong learning: concepts and conceptions. *International Journal of Lifelong Education*, 19(1), 2-19.

Simões, L. e Gouveia, L. (2008). *Web 2.0 and Higher Education: Pedagogical Implications*. Higher Education: New Challenges and Emerging Roles for Human and Social Development. 4th International Barcelona Conference on Higher Education Technical University of Catalonia (UPC). 31 March, 1-2 April.

ATTWELL, G. (2004), *E-Learning and sustainability: report for european commission learning folders project*. [Accessed 1st November 2007] Available from Wide World Web:<<http://www.knownet.com/writing/papers/sustainabilitypaper>>

BARONE, C. (2005), The new academy. In: D.G Oblinger & J.L Oblinger (eds) *Educating the net generation*. [Accessed 2nd November 2007] Available from World Wide Web: <www.educause.edu/educatingthenetgen/>

BONK, C. J., & CUNNINGHAM, D. J. (1998). In Bonk, C. J., & King, K. S. (Eds.). *Electronic collaborators*. Mahwah, NJ: Lawrence Erlbaum Associates.

CLARK, R.E. (1994). Media will never influence learning. *Educational Technology Research and Development*, 42(2), 21-29.

COBB, P. & BOWERS, J. (1999). Cognitive and situated learning perspectives in theory and practice. *Educational Research* 28 (2), 4-15.

CRUZ, S. C. & CARVALHO, A. A. (2006). WeBlog como Complemento ao Ensino Presencial no 2º e 3º Ciclos do Ensino Básico. *Revista Prisma.com*, 3, pp. 64-87.

DOWNES, S. (2006), E-learning 2.0, *ACM eLearn Magazine*. [Accessed 3rd November 2007] Available from World Wide Web: <<http://www.elearnmag.org/subpage.cfm?section=articles&article=29-1>>

EÇA, T. (1998). *NetAprendizagem: A Internet na Educação*. Porto: Porto Editora.

HERRINGTON, A. & HERRINGTON, J. (Eds). (2005). *Authentic learning environments in higher education*. Hershey, PA: Information Science Publishing.

HOPPER, K. B. (2003). In defense of the solitary learner: a response to collaborative, constructivist education. *Educational Technology*, March-April, pp. 24-29.

HUTCHINS, E. (1995), *Cognition in the wild*. Cambridge, MA: The MIT Press

RODRÍGUEZ ILLERA, J. L. (2007). How virtual communities of practice and learning communities can change our vision of education. Conference given at the Faculty of Psychology and Educational Sciences of the University of Lisbon, on 31st May, 2007. *Sísifo. Educational Sciences Journal*, 03. [Accessed 2nd November 2007] Available from World Wide Web: <<http://sisifo.fpce.ul.pt>>

- JACQUES, D. (2000). *Learning in groups: A handbook of improving group work (3rd ed.)*. London: Kogan Page.
- JONASSEN, D. (1996) *Computer-mediated communication: connecting communities of learners*. New Jersey: Prentice Hall
- KOPLER, E. J. R., & SLOEP, P. (2003). *Learning Networks: Connecting people, organizations, autonomous agents and learning resources to establish the emergence of effective lifelong learning*. Heerlen: Open University of the Netherlands.
- KVAVIK, R. (2005). Convenience, communications, and control: How students use technology. In D. Oblinger & J. Oblinger (Eds.), *Educating the Net Generation* (pp. 7.1-7.20): EDUCAUSE.
- LAVE, J., and WENGER, E. (1991), *Situated learning: legitimate peripheral participation*. Cambridge, MA: Cambridge University Press
- LEVY, P. (1997), *Collective intelligence: mankind's emerging world in cyberspace*. New York: Basic Books.
- LOW, L. and O'CONNELL, M. (2006), Learner-centric design of digital mobile learning *Paper presented at the Online Learning and Teaching (OLT) Conference, 26 September, Queensland University of Technology, QLD*. [Accessed 2nd November 2007] Available from World Wide Web: <http://margoconnell.Wikispaces.com/papers>
- MASON, R. (2006). Learning technologies for adult continuing education. *Studies in Continuing Education*, 28, 2, pp.121-133
- MCLELLAN, H. (Ed.). (1996). *Situated learning perspectives*. Englewood Cliffs, NJ: Educational Technology Publications.
- MONEREO, C. (2005). Internet, un espacio idóneo para desarrollar las competencias básicas. In C. Monereo (coord.), *Internet y competências básicas. Aprender a colaborar, a comunicarse, a participar, a aprender*. Barcelona: Graó.
- NEGROPONTE, N. (2005), *One Laptop Per Child: Presentation on the World Economic Forum 2005 / Davos*. [Accessed January 2, 2008]. Available from World Wide Web: <<http://www.weforum.org/en/index.htm>>

O'REILLY, T. 2003. *The Architecture of Participation*. [Accessed 1st November 2007].

Available from World Wide Web: <<http://www.oreillynet.com/pub/wlg/3017>>

O'REILLY, T. (2005), *What Is Web 2.0 ?*. [Accessed 1st November 2007] Available

from World Wide Web: <<http://www.oreilly.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html>>

OBLINGER, D.G., & OBLINGER, J.L. (2005), Introduction. In D.G. Oblinger & J.L.

Oblinger (eds). *Educating the Net Generation..* [Accessed 1st November 2007]

Available from World Wide Web: <www.educause.edu/educatingthenetgen/>

PIAGET, J. (1960/1995). *Problems of the social psychology of childhood*. New York:

Routledge.

PRENSKY, M. (2002). *What kids learn that's positive from playing video games*

[Accessed 7th November 2007] Available from World Wide Web:

<<http://www.marcprensky.com/writing/default.asp>>

RYCKMAN, R. (2004). *Theories of Personality*. Belmont, CA: Thomson/Wadsworth

ROBERTS, G. (2005), Technology and learning expectations of the Net Generation. In:

D. Oblinger, and J. Oblinger (eds). *Educating the Net Generation*. [Accessed 1st

November 2007] Available from World Wide Web: <[http://www.educause.edu/](http://www.educause.edu/EducatingtheNetGeneration/5989)

[EducatingtheNetGeneration/5989](http://www.educause.edu/EducatingtheNetGeneration/5989) on 6/14/2007 >

RUMELHART, D. E., MCCLELLAND, J. L., and the PDP research group. (1986).

Parallel distributed processing: Explorations in the microstructure of cognition.

Volume I. Cambridge, MA: MIT Press.

SANTROCK, J. (1998). *Child Development*. Dallas: McGrawHill

SIEMENS, G., (2004). *Connectivism: A Learning Theory for the Digital Age*.

Elearnspace. [Accessed 5th November 2007] Available from World Wide Web: <

<http://www.elearnpace.org/Articles/connectivism.htm> >

SIEMENS, G. (2007). *Networks, ecologies, and curatorial teaching*. [Accessed 5th

November 2007] Available from World Wide Web:

<http://www.connectivism.ca/Blog/2007/08/networks_ecologies_and_curator.htm

Simões, L. e Gouveia, L. (2008). *Web 2.0 and Higher Education: Pedagogical Implications*. Higher Education: New Challenges and Emerging Roles for Human and Social Development. 4th International Barcelona Conference on Higher Education Technical University of Catalonia (UPC). 31 March, 1-2 April.

SLAVIN, R.E. (1994). Student team-achievement divisions. In S. Sharan (ed.), *Handbook of Cooperative Learning*, pp. 3-19. Westport, CT: Greenwood Press.

STAGER, G. (2005), *Towards a pedagogy of online constructionist learning*. [Accessed 2nd November 2007] Available from World Wide Web: <<http://www.stager.org/articles/onlineconstructionism.pdf>>

STAHL, G., KOSCHMANN, T., & SUTHERS, D. (2006). Computer-supported collaborative learning. In K. Sawyer (Eds.), *Cambridge handbook of the learning sciences* (pp. 409 - 426). New York: Cambridge University Press.

STRAUSS, W., & HOWE, N. (1997). *The fourth turning: An American prophecy*. New York: Broadway Books.

SUN, R. (2006). *Cognition and Multi-Agent Interaction*. Cambridge University Press.

TAPSCOTT, D. (1997), *Growing up digital: the rise of the net generation*. McGraw-Hill.

TAPSCOTT, D. & WILLIAMS, A.D. (2006). *Wikinomics: How mass collaboration changes everything*. New York: Penguin Books.

UNESCO (2005). *World report: Towards knowledge societies*. [Accessed 1st November 2007] Available from World Wide Web: <http://portal.unesco.org/ci/en/ev.php-URL_ID=20507%RL_SECTION=201.html >

VYGOTSKY, L. S. (1978), *Mind in society: the development of higher psychological processes*. Cambridge, MA: Harvard University Press.