

# A Collaborative Approach for the Development of Networked Learning Environments Using the ADDURI Framework

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## **Abstract**

Advances in Information and Communication Technologies (ICTs) have made it possible to reach a large number of distance learners beyond the correspondence tuition models traditionally used in open and distance learning. Designers and developers are increasingly working with Virtual Learning Environments (VLEs) for distance teaching and learning. However, designing and implementing such learning systems remains a challenge due to the many interrelated components, factors, choices and many possible approaches. In this paper we present the ADDURI (Analyse, Design, Develop, Use, Review, Improve) resource based learning and teaching framework. We analyse the key cross-disciplinary activities that influence the inter-relationships of the groups in order to provide a systematic methodology for the development of Collaborative Networked Learning Environments, and provide guidelines for the adoption and use of the framework. We conclude with indications of further work.

## **Keywords**

Networked learning, e-learning, collaboration, technology based learning, ADDURI.

## **Introduction**

Today's Information and Knowledge Society has placed new demands on education and a new paradigm of education is required. Learning, facilitated by educational systems and the pedagogic process, is globally undergoing dramatic changes. Visions and objectives of future learning have to be redefined in order to design the new paradigm of education. Lifelong Learning initiatives can be facilitated by ICTs (Georgiadou and Palmer, 2007).

The explosion of Information and Communications Technologies (ICTs) have brought learners closer by erasing the boundaries of time and place for traditional classroom settings and open and distance learning (ODL). These technologies enable distance education programmes to provide specialised education facilities to learners from remote geographical areas with improved forms of interactivity between students and teachers and between students and students.

In Europe much knowledge, experience and numerous learning resources exist, but they are not shared effectively, they are reinvented, hence effort and money are wasted. The spirit of the Bologna process and declaration specifies that Resource Based Learning (RBL) relies on the development, use and continuous improvement of Integrated Learning Resources. The process of development of these learning resources is complex, multidisciplinary and costly (Georgiadou and Palmer, 2007).

In recent years, many universities and learning organisations have been developing courses using a variety of media, multimedia and hypermedia, with most common the World Wide Web (WWW) and the Internet, to deliver distance education programmes, with e-learning being the most popular form. In parallel, Learning Management Systems (LMS), like WebCT, Blackboard and Desire2Learn, have been

advanced in order to enable educational institutions and corporations to manage their networked learning delivery.

However, advances in technology should never be considered as a panacea for education, forcing us to abandon proven technologies and methods in order to respond to new technologies. We must rather be engaged in adapting our previous experiences to new environments. There is always a continuation of evolution in applying old practices into new situations. This also refers to the nature of knowledge creation, which evolves dynamically and continuously (Malhotra, 1997).

Several instructional practitioners are tempted to proceed to the application of new technologies without considering theoretical views, regarding the field they are involved in. In addition, they do not collaborate with specialists in ICT and other fields.

As e-learners needs increasingly unfold and requirements of e-learning environments demand a development process with diverse quality properties, there has been a shift in re-thinking and re-structuring the theory and practice of e-learning approaches.

The design and realisation of an effective e-learning system involves multidisciplinary knowledge and collaborative efforts of a spectrum of scientists, e-learners and educators. E-learning itself is a combination of many other existing fields and as such, whatever happens in technology, learning theory, web design, network analysis, etc. impacts and shapes e-learning (Elearnspace [1]). Moreover, designing e-learning is a combination of instructional design, usability, and information architecture. These principles are important for creating student-focused learning materials (Elearnspace [2]). The knowledge background of every person involved in the development process needs to be placed in a suitable context.

People with a relevant background in Information and Communication Technologies (ICTs) are normally responsible for developing an e-learning system, or designing suitable tools for developing an e-learning system. It is reasonable to assert that they need to be guided by people who have appropriate knowledge and suitable background in Instructional Systems Design Methodologies, since the deliberate and intentional act of communicating content to student (educational communications) and the technologies in which they are encoded are conceived, analysed and designed by educational analysts (Jonassen and Reeves, 1996). Effective instruction in any mode (traditional or networked) is a result of careful planning that follows a transparent process from the project idea to evaluation and review. Thus, in developing an e-learning system there is a need to face the matter in a systemic (holistic) approach.

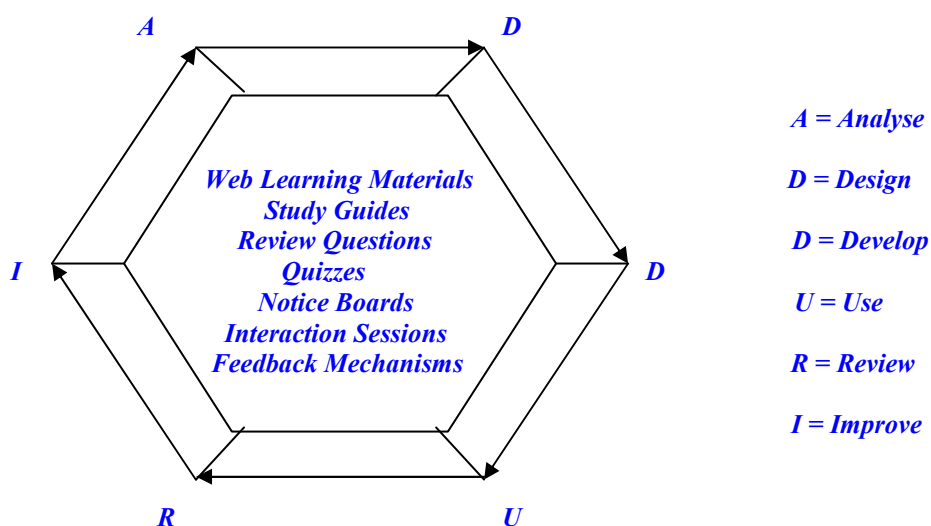
Designers and developers are increasingly working with Virtual Learning Environments (VLEs) for distance teaching and learning. However, designing and implementing such learning systems remains an interesting, but difficult exercise and research area. Such learning environments are frequently characterised by technical inconsistencies, such as poor technical infrastructure or limits in network performance, meaning that users will experience delays (Hatzipanagos et al, 2002). The real campus is of such richness that any computer based interactive learning environment, however sophisticated and technologically advanced, cannot approach a realistic rendering of the real campus (Hatzipanagos, 2001, Hatzipanagos et al, 2002).

Tested and successful face to face teaching practices do not translate and transfer easily to successful interactions inside the e-learning environments. Online courseware and communication tools are not as accessible for the learner as they claim to be, due to the technologies involved being not as natural or intuitive to use. It is necessary therefore to study the contribution made by the Computer Supported Cooperative Work (CSCW) and Communities of Practice (CoP) movements (Wenger et.al, 2002; Lave & Wenger, 2001; Wenger, 1998) and develop the mechanisms for the realignment of human and technology resources across institutions and organisations, and a realignment for the development of the environment with their particular needs in order to improve efficiency and quality, enriching, thus, previous works of other researchers to this direction (Beaty, et al., 2002; Banks & Powell, 2002; Harris & Ewins, 2002) and in online professional development (Zibit, 2004).

## Instructional Systems Design: the ADDURI Framework

In delivering instruction various models have been proposed. The most well-known and frequently used models in Instructional Systems Design (ISD) are usually based on the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) concept. An adaptation of the basic framework structure and, subsequently, its transformation in order to satisfy the needs and requirements posed within a Networked Learning Environment could be made in a way that follows the principles of Information Systems (IS) development, since e-learning is an IS itself.

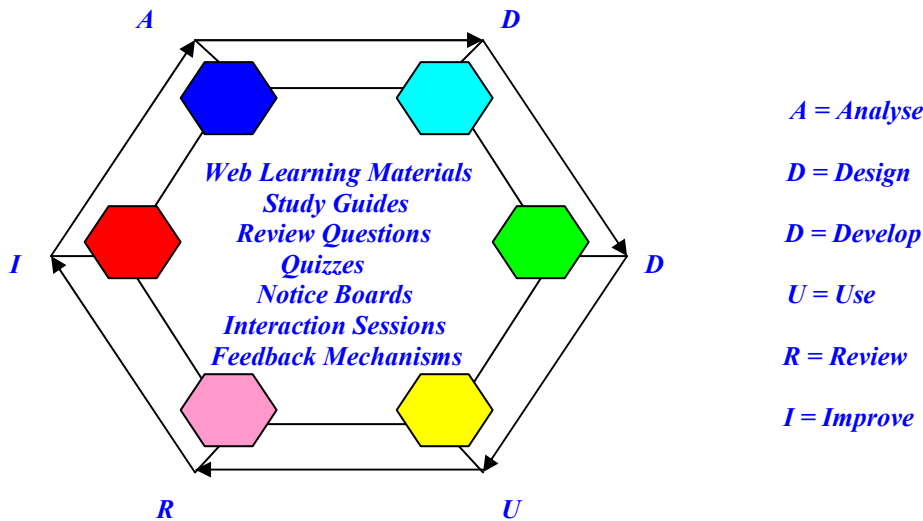
The ADDURI framework shown in Fig.1 (Valkanos, et al., 2005), was proposed aiming to integrate know how from information systems development and instructional design. The goal was to create a general e-learning framework for offering technology-based learning independent of teaching methodologies. The framework is flexible in order to allow different teaching and learning techniques, and thinking tools to be used for delivering a course. Such a framework could be utilised not only by learners, but also by individuals involved in planning, managing, developing and assessing e-learning resources.



**Figure 1: The ADDURI Model**

The ADDURI framework consists of six phases, as its acronym indicates, namely, Analyse, Design, Develop, Use, Review and Improve. It is largely based on the software development lifecycle followed by several IS development methods. Here, there is an emphasis on Use, Review and Improve applied both to the framework itself and to specific resources produced using the framework. Additionally it goes back to first principles embedded in the Plan, Do, Check, Act (P-D-C-A) cycle introduced by Deming in the early 50s, and strengthened by the Total Quality Management movement (Deming, 1986; Siakas et. al, 1997). The framework itself needs to be adapted to the knowledge needs, technological infrastructure, culture or any other predefined target of specific organisations. The ADDURI model reflects a process-oriented plan-driven transition learning mode.

The ADDURI improvement cycle operates simultaneously at two levels. Fig. 2 shows the development of learning resources lifecycle. Each phase is itself a cyclic process with sub-phases and deliverables feeding into the next phase. The development of technology-based learning resources follows a self-similar lifecycle, providing a continuous improvement loop overall and similarly. This self-similarity and the multiple nested loops sub-phases are:



**The Analysis Phase (Dark Blue)**

- A1 – Goals / Objectives
- A2 – Learners’ Analysis (Previous Knowledge and Characteristics)
- A3 – Instructional Analysis
- A4 – Technological Infrastructure (Existing & Desirable)
- A5 – Selection of Pedagogic Model
- A6 – Allocation of Budget, Personnel & Setting of timescales

**The Design Phase (Turquoise)**

- Des 1 – Architectural Design
- Des 2 – Detailed Design (Logical)
- Des 3 – Detailed Design (Physical)
- Des 4 – Human Computer Interface
- Des 5 – Application Design (Specifications)
- Des 6 – Evaluation Design

**The Development Phase (Green)**

- Dev 1 – Prototype (HCI)
- Dev 2 – User Feedback
- Dev 3 – Implementation
- Dev 4 – Testing (Module)
- Dev 5 – Testing (Integration)
- Dev 6 – Testing (Acceptance)

**The Use Phase (Yellow)**

- U 1 – Pilot Application
- U 2 – Collect Data (Focus Groups, Surveys, Shadowing)
- U 3 – Analyse Data
- U 4 – Replicate Application (experiments)
- U 5 – Collect Data (across applications, cultures, organisations)
- U 6 – Analyse Data

**The Review Phase (Pink)**

- R 1 – System Performance (strategies, timescales, budgets, philosophy)
- R 2 – Infrastructure & Resources
- R 3 – Application Performance (e-learning Platform)
- R 4 – Learners’ Involvement
- R 5 – Achievement of Learners’ Objectives
- R 6 – Suitability of Pedagogic Model

### **The Improve Phase (Red)**

I 1 – Infrastructure

I 2 – Applications (Portability, Efficiency, Reliability Functionality, Usability, Maintainability )

I 3 – Domain Specialisation

I 4 – Measurement Programme

I 5 – Feedback Mechanisms

I 6 – Pedagogic Model

The ADDURI model reflects a process-oriented plan-driven transition learning mode. During the Analysis phase the designer develops a clear understanding of the main stakeholders' (learner, teacher, institution and society) requirements, needs, desired outcomes and learners' existing knowledge and skills. A clear statement of objectives helps instructors to select the course content, the teaching strategies and to determine the assessment procedures. It also helps students to know what to expect to learn from the course, what they will be required to do and how they will be assessed. Learners' analysis determines the learners' subject knowledge level, personal characteristics, intellectual skills and previous experiences. Instructional analysis determines, first of all, the suitability of the course for online delivery, the areas of knowledge and the skills required in order to achieve the instructional goals. Media selection is driven by the instructional learning goals and the impact of technology. A clear and good understanding of the suitability of the kind of communication each medium offers can lead to a better design of e-learning environments. An instructor, experimenting and applying various teaching/learning concepts, can reach to an amalgamation of various, sometimes contradictory, theories that may work well together in order to achieve the desired result, that is, an effective e-learning. Placing strategic focus in using e-learning organisationally, the investment in e-learning has to be aligned to critical goals in order to achieve them. Proper personnel placement and right setting of timescales for e-learning projects leads to the achievement of the strategic organisation goals. In the Design phase the learning environment (mode of interaction, content, exercises, assessment, pedagogic model etc.) is designed to meet specific learning objectives and goals. In the Development phase the learning material is created and tested. In the Use phase developed materials are delivered or distributed to learners and data regarding the activities of those involved in the learning system are collected and analysed. The Review phase quantifies entities, such as the quality of learning outcome, learning system's performance, stakeholders' satisfaction and, in general, determines how well the whole system is performing in order to achieve the learning objectives under the pedagogic model chosen. The Improve phase includes continuous feedback efforts considering the infrastructure, the learning system applications and the pedagogic model, for enriching the learning quality and performance, and enhancing stakeholder value and satisfaction.

## **Collaboration**

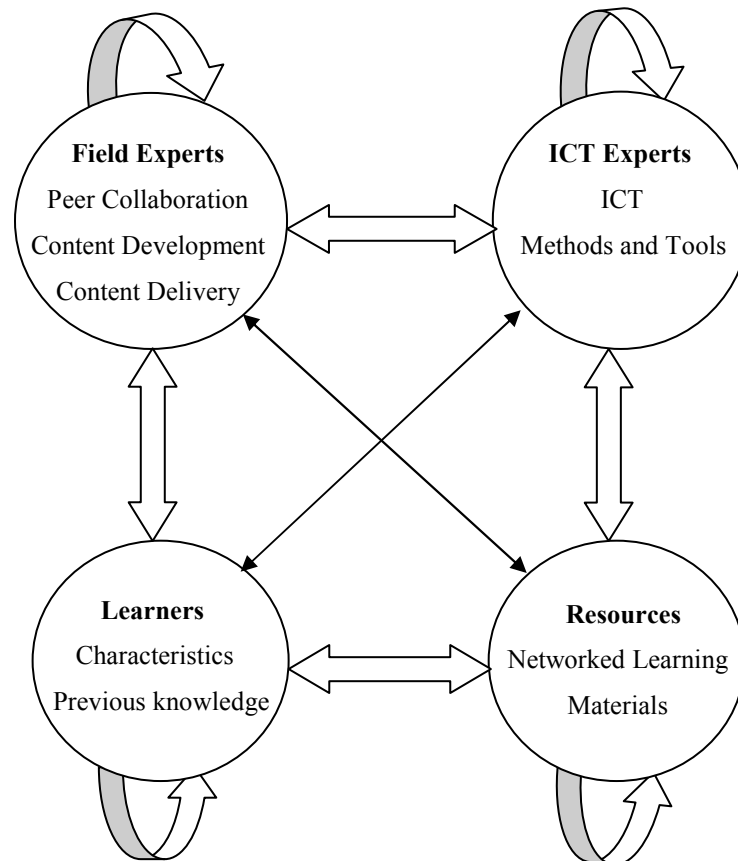
“In our information society, no one organisation knows everything it needs to know ... collaboration creates a process for sharing information between interested parties – so that both benefit by having a more global understanding of issues and concerns. The global understanding created by collaboration, fosters more accurate decision making, greater efficiencies, lower costs, and propels innovation” (Elearnspace [3]).

The notion of collaboration spans a very broad spectrum of participants, applications, devices and platforms, from simply sharing information with another person, department or organisation to unifying communication processes and content and establishing forms for accessing resources and building content. The purpose of collaboration is to combine expertise and resources in order to meet the needs of all learners. What is expected from collaboration is supportive interactive group learning, shared understanding, social construction of knowledge and acquisition of competences.

During the development of a networked learning course there are certain groups of people that collaborate amongst “clusters”. There is also an internal collaboration amongst the elements within each group. The four “clusters” or groups, in figure 3, are:

- Field Experts (People knowing the learning domain, such as teachers/instructors)
- ICT Experts (ICT staff, methods and tools)

- Learners (students with different learning preferences and levels of previous knowledge and experience)
- Resources (Internal learning material developed by instructors and students and external learning material in on-line libraries, web-pages, web 2.0, etc.)



**Figure 3: Collaboration amongst and within “clusters”**

Within the Field Experts there is collaboration between peers during the content development and evaluation. Within the ICT Experts there is collaboration regarding ICT methods and tools. Within the Learners Collaboration is encouraged between learners through group work and CoPs for increased knowledge sharing.

### **Field Experts Intra-relationship Collaboration**

For instructors, online or classroom, the goal is effective learning. Collaboration amongst educators involves, amongst others, setting and sharing of goals, instruction and assessment strategies and problem solving. Effective teams of teachers will work together as equal partners in interactive relationships in all aspects of planning, teaching and assessment. Areas for this collaboration will include curricula and instruction, assessment and evaluation and course management. In a collaborative model of field experts skills, experiences and perspective are shared in the team. An important outcome of such collaboration is that the viewpoints converge and the process of meeting the needs of learners become more standardised and effective to match the different learning styles, strengths, and special needs of learners. The aim of the field experts’ collaboration is to Analyse, Design, Develop and Use the processes, according to the ADDURI model, in order to produce desired results, as defined by the organisation goals.

## **Field and ICT Experts Collaboration**

ICT experts tend to focus on the technology and not the learning. The focus of an e-learning implementation needs to be on learning and needs to be at organisational level. Since technology plays a pivotal role in any e-learning solution and the ICT expert can evaluate, from a technological viewpoint, the feasibility of pursuing certain technical options, collaboration is essential. It also improves learning effectiveness as a result of advanced technology solutions and commitment of stakeholders. This kind of collaboration spans all stages of the ADDURI model.

## **Field Experts – Learners Collaboration**

Learners are the ones most impacted by e-learning. We suggest that the design stage in the ADDURI model should be adopted to meet the needs of the learners. Teachers' roles are changing from imparting information to facilitating students' acquisition of learning and generic skills.

Collaboration is the social process that supports learners' development of capabilities to learn. The assistance that learners require may be provided by domain/field experts, ICT experts, peer-learners and learning resources. In addition support can be sought from administrative staff and external sources.

The learning exercises should promote collaboration and team skills, as well as highlight capability of learners to make contributions that are valued by peers, educators and prospective employers. Learners should be asked to situate their learning in authentic contexts, tackle ambiguity, hone their decision – making skills, acknowledge multiple perspectives and practice the type of negotiation required of them as professionals.

A clear statement should be made regarding the objectives of the collaborative projects, the associated tasks and activities, and the assessment requirements. Learners should feel empowered to take the initiative in making decisions and solving problems in their collaborative work. Introducing collaborative learning tasks (into a course) involves careful planning and preparation of the learners.

Regular feedback from the domain experts through the environment provides clear guidance and encouragement for the learner to address their weaknesses and improve their learning progress.

## **Learners Intra-relationship Collaboration**

Empowering learners in a collaborative networked learning setting fosters professionalism, responsibility for learning, reflection and ultimately measurable learning outcomes.

Collaborating learners share a common purpose, depend upon each other, share information with one another to accomplish common tasks, and are accountable to each other for their success. Facilitated by an online coach, mentor or group leader, participants actively communicate in interactive groups with one another within a contextual framework by using tools, such as Web 2.0

Self and peer assessment, rather than teacher assessment, gives learners a greater ownership of the learning they are undertaking. Involving learners in assessment of their peers ensures that mark awarded to a group member accurately reflects the individual contribution. Learners can learn valuable skills, such as reflection, analysis and fairness, when they engage in peer assessment, and they, also, learn to be less reliant on others as “experts”.

## **Conclusion**

The eLearning initiative of the European Commission seeks to mobilise the educational and cultural communities, as well as the economic and social players in Europe, in order to speed up changes in the education and training systems for Europe's move to a knowledge-based society. As Figel states, (Figel, 2007), “Globalisation, new technologies and demographic developments constitute an enormous challenge; one of the answers to this problem is the access to lifelong learning”.

## References

- Banks, S. & Powell, A. (2002). Developing Institutional Readiness for Implementing Networked Learning, *Networked Learning Conference 2002*.
- Beasley, R.E., & Vila, J.A. (1992). The identification of navigation patterns in a multimedia environment: A case study. *Journal of Educational Multimedia and Hypermedia*, 1(2), pp. 209–222.
- Beaty, L., Cousin, G. & Deepwell, F. (2002). Introducing E-learning via a Community Network: a Teaching and Learning Strategy in Action, *Networked Learning Conference 2002*.
- Borgman, C. L. (2006). What can Studies of e-Learning Teach us about Collaboration in e-Research? Some Findings from Digital Library Studies, (August 1), 2006, UCLA Graduate School of Education & Information Studies, Publications, Paper jcs06.
- Deming, W. E. (1986): *Out of the Crisis: Quality, Productivity and Competitive Position*, Massachusetts, USA.
- Elearnspace [1]. *The Whole Picture of Elearning*. <http://elearnspace.org/Articles/wholepicture.htm> [viewed 9 March 2007].
- Elearnspace [2]. *Designing Elearning*. <http://elearnspace.org/doing/designing.htm> [viewed 9 March 2007].
- Elearnspace [3]. *Collaboration*. <http://elearnspace.org/managing/collaboration.htm> [viewed 9 March 2007].
- Figel, J. (2007), Commissioner for Education and Culture [http://europa.eu.int/comm/education/programmes/elearning/index\\_en.html](http://europa.eu.int/comm/education/programmes/elearning/index_en.html)
- Georgiadou, E, Palmer, G (2007) eForminfo – A European project for knowledge and learning materials sharing and on-line assessment, *Proceedings of Software Quality Management*, Tampere, Finland, August 2007.
- Harris, R. A. & Ewins R. (2002). Peer-to-peer Networked Learning across Institutions: The Virtual Learning Space and the Support of Staff Development, *Networked Learning Conference 2002*.
- Hatzipanagos, S, Georgiadou, E. Sadler, C. (2002). Removing the Barriers to accessibility: technologies and pedagogies of on-line learning.-Accessible Courseware Shared spaces, *International European Distance Education Network Conference (EDEN)*, Granada, Spain, June, 2002.
- Hatzipanagos, S.: (2001). Web Based Learning and "Off-the-shelf" Software: towards a Typology of VLE Interfaces. *EUNIS*, pp. 438-447.
- Jonassen, D. H., Reeves, T. C. (1996). Learning with Technology: Using Computers as Cognitive Tools, in *Handbook of Research for Educational Communications and Technology*, David H. Jonassen (Ed.), Simon & Schuster Macmillan, New York.
- Lave, J., Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*, Cambridge, University Press.
- Malhotra, Y., (1997). Knowledge Management in Inquiring Organizations, *Proceedings of 3rd Americas Conference on Information Systems (Philosophy of Information Systems Mini-track)*, Indianapolis, August 1997, pp. 15-17, pp. 293-5.
- Siakas, K., Berki, E., Georgiadou, E. & Sadler, C. (1997). The Complete Alphabet of Quality Information Systems: Conflicts & Compromises. Lt. Gen. J. S. Ahluwalia (Ed.) *Total Quality Management- The Transforming Role of Quality in a Turbulent World*, The 7th World Congress on Quality & Qualex, 17-19 Feb, New Delhi, India, Institute of Directors-IOD, pp. 603-618, Tata McGraw-Hill Publishing Company Ltd, New Delhi.
- Valkanos, N., Georgiadou, E., Hatzipangos, S., Berki, E. & Siakas, K. (2005). "ADDURI: A Framework for the Development and Support of Resource-Based Learning Environments and Materials". Dafoulas, G. A., Bakry-Mohamed, W. & Murphy, A. *e-Learning Communities International Workshop Proceedings*. Jan 3, Cairo. pp. 129-133, Middlesex University Press: London.
- Wenger, E., McDermott, R., Snyder, W. (2002). *Cultivating Communities of Practice: a Guide to Managing Knowledge*, Harvard Business School Press, Cambridge, MA.
- Wenger, Etienne (1998). *Communities of practice*. Cambridge & New York: Cambridge University Press.
- Zibit, M., (2004). The Peaks and Valleys of Online Professional Development, *eLearn Magazine*, vol. 4, Issue 3, March 2004.