# TEACHERS' PROFESSIONAL DEVELOPMENT THROUGH LEARNING ECOLOGIES: WHAT ARE THE EXPERTS VIEWS?

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## Introduction

Professional profiles and the skills and knowledge that individuals need to thrive in today's society have been changing due to social changes generated in recent decades. We know that there is no single reason, but there is no doubt that the role of Information Technology and Communication (ICT) have been taking in all dimensions of our society is one of them. From this concept arises the influence of 'Net society'; a society whose social structure is based on a series of networks activated micro-electronically, with information and communication technologies, which are digitally processed and basically organized via the Internet Castells (2000, 2001, 2009). In a similar direction, Berners-Lee (2008) introduced the concept of 'social collaboration' where the Internet is perceived as something more than a tool for the transmission of data and documents. "The Web is humanity connected via technology", enabling people to receive, give and construct together in order to fulfil their individual and collective needs.

The scenario described above promotes the expansion of social networks on the Internet within the framework of Web 2.0 as a part of this phenomenon. Cross (2010); Downes (2007) and Siemens (2004) have described the benefits of informal learning, based on the connectivism theory. The possibility of creating networks of contacts and communities, being able to access content and information not physically available to us and to partake in experiences being developed by professionals in far-off distant contexts has meant that individuals can now become a communication node, which simultaneously gives and receives. These authors place great emphasis on the potentialities and benefits, which these learning communities can provide for professional development.

Within this setting, where ICT have an undisputed dominance, there emerge complex sets of contexts, comprised of activities, resources, and relationships, which provide new opportunities for learning in both physical and virtual spaces, and new opportunities for non-formal and formal learning. These sets of contexts are referred to as ecologies of learning, and

in this study,-Project ECO4LEARN[1] –, we focus on how these ecologies determine the professional profile of teachers in compulsory education, and how they can contribute to personalize training needs and increase the effectiveness of their professional development.

With this in mind, and with the aim of focusing our research on one particular group of professionals, we set out to provide answers to the following questions: What role do ecologies of lifelong learning play in teachers' training and professional development? What are the elements that make up teachers' lifelong and life wide learning ecologies? What role does each of the elements play and how do ICTs contribute? What benefits do teachers find in the various components that make up learning ecologies beyond those of traditional development schemes?

To answer these questions we have considered the use of ICT in education extends the potential learning space for professional development and updating of skills, thereby facilitating the concept of "life-long learning" (Delors, 1996) and supporting the policies of the European Commission (2005). But the potential benefits of ICTs go much further than just life-long learning, as they also promote both "life-wide learning" and "life-deep learning", concepts developed in studies (Banks et al., 2007) carried out at the LIFE Centre, USA. In addition to the time spent by each individual on his/her formal professional development, there is also the time spent on informal development via unplanned contacts and experiences ("*life-wide*"). Similarly, there is time dedicated to a more qualitative, deeper type of learning experience ("*life-deep*").

## Teacher's professional development needs in the Open World

The professional development of teachers, at any stage of education, can be viewed as a unique opportunity for change and life long learning, beyond the conventional curriculum. It is seen as the 'best way' to guarantee the development of highly productive work environments (Carnoy, 2001).

According to Guitert and Area (2005, p.81) "rapid technological changes, the emergence of new cultural habits, increase in jobs related to the digitalization of information and the constant growth of scientific knowledge all create the need for a reconsideration and restructuring of the training models used hitherto". The European Commission (1996, p.22) states that "the crucial problem of employment in an economy which is constantly changing leads to the need for change in systems of education and professional training". Highlighting this point, Ferraté (2003), quoted by Guitert and Area (2005), emphasizes the fact that training, which overcomes the barriers of time and space, must be able to use and take advantage of ICTs in a correct manner and this can only be achieved via the necessary redesigning of the methodological content of training programs. This content must take into

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[1] Lifelong learning ecologies: contributions of ICT to teachers' professional development (ECO4LEARN). The Ministerio de Educación, Cultura y Deporte from Spain, supported this research. The aim of the project is to analyze and understand the ways in which learning ecologies contribute to the development and improvement of the professional activities of primary school teachers.

account three basic tenets of educational change (UNESCO, 2008): basic knowledge of ICTs; a widening of knowledge and the creation of knowledge via the use of ICTs.

Authors such as Oblinger and Oblinger (2005), Palfrey and Gasser (2008), Prensky (2001), or Tapscott (2009) quoted by Sangrà et al. (2001) highlight the characteristics of the new generation of learners in our classrooms. While some authors argue that there has not been a generational change as such, but rather that changes have been determined by the context in which young people are growing up (Bullen et al., 2009; Bennet, Maton & Kervin, 2008; Jones & Cross, 2009; Kennedy et al., 2006; Romero et al., 2010; Selwyn, 2009), it is clear that teachers are aware that their skills need to be updated to deal with the new scenario they face.

The teacher nowadays also must evolve into a different role, becoming a facilitator of learning rather than someone who is transferring information, a content generator, promoter of the use of ICT, especially in social networks and Web 2.0 tools. With this vision of what the future teacher should be in the school environment, we have chosen to look at different cases in this investigation to which we have referred to as "champions" or pioneers of educational change.

## *Lifelong learning ecologies*

The concept of ecology, developed by different authors such as Barron (2004, 2006), Brown (2000), Luckin (2010) or Uden, Wangsa and Damiani (2007) moves beyond Communities of Practice, Interest groups or Learning Communities and further even than social networks, given that these only exist as selected components of each individual's learning ecology. From this viewpoint, we understand the concept of learning ecology to be "a set of contexts made up of configurations of activities, materials, resources and relations generated in physical or virtual spaces, which provide opportunities for learning" (Barron, 2004, p.6). The conflict between physical or virtual, as they appear in this definition, has currently changed into juxtaposition.

We understand that learning ecologies are composed by different contexts and elements, with or without a technological base, that people use and manage for their professional development. These elements can range from institutionalized classroom courses to participation in specialized social networks through reading books or watching a television program. Each and every one of these elements is part of the learning ecology of an individual, who decides which ones to use, activating relationships with other people and environments that can bring and acquire new skills. This ecology as a set of elements, which go beyond a social network or community of practice, is undoubtedly mediated by technology; expand geometrically action, multiplying creating learning opportunities.

What is still unclear is whether learning ecologies, in the contemporary sense, with the scenarios described so far and influenced by ICT, can enhance formal learning systems that have been used so far. This is the reason why different questions arise in this context: Is the concept of learning ecologies a valid way to explain and increase levels of personalisation in life-long learning? How can each individual use his/her own learning ecology in order to

improve his/her professional activity? Which success factors or strategies need to be identified? What role does ICT play in the setting up of these ecologies?

## Methodology

With the general aim of this project, the research that we propose is part of a methodological paradigm that integrates two aspects: the interpretive perspective and socio-critical perspective. Thus, the aim we pursue is not only focused on describing and understanding learning ecologies along the lives of teachers, but also the transformation of both the practice and the socio-educative scenarios and the decision making that make this transformation possible (Sandin, 2003). In order to obtain a comprehensive view of the reality analysed, quantitative and qualitative methods were considered (Del Rincón et al., 1995) forming a mixed methodology (Hernandez et al., 2006; Hesse-Biber & Leavy, 2008).

The investigation procedure takes on 5 phases of development. In particular, to achieve the proposed goal, analysing and understanding the contributions of learning ecologies in the development and improvement of primary school teachers. We propose, first, to conceptualize learning ecologies for teacher education: understanding what they are and how they are configured, what are the main components and in particular those related to ICT. This first step of mainly theoretical, based on an exhaustive review of the literature, combined with the Delphi technique in which 10 national and international experts involved in the field of teacher training and educational use of ICT, allowed us to develop criteria for the selection of cases on teachers whose learning ecology for Training ICT is a key role.

In this paper we present, namely, the results obtained after the application of the Delphi technique, which allowed us to determine the criteria that have been taken into account in the selection of cases addressed in the next phase.

### *Delphi technique*

As the aim of the project was to first conceptualize learning ecologies for teacher training, - understanding what they are and how they are configured, what are the main components and in particular those related to ICT, among others, it was decided to work in parallel and in combination with the literature review as well as the use of Delphi technique.

After exploring the concept of learning ecologies for the professional development of teachers, from the literature review, we proceeded with the Delphi technique and the extraction of the key elements that make mediated learning ecologies through ICT training.

Based on the theoretical bases identified, a qualitative exploration was carried through the Delphi technique, which is based on the principle of collective intelligence (Parisca, 1995). Furthermore, this is primarily employed "in cases where judgmental information is indispensable, and typically use a series of questionnaires interspersed with controlled opinion feedback" (Okoli & Pawlowski, 2004, p.16). This technique allowed us to explore the perceptions of experts in the field of teacher training and the use of ICT in education

regarding the key elements in the learning ecologies of teachers. Experts were chosen based on their level of experience in the use of ICT in education, both from the point of view of teaching and research. We believe that this technique adapted to our initial target due to the emerging nature of the subject matter, targeting, therefore, the prospective analysis.

In terms of the number of participants required to a Delphi, this varies according to the research goals. Brockhoff (1975) carried out some tests comparing face-to-face and the dynamics of the Delphi communication and regarding group performance and expertise. He concluded that groups as small as four can perform satisfactorily. Regarding this recommendation, the process that followed was the completion of two rounds that consisted of 18 national and 3 international experts in these previously described areas.

The first round was aimed at, apart from some open questions, receiving information from these experts about their views regarding what ecologies contribute to professional teacher development and what components characterize these ecologies. From the analysis of the information obtained in the first phase and in order to obtain the highest degree of consensus among the experts, a questionnaire was designed to be completed by the same participants from the previous phase.

The questionnaire was divided into four blocks based on the questions raised in the first phase: How do today's primary school teachers develop themselves and stay updated? What specific components -resources, activities, face-to-face interactions or not, networks, etc.- help the professional development of primary school teachers? Which of these components promote a more efficient improvement of educational practice in terms of transfer? And, what are the benefits and drawbacks of each of these components in a teachers' professional development?

Each block contained a number of items from the responses taken from the previous round and were rated on a scale from 1 to 5 depending on the degree of overlap among expert responses as well as to the block to which they belonged (with elements as updated cited resources, the degree to which specific components were expressed by the experts in the previous round with regard to the professional development of teachers, the degree to which these components promote the improvement of educational practice and the benefits and disadvantages of the identified components that were expressed in the previous round). Subsequently, a descriptive statistical analysis of the questionnaire responses was conducted in order to validate the items identified in the first phase and sort them according to their ranking according to the experts (from highest to lowest), in which Mean and Mode values were used.

It is important to emphasize that the questionnaire aimed to validate the detected items and helped us organize and sort them according to relevance expressed by the experts themselves. Consider the results shown below.

## Results

With the general The results obtained after consulting the experts using the Delphi technique are presented in the following table which is organized into blocks that represent the most relevant sets and items that compose learning ecologies which additionally to provides a Mean and Mode index for each one of its components.

| Block A: | Self-training | Formal training courses | Teacher Communities and Groups | |
|---|---|---|---|---|
| How do primary and secondary school teachers currently stay updated? | 1.A Through content on the web (blogs and content generated by other teachers) (Mean: 3.5, Mode: 5) 2.A Through social networks (eg Twitter, Facebook or Tiching) (Mean: 3.28, Mode: 4) 3.PLE, books and magazines online and in print. (Mean: 2.8, Mode: 2) | 1.Blended (Mean: 3,07, Mode: 4) 2.Face-to-face (Mean: 2,85, Mode: 4) 3.Online (Mean: 2,71, Modae: 4). | 1.Investigation and innovation groups (related to one or more projects (Mean: 3,3, Mode: 4) 2.Exchange groups not necessarily related to a project (communities of practice or common interest, informal and or spontaneous working groups) (Mean: 3,2, Mode: 3). 3.Associations 4.Attending seminars or conferences (Mean: 2,6, Mode: 2 5.Foundations and institutions (Mean: 2,5, Mode: 2). | |

| Block B: | Face to face interaction: | Online interaction | Resources and digital and analog media | Training activities of different types |
|---|---|---|---|---|
| What specific components (resources, activities, or face to face interactions, networks, etc.) help the professional development of primary school teacher? | 1.Peer interaction from an informal point of view (Mean: 3,9, Mode: 4) 2.Professional networks (e.g. Movimiento de renovación pedagógica de Catalunya, Asociación Rosa Sensat, Asociación Espiral (Mean: 3,6, Mode: 4) 3.Peer interaction from a formal point of view (Mean: 2,5, Mode: 3) | 1.Educational networks based on teacher initiative (for example *Tiching*) (Mean: 3,2, Mode: 4) 2.Educational networks (Promoted by regional governments, businesses, etc. (e.g. XTEC) (Mean: 3,1, Mode: 3) 3.Social networks in general (Mean: 3,07, Mode: 3) | 1.Portals and educational websites created by teachers, search engines and educational resource repositories (Mean: 3,3, Mode: 5) 2. Educational Blogs (Mean: 3, Mode: 4) 3.OER (Mean: 2,8, Mode: 3) 4 Magazines and specialized books on educational issues (print or digital) (Mean: 2,7, Mode: 3) 5.Online spaces created by the institution themselves. (Mean: 2.4, Mode: 3) | 1.Courses and training at the institution where they are working (mean: 3,3, mode: 5) 2.Courses and activities with teachers from other schools or associations (Mean: 3.1 Mode: 5) 3.Courses and activities offered by the administration (recognized) (Mean: 3.1 Mode: 4) 4.Conference Courses, workshops and activities offered by higher education institutions (Mean: 2.7, Mode: 2) 5. MOOCs (Mean: 2.2, Mode: 2) |

| Block C | With regard to the training of teachers in the improvement of primary education, emphasis is placed on | Conditions that must happen for the transfer of teacher training in the classroom | Teacher learning communities | |
|---|---|---|---|---|
| Which of these components promote a more efficient improvement of educational practice in terms of transfer? Why? | 1.Teacher training at their institutions arising from institutional strategy or recommendation by a directive team to solve specific issues situated in the actual context of teachers increasing their potential for transfer to the classroom. It may be in face-to-face or online. (Mean: 3,2, Mode: 5) 2.Individualized training, understood as a more personalized training and that be considered to become more efficient. It can also happen face-to-face or online. (Mean: 3,2, Mode: 3) | 1.Understood as an organic process of adoption and not necessarily conscious: the intrinsic (internal or personal factors of the teacher, personal motivation) (Mean: 3.5, Mode: 5) 2. Extrinsic (external factors: employment context, the faculty group atmosphere, faculty) (Mean: 3.07, Mode: 3). | 1.Teamwork with teachers from the same school or teachers from other schools that may happen in relation to a particular project or issue on a more timely basis, because it would associate the permanent learning communities. (Mean: 3.4, Mode: 5) 2. The creation of learning communities and spontaneous communities of practice voluntarily established where experiences are shared horizontally. Notably, the teachers involved in such interactions are often the most innovative and often maintain more or less stable communities. (Mean: 3.3, Mode: 3) 3. Personal interaction that from individual created teachers make up the community. (Mean: 3.14, Mode: 3) | |

| Block D | The most emphasized benefits based on order of importance identified by their ranking in the questionnaire | Identified drawbacks (based on the same ordering criteria of benefits) |
|---|---|---|
| What are the benefits and drawbacks of the identified components in the professional development of teachers? | 1.Ability to share experiences and information of interest (Mean: 3.9, Mode: 5) 2.Ability to identify with peers and learn about different proposals. (Mean: 3.7, Mode: 5) 3.Ability to access a large number of resources for implementation in practice. (Mean: 3.6, Mode: 5) 4.Promotion of an open teacher profile that is dynamic and critical to the educative system and the practice itself. (Mean: 3.5, Mode: 5) 5.Other courses of action in the classroom were suggested to them. (Mean: 3.57, Mode: 5) and the broadening of the educational skills of teachers. (Mean: 3.57, Mode: 5) 6.The promotion of reflection on educational practice. (Mean: 3.5, Mode: 5) 7.The promotion of permanent learning ( lifelong and wide life learning). (Mean: 3.5, Mode: 4) 8.The creation of communities of practice. (Mean: 3.3, Mode: 4) 9.Respect and consideration of the individual interests of each teacher in their individual training. (Mean: 3.2, Mode: 5) Promotion and proliferation of languages, systems, resources, devices, etc. (Mean: 3.28 Mode: 5) 10. Proliferation of new learning environments and spaces. (Mean: 3.28, Mode: 3) 11.Promotion of improvement training. (Mean: 3.21 Mode: 3) 12.Promotion of the movement of materials and closed resources (and often printed) to open resources. (Mean: 3.07 Mode: 4) 13.Response to a joint project for diagnosis and training centers. (Mean: 2.7, Mode: 2) | 1.Not everyone responds with the same motivation and participation (Mean: 3.57, Mode: 5) 2.Sometimes, the permanent updating of teachers does not result in any transfer to educational practice in the classroom or towards any other end. (Mean: 3.2, Mode: 4) 3.Permanent changes in the teaching-learning practices without consolidating practice. (Mean: 3.2, Mode 3) 4.Said components are not useful for non-permeable innovation centres. (Mean: 3.07, Mode: 5) 5.Generation of feelings that resource selection results to be too time consuming as well as feelings of very rapid change and insecurity. (Mean: 2.8, Mode: 3) 6.Online activities are often perceived as individual activities and difficult in practical application. (Mean: 2.78, Mode: 3) 7. Teachers do not receive training in the proper use of resources and tools. (Mean: 2.71, Mode: 3) |

Figure 1. Results of the learning ecologies components

## Discussion and Conclusions

The first point we would like to highlight in the discussion of results is that this research becomes even more meaningful regarding the findings described below because the experts consulted are professionals who come from face-to-face models.

In relation to how primary school teachers update themselves today, experts stress independent learning through access to blogs of other teachers producing similar content, social networking, reading books as well as printed and digital magazines. Additionally, the order established from the assessment of the questionnaires indicates that, according to experts, teachers are trained more efficiently from the content developed by other teachers that can be related to their daily practice, which consequently leads to more active participation and moves aside those levels established by other experts in the field. Furthermore, innovative actions in the school itself, community interaction, educational groups that aim to exchange concerns and best practices can be considered elements of valuable training for faculty experts. Finally, training courses, whether face-to-face, online or blended have been expressed to be something less valued which indicates that experts believe that the use of content generated by other teachers, conducting innovative actions in practice and the exchange of experiences are more valuable for teacher training and updating.

About what specific components mostly affect the teachers' professional development, we can conclude that are personal interaction that takes place with peer exchange and the dialogue established through participation in professional networking and educational networks, such as those promoted from the regional government, companies, or associations. Moreover, digital and analog media resources such as portals, blogs, websites, Open Educational Resources, among others, are considered very useful for updating their needs. And finally, highlights the different training types, such as conferences and seminars, courses and training activities offered by the centre where they are working, other activities offered by the administration or by higher education institutions or associations, as well as Massive Open Courses (MOOCs).

With regard to which of these components produces a noticeable improvement in educational practice in terms of transfer, great emphasis is placed on the faculty –virtual or in person- as a natural area in which teachers come together and share common concerns and projects. It is in the faculty where dialogue activities, the creation of communities and working groups, innovation, and the exchange of activities and training that are needed are promoted. Another component is based **on innovation activities in the centre based on the reflection,** arising from a permanent attitude of review and evaluation of practice that has a clear focus on improvement and innovation. In like manner, **distributed teaching resources through portals** can also be considered, since they can be used as examples for generating ideas that can be put into practice. The training of teachers both in the centre as the individual itself can also be highlighted.

Finally, regarding the advantages and disadvantages of the components that set the learning ecologies that influence the teachers' professional development, the experts participating in this research mostly identified the reflection of practice, peer contact, the opportunity to discuss common issues and questions, sharing resources and activities they already designed and used before, and the promotion of innovation, all as advantages. As major drawbacks, searching for resources is considered to be time consuming as well as the participation in

workshops that sometimes do not result into any improvement based on the inability for transfer, or the non-consolidation of some innovations or practices carried out due to constant change and little stability.

## References

1. AREA, M. (2006). Autoformación del profesorado. Colaboración a través de la red. Práctica docente, 3.

2. Banks, J.A.; Au, K.H.; Ball, A.F.; Bell, P.; Gordon, E.W.; Gutiérrez, K.D.; Heath, S.B.; Lee, C.D.; Lee, Y.; Mahiri, J.; Nasir, N.S.; Valdes, G.; Zhou, M. (2007). *Learning in and out of school in diverse environments.* Seattle, WA: The LIFE Center.

3. Barron, B. (2004). Learning ecologies for technological fluency in a technology-rich community. In *Journal of Educational Computing Research, 31,* (pp. 1–37).

4. Barron, B. (2006). Interest and self-sustained learning as catalysts of development: A learning ecology perspective. In *Human Development, 49(4),* (pp. 193-224).

5. Bennet, S.; Maton, K.; Kervin, L. (2008). The 'digital natives' debate: A critical review of the evidence. In *British Journal of Educational Technology, 39(5),* (pp. 775-786).

6. Brown, J.S. (2000). Growing up: Digital: How the web changes work, education, and the ways people learn. In *Change: The Magazine of Higher Learning, 32(2),* (pp. 11-20).

7. BROCKHOF(1975). The performance of forecasting groups in computer dialogue and face-to-face discussion. In H. Linstone & M. Turoff (Eds.), The Delphi Method: Techniques and Applications (pp. 285-311). Massachusetts: Addison Wesley

8. Bullen, M.; Morgan, T.; Belfer, K.; Qayumm, A. (2009). The net generation in higher education: rhetoric and reality. In *International Journal of excellence in e-learning, 2(1).*

9. Berners-Lee, T. (2000). *Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web.* Nueva York: Harper Paperbacks.

10. Carnoy, M. (2001). Sustaining the New Economy – Work, Family, and Community in the Information Age. Harvard University Press.

11. Castells, M. (2000). *The rise of the network society.* USA: Blackwell.

12. Castells, M. (2001). *La galaxia internet. reflexiones sobre internet, empresa y sociedad.* Barcelona: Areté.

13. Castells, M. (2009). *Communication power.* New York, USA: Oxford University Press.

14. CROSS, J. (2007). Informal Learning: Rediscovering the Natural Pathways that Inspire Innovation and Performance. San Francisco: Pfeiffer.

15. Cross, J. (2010). "They had people called professors …!" changing worlds of learning: Strengthening informal learning in formal institutions? In U.-D. Ehlers & D. Schneckenberg (eds.), *Changing cultures in higher education: moving ahead to future learning.* Heidelberg: Springer.

16. Delors, J. (1996). *La educación encierra un tesoro.* Comisión Internacional sobre la Educación para el Siglo XXI, Santillana.

17. Downes, S. (2007). What connectivism is. In *Half an Hour, 3.*

18. European Commission (1996). *White Paper on Education and Training. Teaching and Learning. Towards the Learning Society.*
http://europa.eu/documents/comm/white_papers/pdf/com95_590_en.pdf

19. European Commission (2005). *Proposal for a recommendation of the European Parliament and of the Council on key competences for lifelong learning.* Bruselas, 2005.

20. Guitert, M.and Area, M. (2005). *Introducción al e-learning. La educación en la sociedad de la información.* Barcelona: UOC.

21. Jones, C. and Cross, S. (2009). Is there a Net generation coming to university? In *Conference Proceedings of ALT-C 2009 "In dreams begins responsibility": Choice, evidence and change,* 8-10 September 2009, Manchester, UK.

22. Kennedy, G.; Krause, K.L.; Gray, K.; Judd, T.; Bennett, S.; Maton, K.; Dalgamo, B.; Bishop, A. (2006). Questioning the net generation: A collaborative project in Australian higher education. In the *Proceedings of the 23rd annual ASCILITE conference: Who's learning? Whose technology?* Sydney.

23. Luckin, R. (2010). *Re-designing learning contexts. technology-rich, learner-centred ecologies.* London: Routledge.

24. Oblinger, D. and Oblinger, J.L. (eds.) (2005). *Educating the Net Generation.* Boulder, CO: Educause Center for Applied Research. http://www.educause.edu

25. OKOLI, C. & PAWLOWSKI, S. D. (2004). The Delphi method as a research tool: an example, design considerations and applications. Information & Management 42(1), 15–29. doi:10.1016/j.im.2003.11.002

26. Palfrey, J. and Gasser, U. (2008). *Born Digital: Understanding the First Generation of Digital Natives.* New York: Basic Books.

27. PARISCA, S. (1995). El método Delphi. Gestión tecnológica y competitividad. In S. Parisca Estrategia y filosofía para alcanzar la calidad total y el éxito en la gestión impresional (pp.129-130). La Havana Academia.

28. Prensky, M. (2001). Digital Natives, Digital Immigrants. In *On the Horizon, NBC University Press, 9(5).*

29. Romero, M., Guitert, M., Sangrà, A., Bullen, M.; Morgan, T. (2010). Learning in Digital: An Approach to Digital Learners in the UOC Scenario. In *Proceedings of EDEN Conference, Valencia.*

30. Selwyn, N. (2009). Rethinking education in the digital age. In N. Prior & K. Orton-Johnson (eds.), *Rethinking sociology in the digital age.* Basingstoke: Palgrave Macmillan.

31. Siemens, G. (2005). Connectivism: A learning theory for the digital age. In *International Journal of Instructional Technology and Distance Learning, 2(1),* (pp. 3-10).

32. Tapscott, D. (2009). *Grown Up Digital: How the Net Generation is Changing Your World.* New York: McGraw Hill.

33. Uden, L.; Wangsa, I.T.; Damiani, E. (2007). *The future of E-learning: E-learning ecosystem.* Paper presented at the Digital EcoSystems and Technologies Conference, 2007. DEST'07. Inaugural IEEE-IES, 113-117.

34. UNESCO (2008). *Estándares de competencias en TIC para docentes.* UNESCO. http://www.eduteka.org/pdfdir/UNESCOEstandaresDocentes.pdf