This is a pre-print version of the chapter contributed to the book Inquiry-Based Learning for Multidisciplinary Programs. A Conceptual and Practical Resource for Educators, edited by Patrock Blessinger and John M. Carfora, Bingley, UK: Emerald group Publishing Limited, in 2015 (pp. 211-232)

Connecting Inquiry-based Learning with Collaborative Work in Online Education

Albert Sangrà[1], *Mercedes González-Sanmamed*[2], *Montse Guitert*[1]

[1]*Open University of Catalonia, Barcelona, Spain*

[2]*University of A Coruña, A Coruña, Spain*

Introduction

Despite universities are probably in a stronger position today than at any other time in history, higher education institutions are currently being challenged by continuing changes in the society.

Historically, they were created to serve a small, elite minority of wealthy family students. In 1969 just less than 8 per cent of 18 years olds got into the university in Britain (Perry, 1976). However, in the last decades these figures have dramatically changed, and in most of the developed countries higher education has become a mass education system. This increase in enrolments also means a growth of the expenses the governments have to assume to maintain university standards, to serve the growing number of students. On the other hand, completion rates did not arise as expected, but remained under the 60% in most of the public universities (Bowen, Chingus & McPherson, 2009).

At the same time, other aspects of higher education characteristics changed. Students were becoming more and more diverse, their age mean become higher due to the number of part-time students that wanted to get a diploma after having left the university or because they have never attended before. Studying and working at the same time has become a common trend.

These new kind of students are demanding more flexibility, new organization and structure of programs, and new ways for being taught and for learning. However, in universities had changed little to accommodate all these changes and these demands.

With the increasing tendency for the social use of the so-called Information and Communication Technologies (ICT) and the conceptualization of education as a lifelong process, the educational institutions have been seen forced to give relay to an important challenge: the integration of these technologies into their structure and, especially, into their teaching. Even though it is obvious that this challenge does not arrive everywhere with the same intensity and at the same moment, since the technology itself is a product of the social and economical conditions of every period and of every country, it is true that it is becoming an element which has provoked important decisions of change in the existing teaching models. From simple and prompt uses of the ICT for the reinforcement of the face-to-face teaching and learning to the use of virtual environments for learning with courses carried out completely online and with a great variety of instructive models, the incorporation of the ICT in the educational processes is being made from very different perspectives and also from an extensive range of formulas.

From research, Bates & Sangrà (2011) stated that the main reasons because universities are moving in this direction are: a) enhancing the quality of teaching and learning; b)

accommodating to the learning style of millennials, c) increasing access to learning opportunities and flexibility for students; d) developing the skills and competencies needed in the 21st. Century; and e) improving the cost-effectiveness of the system.

Online or blended programs are the most significant way in which most of the universities are facing this situation, even if their aims are twofold: to increase the number of students and to adapt themselves to the new methodological approaches in an easiest way. Online education has been growing in the last decade as some studies have concluded (Allen & Seaman, 2014).

Online education is seen as an opportunity for adult working people who need a permanent training and updating to adapt to the constants changes they are facing. This training has to be carried out from the acknowledgement of the people's and organization's needs. It is not about to give access to the university, but to bring the university at home.

It is probably true that online education might bring us economic benefits, but in the main aim of this chapter is to point out on those more related to the way it can make learning easier and more efficient. In this sense there are four main pillars in which the benefits of online education could be founded:

- **Flexibility.** It deals with the adaptation to the students' needs, and allows having a system which can be easily adapted to the professional, familiar and personal reality of the students. Flexibility goes beyond overcoming time and space constraints, and learning styles and assessment methods should also be considered.

- **Collaboration.** The students should not feel isolated while studying, because they are not alone at all in their learning process. Group work, and the establishment of cooperative relationships between them bring to the creation of an actual virtual learning community.

- **Personalization.** Every student is a different one. The previous background could and has to be considered to give the students appropriate paths to convey their learning itineraries. Their main interests and speed of progress can be taken into account when designing online education courses.

- **Interaction and interactivity.** The revolution in distance education came with the emergency of the virtual teaching and learning environments, which let the students interact amongst them and with the teachers. Any advanced online education model can avoid considering interaction as a key issue of its quality, as well as the interactivity of the resources and materials is a must.

Another added benefit is, at it will be mentioned later on in this paper, that online education is disruptive enough to allow overcoming the traditional teaching and learning models to improve them, and to promote the changing role of the teacher and of the students.

The chapter aims to show how inquiry-based learning (IBL) approach can be successfully used in online education. To this purpose, we will present the experience of the Digital Competence Program, which is designed considering the principles of collaborative work, implemented with a wide range of educational resources taking advantage of ICT benefits, delivered online, and evaluated from the voices of both

students and teachers. In addition it is a good example of a multidisciplinary approach because it covers several disciplines.

Theoretical framework

The inquiry-based learning approach fosters students' active engagement in online learning. Garrison & Cleveland-Innes (2005) and Oliver (2008) consider it an effective method of leading students learning process to higher-order learning in university-level educational programs. Several techniques can be applied when using an IBL approach, as case-studies, problem or project-based activities, or collaborative work (Weerasinghe, Ramberg & Hewagamage, 2012).

Even if the simplest consideration of IBL is that it is a question-driven approach, or as learning based on research, a number of authors underline that technology facilitates that IBL could have a strong component in collaborative learning, since it requires active participation from students (Brindley, Walti & Blaschke, 2009; Garrison, 2006; Harasim, 1995).

The work carried out by Garrison, Anderson & Archer (1999) conceptualized the Community of Inquiry (CoI), which is used as a means of organization for fostering inquiry-based learning in online education. The need for social, cognitive and teaching presence supports the idea that collaboration is the main concept underlying the CoI that should be appropriately organized and not left to chance (Garrison, 2006). Anderson (2008) also reports that the teaching role in an online community of inquiry can be considered as collaborative work.

Online collaborative learning assumes the principles of collaborative learning and takes advantage of the affordances of the technology for a more satisfactory and efficient implementation in creation online learning communities. Harasim *et al.* (1995) define

collaborative work as an activity in which several people work together to define a meaning, explore an issue, or improve some skills. Particularly, and as Johnson & Johnson (1999) pointed out, collaborative work goes beyond simple teamwork because there are shared objectives and common beneficial outcomes both individually and for the whole group are searched. As Guitert, Guerrero, Romeu & Padros (2008:27) highlighted: *"collaborative work is a process in which every single person learns more than what he or she would learn by his/her own, as a result of the interaction between the components of the team"*. In addition, the emphasis is on the idea of "built knowledge" (Scardamalia & Bereiter, 1994; Staht, 2006), which happens when the group goes forward shaping meanings that allow discovering knowledge and achieving the expected skills from the joint reflection.

Thus, interaction becomes the key element, both for conforming and giving cohesion to group and for achieving common purposes, especially those related to learning. The vision of learning as a process of construction of shared meanings through social communication represents the theoretical foundation of collaborative work (Brown & Duguid, 2000; Hiltz, Coppola, Rotter, Turoff & Benbunan-Fich, 2001).

In the online learning environments, learning is conveyed through the work with different tools and materials, and from the dynamics of relations and exchanges between the students themselves and between then and the teachers (Palloff & Pratt, 1999). For this reason some authors point out that collaboration is one of the hallmarks of learning in online environments (Dillenbourg, 2003; Garrison, 2006; Guitert & Pérez Mateo, 2013; Harasim *et al.*, 1995; Kirschner, 2002). As an example of which is the scope that currently has collaborative learning through technology the research line known under the acronym of CSCL (Computer Supported Collaborative Learning) deserves a

mention. The theoretical and practical contributions of this line of research are helping to conceptualize and generate proposals for the action based on methodologies consistent with the inquiry-based learning approach.

For an effective learning in online communities at least two warnings should have to be taken into account. First, as identified by Stahl, Koschmann & Suthers (2006), it should not be assumed that students know how to work in group. Consequently, it is not recommendable to let them collaborate in a spontaneous way. On the other hand, there is the need to be aware that technology-based tools by themselves warrant neither a fruitful collaboration, nor an appropriate learning. (Nardi, 1996; Onrubia & Ángel, 2012). It becomes essential to design an online learning proposal in which the whole set of elements of the curricular design are considered and the dynamics of interaction and the pursued purposes, defined. (Guitert *et al.*, 2003; Oakley, Felder, Brent & Elhajj, 2004; Medina & Suthers, 2008; Echazarreta *et al.*, 2009; Rubia, 2010). The lack of instructional planning or an inappropriate design can be harmful at the academic level and cause rejection by students to collaborative work. Contrarily, the students which collaborative learning is planned, structured and monitored are more satisfied with their learning process (Felder & Brent, 2001). Another of the recommendations facing a successful collaborative work process regards to the type of tasks the students are required to do. Escofet & Marimon (2012) suggest procedural tasks, as analysis and problem solving, and highlight collaborative work will result more significant when suppose to solve a complex activity which demands different actions and decisions. Gros & Adrián (2004) also link collaborative work with problem solving, project implementation or interactive discussions, stressing the need to assign roles within the group and highlighting tutor's role as a guide which warrants collaborative activity.

Another key factor in the development of collaborative work is that related to the configuration of the work groups (Isotani, Inaba, Ikeda & Mizoguchi, 2009). There is an agreement in considering that heterogeneous groups lead to a better learning, due to the contrast of different point of view and the degrees of understanding coming from diversity, as well as the fact that the process for conforming and creating the groups seems to be crucial to ensure learning (Dillenbourg, 2002; Felder & Brent, 2001; Guitert *et al.*, 2003; Exley & Dennick, 2007; Pujolàs, 2008). Exley & Dennick (2007) mention the importance for making the fundamental aims of collaborative work explicit, and fall upon the need to establish some basic rules and an attitudinal and rational framework for all the work the group has to carry out and the importance of making the schedule and distribution of tasks public and clear. Several authors (Haake & Pfister, 2010; Hernández, González-Sanmamed & Muñoz, 2014; Onrubia & Ángel, 2012; Sobreira & Tchounikine, 2012) study the need for generating collaboration scripts, which can provide the students with instructions on structuring, interacting and collaborating around the task or problem, becoming a means for an agreement and commitment between the students and the teacher, and to support the goal of organizing the work.

Definitely, the need for overcoming the traditional transmissive teaching models and encourage the change of the teacher's and the student's role, could be done through the current digital technologies which allow developing collaborative processes leading to foster the social construction of learning. Especially, and thanks to the tools grouped around the so-called Web 2.0 activities that will support the inquiry-based learning approach can be designed (Rhoades, Friedel & Morgan, (2009).

Context

The Universitat Oberta de Catalunya (UOC) is a fully online university settled in 1995. UOC developed a new brand educational model in which the concept –and the tool- of *Virtual Campus* was the main element, using the Information and communication Technologies (ICT), particularly the Internet, as a means to make students, online tutors and instructors interact between them. This particular educational model was developed from its very beginning and has been continuously improved. Student enrolment has dramatically grown up during these years, starting with 200 students in 1995 and having over 60,000 right now.

The inquiry-based learning approach through collaborative learning techniques has been applied in a number of educational and training activities since 1998, when it was included in two courses as a pilot project. Today, this methodology is a consolidated course component, systematically applied and planned through a wide range of different types of educational actions.

At UOC, particularly, this collaborative e-learning model starts by placing the student firmly at the very centre of the learning process; and the educational resources are all based around the student. Not only does UOC provide a "virtual campus", but it also includes other elements as teaching materials, a virtual library and a continuous assessment system, resulting in a truly integrated system providing all the required support for a successful e-learning experience.

Figure 1 set out the UOC teaching model. The student interacts with all the different components, normally by means of the "Virtual Campus".

FIGURE 1 SHOULD APPEAR ABOUT HERE

The student is seen as being at the centre of his or her own learning process; the other components are available to the student so that he or she can manage and control the process.

The role of teaching at UOC is to provide students with tools and guidelines which facilitate their learning processes, while also responding to their needs. Instead of functioning as mere sources of information, online tutor become facilitators of learning and a means for triggering the inquiry-based learning approach.

Once the course starts, the course plan establishes a learning process and working methodology for each student, as well as planning the content and the assessment criteria for each subject. Its aim is to orientate and guide the student's work throughout each semester. As an instrument for facilitating learning the course plan is a basic tool. The system of continuous assessment is outlined within the course plan for each subject. Throughout the semester, a series of activities must be completed and these are guided and assessed by the instructor responsible for each subject.

This assessment system ensures that students gain the maximum from their course and guarantees that they achieve the objectives set for each subject. At the same time it allows them to plot the continuous development of their learning process, evaluating and measuring progress on a daily basis.

In the virtual classroom, the student interacts continuously with both online tutors and other classmates, experiencing the joy of learning and generating knowledge by sharing ideas and proposals and resolving doubts on course content, either individually or collectively. The virtual classroom provides the student with planning, communication, evaluation functions and resources.

Collaborative work is a fundamental element of this ICT-based teaching model, and any such model which sees the student as the centre of the learning-teaching process.

From the very beginning one of the main concerns at this university has been to make the students skilled in using all the digital resources available for learning in order to help them to become digital citizens. Bearing in mind the quick changes of digital technologies, "*digital competence requires the ability to learn about and with digital technologies, to choose the right technology and to do so confidently*." (Janssen & Stoyanov, 2012:25).

Ferrari (2012) defines Digital Competence as "*the set of knowledge, skills, attitudes (thus including abilities, strategies, values and awareness) that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing, consuming, and empowerment*." (Ferrari, 2012:3-4).

FIGURE 2 SHOULD APPEAR ABOUT HERE

At the UOC, the Digital Competence Program is made of a set of courses that are cross-sectional to all the undergraduate degrees at UOC. It aims to give the students the opportunity to acquire from the very beginning those cross-sectional competences and skills that are needed for a successful study and achievements in online environments (Pérez-Mateo, Romero & Romeu, 2014). The program annually serves 4.000 students.

In this framework, ICT Competences (CTIC hereafter) is a 6 ETCS cross-sectional course which is compulsory at the whole set of programs at UOC. It is recommended to

take it at the first semester of your stay at the university. Its main aim is to make the students work on two cross-sectional institutional competences: “Use and application of ICT in the professional and academic environments” and “Online teamwork”. These general competences have a number of more specific ones:

- Search and selection of information in the Net
- Processing and elaboration of digital information
- Presentation and dissemination of digital information
- Basic notions of digital technology
- Work and study planning in a virtual environment
- Digital project management
- Net communication strategies
- Teamwork in online environments
- Digital attitude

The course methodological approach is based on project working (Railsback, 2002), and it leads to elaborate a digital project through collaborative work. Students are grouped in 3-4 and have an online shared work space in which they have several tools. Between them, wiki stands out as the tool that conveys all the project creation process.

Collaborating digitally: how it works, how it is organized

Considering all the previous literature and the context, the program is being developed under the principles of collaborative learning within the framework of the inquiry-based learning approach.

The approach to be carried out is not only oriented to the use of technological instruments but also to the putting into practice of key methodologies and skills for working in a virtual environment. The teacher orients and facilitates this process of construction in an ongoing way through his/her online teaching presence. Assessment is based on continuous evaluation and on the pertinence of the activities, designed as authentic experiences to ease the building of mental structures (Herrington, Oliver & Reeves, 2003).

The technology has currently developed ubiquitous systems which let the user to endeavor actions in a totally transparent way, without perceiving what the technology which is supporting them is. Students usually use resources for developing collaborative learning processes which have the needed applications fully integrated. This online collaborative learning approach is defined by the Collaborative Learning in Virtual Environments Research Network (RACEV)[1] as *"a shared, coordinated and independent process, in which the students work together to reach a common goal in a virtual environment. Collaborative learning is based on a process of activity, interaction and reciprocity between the students, making the joint construction of meaning and an individual advance toward higher development levels"* (Guitert & Pérez-Mateo, 2013). This process is carried out in a scenario in which technology only appears as a workplace.

As stated, developing a collaborative digital project is contemplated. Project-based working could be defined as a methodology in which students are distributed in small

[1] RACEV, for the short of the Spanish "Red de Aprendizaje Colaborativo en Entornos Virtuales" (http://blogs1.uoc.es/racev/)

groups to explore, investigate and analyze authentic problems (Area, 2005). Accordingly with the Buck Institute for Education (BIE)[2], Project-Based Learning (PBL) leads students to carry out a search process which main aim is to answer a question, problem or challenge. From this approach the students not only learn from the content, but they bring into play a range of skills related to information (as searching, processing or dissemination), collaboration, communication , critical thinking and organization amongst others.

Stages of the collaborative digital project

The development of the project is planned in 4 phases (Starting, Structuring, Development, and Concluding), each of which puts forward a set of interrelated activities. Students are asked to group themselves in four, in an online environment which integrates different tools.

Observation and analysis of the practical application of cooperative learning reveals that virtual groups tend to go through four stages. These are team creation, consolidation, implementation and closure. These four stages are all critical to the success of the virtual team, since they involve decision-making regarding various fundamental aspects of the process (communication, organization and planning, the role of the tutor, and others). Generally speaking, the features of each phase could be synthesized as follows:

TABLE 1 SHOULD APPEAR ABOUT HERE

Therefore, an effort has been made to systematize these stages and describe them as accurately as possible in order to be able to recommend activities to facilitate online

[2] www.bie.org

tutoring and student dynamics, and ongoing assessment throughout each of the four stages.

The starting phase provides the context to create the work teams and carry out the first searches. This helps the students to focus the project, and to establish collaboration and interaction patterns within the team, as well as the planning and distribution of the project tasks between all its members.

TABLE 2 SHOULD APPEAR ABOUT HERE

In the second phase, the work team goes deeper in the search of information. At the same time, they organize themselves to adequately structure the project. In this phase, the work is getting consolidated and the initial planning is reviewed.

TABLE 3 SHOULD APPEAR ABOUT HERE

Later on, in the third phase, the project has to be implemented: the gathered information is classified and processed. Then, a first version of the digital project is reached, considering format and content elements. A self-assessment and a peer-assessment of the work in the group are also done at this point.

During the implementation phase, it has been observed that the online tutor tends to play a monitoring role, intervening when the group need help to overcome a problem or conflict, yet remaining sufficiently distant for the group to function and develop autonomously. This monitoring role includes the following:

- Monitoring group members who are not sufficiently active or participative so as to determine the causes and provide support as appropriate.

- Providing advice regarding working calendars, evaluation criteria, etc., yet trying to play a less active role as group autonomy increases, so as to avoid the group's becoming overly dependent on the online tutor's help.
- Fostering frequent contact and communication between group members.
- Providing help with the group work tool and program activities.
- Qualitative evaluation of the team working process, on receipt of the student assignments.

The online tutor does not intervene directly at this stage, nor does he or she protect or control it excessively. If a problem occurs, the online tutor tends to wait and create the conditions in which the group members ask for help. When the group has presented their completed assignment, the online tutor evaluates the work done and returns it along with feedback designed to help the students improve both the task and their functioning as a group.

It has been observed that as teams grow in autonomy, the online tutor's role diminishes progressively to the point where he or she only provides help when explicitly asked to by the team or when further progress is impossible without intervention.

When conflict occurs (a member drops out without warning, failure to meet task deadlines, domination by one member rather than consensus, etc.), group members often ask the online tutor to intervene.

Finally, the last stage arrives when closing and dissemination come. The final version of the project is shared and discussed with the classroom mates. Also a final evaluation of

the whole process of the development of the digital project is carried out. The approach which is used is not only oriented to the use of technology tools, but to the implementation of key methodologies and abilities to properly and effectively work in a virtual environment.

The teacher guides and makes constantly easier this process of construction. Evaluation is based in a continuous assessment system (in group and individually), which guarantees the progressive acquisition of the competences that should be reached in every phase.

TABLE 4 SHOULD APPEAR ABOUT HERE

Evidence of achievements

As an institutional policy, general surveys to evaluate the quality of the programs and the satisfaction of the students are launched at the end of every term in order to get the voice of both the students and the teachers.

In the framework of these surveys, 3 questions Likert-type rating scale and 2 open ones are focus specifically with the inquiry-based learning approach through collaborative learning techniques. In the last term, the survey was submitted to a population of 3,183 students (second term), getting a response of 36.6%. This means that that the total number of respondents was 1,167, which can be considered significant (error sampling ±2.32%).

The students were asked to score the degree of usefulness of the proposed methodology for the acquisition of the digital competences. As a result, 81.78% consider it “very useful”, 13.1% just “useful”, and 3.15% “almost usefulness”.

The mean of passing students in the course is 77.4%, and they show a high level of satisfaction on it (83.31%).

Students explicitly express the usefulness of the approach when state “digital work Project implementation using wiki has been very useful to carry out group work; it is a tool that I will be able to use it in other learning situations at the university and outside.” Another student says “at the beginning all were getting a little bit lost, but we were learning supporting one to each other; it demands some practice, especially when you’ve never worked with this approach”.

Teachers play a significant role to guide the students in the use of the tool. As a student affirms, “I found interesting that the teacher encouraged us to use wiki comments as an element for communication and that encouraged to change is aspect for default for a more personal one”. Satisfaction level regarding the teachers is very high (97.6%).

Going deeper in this issue, comments on the teachers’ role are quite positive: “Contributions from the teacher, through either e-mail or discussion board, have been the best tool to achieve the required knowledge to successfully pass the course.” “The teacher has been the essential support to solve any doubt, which given my lack of experience on the subject had created some uncertainty.” “I would like to thank the rol

of the teacher on monitoring, giving feedback and guiding that has provided at any moment".

Students also mark team work highly, and they consider it is worth even if the effort is significantly high, too. "I have enjoyed this course very much; despite the different problems we found in our group, it has let me to learn to work asynchronously and to achieve some digital skills". "What I have learnt working in group I couldn't get it alone. Initially, asynchronous group work is very hard, but when you learn how to plan and organize it you can carry out project that you couldn't do by your own."

Finally, the overall satisfaction regarding the inquiry-based learning approach is clear: "Definitely this course, the first I've taken, has allowed me acquiring some online group work strategies, and to have mastery enough to use the tools to study in a virtual environment. In addition, I learnt how to plan my work, to have a critical attitude … in sum, to be a competent digital person." "It is a course that has made me easier to access and has provided tools and strategies to study in a fully online university". "I really had a nice time in this course".

Final remarks

The experience has been really successful. It shows the inquiry-based learning approach, mainly through collaborative activities is very valuable in online education contexts. It has been proved that a good organization of the different stages of a collaborative digital project result in a high level of student satisfaction and achievement. In addition, teachers have shifted their role in order to become facilitators of the learning process of the students: asking questions, organizing the environment,

giving support and advice and assessing –collaboratively with the students, too- the achieved learning. Students not only learnt to handle some technological tools, but got a good basis for developing critical thinking, to get, select and introduce information, and to collaboratively work in group.

References

Allen, I.E. & Seaman, J. (2014). *Grade Change. Tracking Online Education in the United States.* Babson Survey Research Group and Quahog Research Group, LLC. Retrieved July 10, 2014: http://www.onlinelearningsurvey.com/reports/gradechange.pdf

Bates, A.W. (Tony) & Sangrà, A. (2011). Managing Technological Change. Strategies for Transforming Tecahing & Learning. San Francisco: Jossey-Bass.

Bowen, W.; Chingus, M. & Mc Pherson, M. (2009). *Crossing the Finish Line: Completing College at America's Public Universities.* Princeton NJ: Princeton University Press.

Brindley, J.E.; Walti, C. & Blaschke, L.M. (2009). Creating effective collaborative learning groups in an online environment. *The International Review of Research in Open and Distance Learning (IRRODL), 10* (3). Retrieved, February 20, 2014 from: http://www.irrodl.org/index.php/irrodl/article/view/675/1271

Brown, J. & Duguid, P. (2000). *The Social Life of Information.* Boston, MA: Harvard Business School Press.

Dillenbourg, P. (2003). Preface. In: J. Andriessen, M. Baker & D. Suthers (Eds.), *Arguing to learn: Confronting cognitions in computer-supported collaborative learning environments* (vii–ix). Kluwer: Dordrecht.

Echazarreta, C.; Prados, F., Poch, J. & Soler, J. (2009). La competencia «El trabajo colaborativo»: una oportunidad para incorporar las TIC en la didáctica universitaria. Descripción de la experiencia con la plataforma ACME (UdG). In *UOC Papers Revista sobre la sociedad del conocimiento*, 8, 13-23.

Escofet, A. & Marimon, M. (2012). Indicadores de análisis de procesos de aprendizaje colaborativo en entornos virtuales de formación universitaria. *Enseñanza & Teaching: Revista interuniversitaria de didáctica, 30* (1), 85-114

Exley, K. & Dennick, R. (2007). *Enseñanza en pequeños grupos en educación superior. Tutorías, seminarios y otros agrupamientos.* Madrid: Narcea.

Felder, R. & Brent, R. (2001). FAQs-3. Groupwork in Distance Learning. *Chemical Engineering Education, 35* (2), p.102-103.

Ferrari, A. (2012). *Digital Competence in Practice: An Analysis of Frameworks.* Sevilla: European Commission. Joint Research Centre. Institute for Prospective Technological Studies. Retrieved June 5, 2014: http://ftp.jrc.es/EURdoc/JRC68116.pdf

Garrison, D.R. (2006). Online Collaboration Principles. *Journal of Asynchronous Learning Networks, 10* (1), 25-34. Retrieved September 3, 2013, http://sloanconsortium.org/sites/default/files/v10n1_3garrison_0.pdf

Garrison, D.R.; Anderson, T. & Archer, W. (1999). Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education. *The Internet and Higher Education, 2* (2-3), 87-105.

Garrison, D. R. & Cleveland-Innes, M. (2005). Facilitating cognitive presence in online learning: Interaction is not enough. *The American Journal of Distance Education, 19*(3), 133-148.

Gros, B. & Adrián, M. (2004). Estudio sobre el uso de los foros virtuales para favorecer las actividades colaborativas en la enseñanza superior. *Teoría de la Educación, 5*

Guitert, M. (2011). Time management in virtual collaborative learning: the case of the Universitat Oberta de Catalunya (UOC). *eLC Research Paper Series, 2*, 5-16.

Guitert, M., Giménez, F., Lloret, T., Marquès, J. M., Daradoumis, A., Cabañero, C. F., Prieto, J., Segret, R., & Cunillera, G. (2003). *El procés de treball i d'aprenentatge en equip en un entorn virtual a partir de l'anàlisi d'experiències de la UOC*. (Document de projecte en línia. IN3,UOC. Treballs de doctorat, DP03-001). Retrieved February 18, 2013: http://www.uoc.edu/in3/dt/20299/20299.pdf.

Guitert, M., Guerrero, A. E., Romeu, T. & Padros A. (2008). ICT competences for Net generation students. International Conference on Advanced Learning Technologies ICALT (IEEE).

Guitert, M. & Pérez-Mateo, M. (2013). La colaboración en la red: hacia una definición de aprendizaje colaborativo en entornos virtuales. *Teoría de la Educación: Educación y Cultura en la Sociedad de la Información, 14* (1), 10-31.

Haake, J. M. & Pfister, H.R. (2010). Scripting a distance-learning university course: Do students benefit from net-based scripted collaboration? *International Journal of*

Computer-Supported Collaborative Learning (IJCSCL), 5 (2), 191-210.

Harasim, L.; Hiltz, S. R.; Turoff, M. & Teles, L. (1995). *Learning Networks: A Field Guide to Teaching and Learning On-Line.* The MIT Press: Cambridge, MA.

Hernández-Sellés, N.; González-Sanmamed, M. & Muñoz-Carril, P.C. (2014). Planning Collaborative Learning in Virtual Environments. *Comunicar, 42*, 25-33.

Herrington, J.; Oliver, R. & Reeves, T.C. (2003). Patterns of engagement in authentic online environments. *Australian Journal of Educational Technology*, *19*(1), 59-71.

Hiltz, S. R., Coppola, N., Rotter, N., Turoff, M., & Benbunan-Fich, R. (2001). Measuring the importance of collaborative learning for the effectiveness of ALN: A multi-measure, multi-method approach. *Journal of Asynchronous Learning Network, 4*.

Isotani, S., Inaba, A., Ikeda, M., & Mizoguchi, R. (2009). An ontology engineering approach to the realization of theory-driven group formation. *International Journal of Computer-Supported Collaborative Learning (IJCSCL), 4* (4), 445-478.

Janssen, J., & Stoyanov, S. (2012). Online Consultation on Experts' Views on Digital Competence. Sevilla: European Commission. Joint Research Centre. Institute for Prospective Technological Studies. Retrieved June 5, 2014: http://ftp.jrc.es/EURdoc/JRC73694.pdf.

Johnson, D. & Johnson, R. (1999). Aprender juntos y solos. Aprendizaje cooperativo, competitivo e individualista. Buenos Aires: Grupo Editorial Aique.

Kirschner, P. A. (2002). *Three worlds of CSCL. Can we support CSCL*. Heerlen: Open University of the Netherlands.

Lebrun, M. (2004). Quality Towards an Expected Harmony: Pedagogy and Innovation Speaking Together About Technology. *Networked Learning Conference. Université Catholique de Louvain (UCL).* Retrieved February 2, 2013: http://www.networkedlearningconference.org.uk/past/nlc2004/proceedings/symposia/symposium5/lebrun.htm

Medina, R., Suthers, D. (2008). Bringing representational practice from log to light. *Proceedings of the 8th International Conference on the Learning Sciences,* 59-66.

Nardi, B. A. (Ed.) (1996). *Context and consciousness: Activity theory and human-computer interaction.* Cambridge, MA: The MIT Press.

Oakley, B. Felder, B., Brent, R. & Elhajj, I. (2004). Turning Student Groups into Effective Teams. *Journal of Student Centered Learning, 2*(1), 9–34.

Oliver, R. (2008). Engaging first year students using a Web-supported inquiry-based learning setting. *Higher Education, 55,* 285-301.

Onrubia, J. & Engel, A. (2012). The role of teacher assistance on the effects of a macro-script in collaborative writing tasks. *International Journal of Computer-Supported Collaborative Learning, 7* (1) 161-186.

Palloff, R. & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom.* San Francisco: Jossey-Bass.

Pérez-Mateo, M.; Romero, M. & Romeu, T. (2014). Collaborative Construction of a Project as a Methodology for Acquiring Digital Competences. *Comunicar, 42, XXI,* 15-23.

Perry, W. (1976). The Open University. Milton Keynes, UK: The Open University.

Pujolàs, P. (2008). *9 ideas clave. El aprendizaje cooperativo.* Barcelona: Graó.

Railsback, J. (2002). *Project-based Instruction: Creating Excitement for Learning.* Portland, OR: Northwest Regional Educational Laboratory. Retrieved September 3, 2013: http://educationnorthwest.-org/webfm_send/460.

Rhoades, E.B., Friedel, C.R. & Morgan, A.C. (2009). Can Web 2.0 Improve our Collaboration? *Techniques, 84* (1) Retrieved July 10, 2013: http://files.eric.ed.gov/fulltext/EJ829506.pdf.

Rubia, B. (2010). La implicación de las nuevas tecnologías en el aprendizaje colaborativo. *Tendencias pedagógicas, 16,* 89-106.

Scardamalia, M. & Bereiter, C. (1994). Computer support for knowledge-building communities. *Journal of the Learning Sciences, 3* (3), 265-283.

Stahl, G. (2006). Group cognition: Computer support for building collaborative knowledge. Retrieved August 3, 2014: http://www.cis.drexel.edu/faculty/gerry/mit/index.html.

Stahl, G., Koschmann, T., & Suthers, D. (2006). Computer-supported collaborative learning: An historical perspective. In R. K. Sawyer (Ed.) *Cambridge handbook of the*

learning sciences, 409-426. Cambridge, UK: Cambridge University Press. Retrieved June 5, 2012: http://GerryStahl.net/cscl/CSCL_English.pdf.

Sobreira, P. & Tchounikine, P. (2012). A model for flexibly editing CSCL scripts. *International Journal of Computer-Supported Collaborative Learning (IJCSCL)*, 7 (4).

Weerasinghe, T.A.; Ramberg, R. & Hewagamage, K.P. (2012). Inquiry-Based Learning With or Without Facilitator Interactions. *Journal of Distance Education, 26(2)*. Retrieved February, 20, 2014: http://www.jofde.ca/index.php/jde/article/view/779/1406.