

# DISTRIBUTED LEADERSHIP COLLABORATION FACTORS TO SUPPORT IDEA GENERATION IN COMPUTER SUPPORTED COLLABORATIVE eLEARNING

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**Abstract:** The aim of this paper is to discuss and analyse students' collaboration as quantitative and qualitative engagement in Distributed Leadership (DL). This is correlated to the quality of interactions evident in idea generation at IT Institute (ITIN) e-courses, in France. Scripting Computer Supported Collaborative eLearning (CSCeL) activities based on DL can scaffold students' interactions to support collaboration and promote their idea generation via learning by doing. Furthermore, the associated tools can serve collaboration via scripting and shed light in the students' interactions and dialogical sequences by opening their interactional space. Such detailed planning can result in effective short e-courses. In this case study, 21 MSc in students in Banking & Insurance Information Systems created 3 teams and worked on a Distributed Leadership project within a 2 days e-course at ITIN. The measurements and data analysis were anchored in quantitative, qualitative and social network methods: students sent a self-reported questionnaire; the Non-Negative Matrix Factorization algorithm was run on the text in combination with qualitative analysis; and lastly the outcomes from the Social Network Analysis tools implemented within the forums. The results indicated that scripting Distributed Leadership can be useful in supporting collaboration for idea generation in short e-courses.

**Keywords:** distributed leadership, CSCeL, collaboration, idea generation, scripts

## INTRODUCTION

Education as a discipline was initially anchored in Cognitive Psychology and Pedagogy and only recently the educators and researchers considered the socio-cultural aspects of learning with the use of tools. Nowadays the Internet and eLearning platforms support the collaborative dimensions of working and learning in groups and can be implemented in short e-courses.

This paper presents a single case study as part of a series of workshops and e-courses specifically developed for ITIN, a French **IT Institute**, Cergy University, in Paris, France. ITIN's main mission is to prepare excellent technical engineers, who are also project managers capable of working efficiently within intercultural teams. Therefore, ITIN's main role is to help students develop their knowledge and their knowledge about their knowledge (meta-cognition; Morin, 2000). In the case of a professional establishment, the role is two-

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fold: working towards knowledge acquisition but also building students' individual expertise and skills. Observing the economic globalization (Friedman, 2007; Stiglitz, 2003) as well as Information Systems globalization (Raivola, 2001), it is vital to prepare the students to become actors of international value chains and intercultural team projects. For this reason, the e-courses in ITIN are also oriented towards developing their soft skills needed for this economic globalization; such skills are essential in Distributed Leadership human factors.

The acquisition of knowledge and its relation to students' competencies has been suggested to be the major change in education in the 21<sup>st</sup> century (Wenger, 2010). For this reason, there is a need to explore the origins of education and collaborative learning in particular to in order to make this need explicit.

The paper is developed as follows: the first part refers to the pedagogical approach; this is importance of the socio-cultural perspective in Computer Supported Collaborative eLearning (CSCeL) and DL as well as CSCeL as such. The second part is dedicated to the tools used to promote CSCeL and DL within this course. The third part presents the scripting of the e-learning design. The fourth part refers to the methodologies, data collection and analysis used in this case study as well as the results and discussion. The last part refers to conclusions and future research.

## **The Socio-Cultural Perspective**

During the last century up to the present day, a series of pedagogical epistemological paradigms emerged (Kuhn, 1962). During the modern transition, there was an emergence of a behaviorist approach based on both the Positivist philosophy (Comte, 1853) and the Darwinian Theory. The learning process was seen as the activation of cognitive reflexes based on action and reaction to specific stimuli. More recently, the cognitive approach (Piaget, 1988) was in essence a rationalist one (Boudon, 1995) addressing man's choices as rational and able to be reduced to reason. Here, the predominant paradigm was ontological: it was believed that knowledge is something that exists in oneself and can be taught and transmitted to others.

The constructivist approach (Lemoigne, 2003) followed perceiving knowledge as being man-made i.e. constructed. Therefore, this knowledge can be developed and nourished by personal experience and the learner himself or herself. For constructivists, it is the actual "acting out" that allows experimentation and as a result, acquisition of knowledge (Jonassen et al., 2002; Berger & Luckmann, 2003). The complementary idea that man learns as a result of social interaction led to the socio-constructivist approach (Vygotsky, 1978; Jonnaert, 2002).

Collaborative activities and learning in groups appears to be the new trend of the 21st century due to the capabilities the new social Web 2.0 tools provide. However, collaborative activities and group learning are *not* new ideas. Comenius (1592-1670), believed that students would benefit both by teaching and being taught by other students. In the late 1700s Lancaster and Bell made extensive use of cooperative learning groups in England while Colonel Francis Parker used cooperative learning procedures in public schools in Quincy, Massachusetts (1875-1880). Cooperative learning appeared in the work of Rousseau and Pestalozzi in the

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18<sup>th</sup> and 19<sup>th</sup> centuries, while in the 1930s, John Dewey promoted the use of cooperative learning groups as part of his project method; peer interaction was central to Vygotsky's socio-cultural learning. In 1940s, Deutch proposed a theory of cooperative and competitive situations (cited in Johnson & Johnson, 1987). During the 1990's Piagetian Constructivism was often supposed to not have taken into account the interpersonal relations (Mercer, 1993; Crook, 1994). However, Piaget himself suggested that “ *cooperation ... eliminates the process ... of egocentric thought*” (1995:208) since cooperation is defined as “... *all relations between or more equal, or believed to be equal, individuals, that is to say, all social relations in which no element of authority or prestige is involved*” (Piaget, 1995:200). Bruner admitted: “*I have come increasingly to recognize that most learning in most settings is a communal activity, a sharing of culture*” (Bruner, 1986:127).

The recent socio-cultural interest in education has arisen from the ideas of the Soviets Vygotsky, Luria and Leontief as they established learning as basically social and culturally achieved rather than an individual process. The internalisation and externalisation processes (Vygotsky, 1978) were proposed as the continual dual dialectic processes whereby humans construct both themselves and their culture primarily through language; therefore, both people and culture are constantly changing over time (Jarvis, 1992).

Despite the interplay of internalisation and externalisation, in the end, the cognitive processing depends on the individual's own cognitive processing and whether the collaboration context favours it. This also means that both ontological and constructivist approaches are of equal importance and need to be supported in the learning design via scripts. Furthermore, other than meeting the ITIN objectives as such by a careful learning design, the e-course needs to be flexible enough so to enhance students' individual skills. This is feasible by embracing students' shared meanings and team-determined plans by creating their own space and background of interaction.

Nowadays computers and the Internet are more integrated in education than never before. Educational organisations are forced to support a new wave of networking and collaboration directed by the Web 2.0 applications which fused the educational borders with the real world. According to Clark and Mayer (2007) the use of technologies in the classrooms is increasing and converging as blended learning replace strictly classroom teaching hours. In both modes, student engagement is central to learning; the lack of it, also known as disengagement or alienation has been a particular research interest (Carini et. al., 2006). Disengagement is a serious issue especially in the middle years of schooling as students fail to complete assignments and disrupt the classes. On the contrary, students' engagement is evident in appearance of excitement, enthusiasm and commitment to their studies as hard work and investment on learning. Consequently, it is a raised issue in the national policies which encourage pedagogies to support student engagement.

Newmann (1992) defines engagement as the student's psychological investment in and effort directed toward learning, understanding or mastering the knowledge, skills or crafts that academic work is intended to promote. Fredricks and colleagues (2004) suggested 3 types of engagement that can be used here as evidence of collaboration: **(a)** behavioural engagement;

(b) emotional engagement; and (c) cognitive engagement. One of the most promising approaches to deal with the engagement and collaboration requirements in this educational context and the increasing demands for net- and web- based education is Computer-Supported Collaborative eLearning (CSCeL). This approach is going to be use in Distributed Leadership which will be discussed next.

## **Distributed Leadership**

Distributed Leadership (DL) has become popular due to the action and influence of people at all levels of hierarchy (Bolden, 2008). DL has been reported to enhance co-creativity and innovation (Ancona & Bresman, 2007; Agbor, 2008). In their interpretive construction of the DL literature review, Bennett and colleagues (2003) referred to DL as “*an emergent property of a group or network of interacting individuals. This contrasts with leadership as a phenomenon which arises from the individual*” (p. 7). Other than introducing the open network in leadership and the major roles of groups and communities, the authors also suggested that there are varieties of expertise distributed across the many, not the few. The variable features identified in this literature review are: control and autonomy; the organisational structure; the socio-cultural context; and the source of change. Such bottom up approach is informal leadership based on the dynamics of team working, conflict resolution, and both pre-defined and spontaneous forms of leadership and team collaboration. In this way more opportunities are developed for the group and community and the members’ skills are enhanced. Therefore, co-creativity, and innovation as applied creativity can be enhanced via learning DL by doing DL (Silva et. al., 2000).

In this e-course, DL was considered twofold; within international teams as in students’ teams in the e-course, and participatory decision making. The first was related to the associated and appropriate eLearning design. The latter was introduced as the involvement of the customers in decision making (e.g. suggesting and voting ideas). In DL collaboration skills are of major importance for: developing initial trust and empathy between the team members; encourage collaboration; sharing information and experience; observing each other’s activities and ways of learning and working; and lastly, enhancing idea generation based on spiral information provision, emulation and argumentation, in order to peak in idea generation.

The sense of presence has also been considered important for communication, team coordination and collaboration. There is a need to “see thyself and others” in order the group to react, act and proact appropriately. Short and colleagues working on studies about discussion on the phone defined social presence as the “*degree of salience of the other person in a mediated communication and the consequent salience of their interpersonal interactions*” (1976:65). They also referred to the concepts of immediacy as the psychological distance (Weiner & Mehrabian, 1968) and intimacy as the interpretation degree of interpersonal interactions (Argyle & Dean, 1965). Later, social presence was the degree by which a person was perceived as real in an online conversation (Meyer, 2002:59). For this reason, the construction of students’ profiles was obligatory to facilitate empathy (Lambropoulos, 2008). Also new tools aimed to enhance social presence and co-presence in

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CSCeL targeting at involving the students in the course and thus, increase their engagement and participation and thus collaboration in CSCeL.

## **COMPUTER SUPPORTED COLLABORATIVE ELEARNING (CSEL)**

It appears that collaboration is a very important cognitive and motivational force required for fostering learning. Two terms have been used interchangeably in the collaborative learning history: cooperation and collaboration. Cooperation was the basis of sociability “*acting together, in a coordinated way at work, or in social relationships, in the pursuit of shared goals, the enjoinderment of the joint activity, or simply furthering the relationship*” (Argyle, 1991:15). Collaboration “*is a principle-based process of working together that produces trust, integrity and break-through results by building true consensus, ownership and alignment*” (Marshall, 1995). Schrage (1990:40) defines collaboration as “*the process of shared creation: two or more individuals with complementary skills interacting to create a shared understanding*”. In order to facilitate research and analysis, Teasley and Roschelle proposed a distinction between cooperation and collaboration (1993):

*Collaboration is a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem... Cooperative work is accomplished by the division of labour among participants, as an activity where each person is responsible for a portion of the problem solving.*

Teasley & Roschelle, 1993:235

Teasley and Roschelle provided a clear distinction based on the fact that tasks are divided between participants: “*each person is responsible for a portion of the problem solving*”.

Lambropoulos and Culwin (2010a) provided a definition based on learners’ skills. Cooperation is related to the process of joint activity. Two or more individuals bring complementary skills and knowledge to a task. Each contributes their particular skill to the common purpose. Accordingly an individual can depart once their contribution has been made. Collaboration is related to the process of joint creation. Two or more individuals bring overlapping skills and knowledge to a task. Ideally each contributes equitably, if not equally, to the common purpose. Accordingly an individual remains engaged until the task has been completed. The confused understanding of the distinction between these two terms extends beyond the literature to the participants themselves. An individual may be both cooperating and collaborating at a task, and be unaware of their contributions. UNESCO also provided a definition; collaborative learning occurs

*when learners work in groups on the same task simultaneously, thinking together over demands and tackling complexities. Collaboration is here seen as the act of shared creation and/or discovery. Within the context of electronic communication, collaborative learning can take place without members being physically in the same location.*

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## Technology & Learning definitions, UNESCO (n.d.)

UNESCO's definition also supports the context of electronic communication breaking the borders of physical locations and thus providing definitions for both onsite and online collaborative learning. The electronic shared space as groupware becomes a frame of reference for the collaboration and provides an environment in which collaboration can occur (Lehtinen et al., 1999). The description of such environment is one of the aims of this paper.

### **Computer Supported Collaborative eLearning (CSCeL) Research**

According to Dillenbourg and colleagues (1996) as well as Fischer and Mandle (2005), the Computer Supported Collaborative Learning (CSCL) focus is exhausted in studies where the individual is the centre of research; there are limited studies focusing on the ways teams function and the interrelated factors that affect knowledge convergence. The transition of the research focus from the individual to group and community learning was evident in the most influence review conducted by Dillenbourg and colleagues (1996). They supported that the development of an understanding of collaborative learning began with the learner as an individual and moved to group learning in a more socio-cultural mode. During the 70s and early 80s, research was focused on the individual's learning processes. The context of their interaction was seen as a backdrop rather than the focus of research in its own right. When the group became the unit of analysis, the focus shifted to the social construction of knowledge; however, this was still on the basis of studying individuals. In terms of empirical research, the focus was on comparative processes to establish whether and under what circumstances collaborative learning was more effective than learning alone.

Because CSCL and in eLearning environment in particular (CSCeL) is inherently complex, it was almost impossible to establish causal links between the conditions and the effects of collaboration. Therefore, Dillenbourg and colleagues (1996) indicated the need for new tools and methods for observing and analysing interactions to increase understanding of the collaborative learning social mode. Dillenbourg (2000) also stressed the social aspect of learning as a designed information space where learners are actors i.e. they co-construct the information space and their learning context. In other words, collaboration among peers needs to be designed and shaped based on the CSCeL environment (Dillenbourg et al., 2009). CSCeL tools provided the collaborative settings aiming to foster conceptual advanced and facilitate learning. Such tools would shed light into these processes and support CSCeL activities.

### **CSCeL Technologies**

Designing e-learning tools to influence CSCeL has methodological advantages. For example, following Hoadley (1998) such tools can give explicit control of the process and support the type of interactions were expected to promote it: tools for coordination, such as project management, tracking and scheduling software; tools for communication, such as email, bulletin boards, teleconferencing, and real-time messaging systems; tools for educational content, such as tools for learning objects; and tools to enhance cognitive processes, such as tools based on argumentation models.

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Three CSCeL tools examples are briefly presented in this section, SpeakEasy (Hoadley et al., 1995), Belvedere (Suthers, 1998) and MessageForum (Jeong, 2005). SpeakEasy had two intended effects on the user: to allow the user to internalize and learn from the knowledge held by other members of the discussion community, and to augment the community's knowledge (construct new knowledge) by synthesizing new ideas. Hoadley and Hsi found that students participated more and more equitably in SpeakEasy than offline discussion and their conceptions advanced as a result of discussion.

Belvedere facilitates and supports constructing and reflecting on diagrams of one's ideas. It prompts students' cognitive activity by giving them a graphical language to express the steps of hypothesizing, data-gathering, and weighing of information supporting collaborative learning through the shareability of diagrams. Suthers found that Belvedere proved to be helpful for higher order social interaction and, subsequently, for better learning in terms of deep understanding.

MessageForum supported online dialogical argumentation. The ForumManager was an MS Excel application for downloading and analyzing messages (and message texts) in Blackboard threaded discussion forums using Internet Explorer browser. Jeong found that the visibility of the structure helped learners' reflection; more replies were elaborated on previous ideas; there were greater gains in knowledge acquisition; there were fewer unsupported claims, greater knowledge of argumentation processes; there was no difference in knowledge acquisition, application of domain content, and convergence towards consensus; and lastly, there were fewer challenges per argument.

### ***Tools to promote DL & CSCeL Group Activities***

When building tools to support educational activities, a connection between the educational task and the tool functionality is needed. In other words, the direct fit between educational task and the method chosen to pursue it is essential (Lambropoulos & Culwin, 2010b). Anchored in Järvenoja and Järvelä (2009), this means that tools need to support the socially constructed self-regulation and enhance their socially shared regulation strategies. Three such tools were built and are now hosted on Moodle (<http://www.intelligentq.net/e-learning/>). In order to support DL and idea generation within groups the forums were enhanced with the tools: the HySynTag (Lambropoulos & Kampylis, 2009), the Participation Avatars (Lambropoulos, 2008; Lambropoulos & Culwin, 2010c) and the Visualisation Interaction Tool (Lambropoulos, et al., 2009).

Re:[Explore] F  
Re:[Idea] Re: Re:  
Re:[Idea] Re: Fantastic  
Re:[Idea] Re: Re:  
Re:[Evaluate] Re:  
Re:[Idea] Re: Re:  
Re:[Explore] F  
Re:[Other]  
Re:[Idea] Re: Fantastic  
Re:[Explore] Re: F  
Re:[Explore] F  
Re:[Explore] F  
Re:[Explore] F  
Re:[Explo  
Re:[Idea] Re: Fantastic  
Re:[Idea] Re: Fantastic

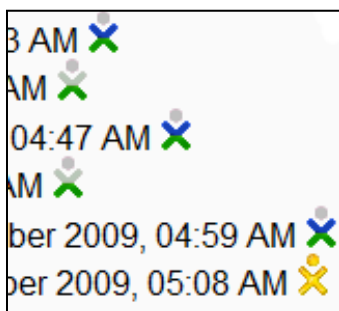
Hybrid Synergy is a five-level non-linear collaborative creativity analytical framework that facilitates and enhances the e-learners' metacognitive awareness. HySynTag tool allows the discussion participants to attach qualitative metadata to their posts based on a specific cognitive model and thus visualise their cognitive levels. This visualisation can occur on three levels: the discussion, the posts, and the overall threaded view. More specifically, they have the opportunity to tag their post in accordance with the Hybrid Synergy levels: Inform, Feel, Explore-Idea, Evaluate, Summarise. Moreover, they have the opportunity to tag their post with the

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tag “Other” when the five levels of Hybrid Synergy seems that they do not cover their argumentation.

Finally, they have the opportunity to post something without tagging ([ - ]) either because the available tags are not suitable or because they do not want to tag their messages. The tool, placed at the bottom of the “Reply” message, can also aid metacognition. The overall view of the thinking levels in one discussion can enhance the spiral and non-linear creativity mobility allowing the “Aha!” experience to occur. The tool also provided a twofold real-time thematic analysis for the students to build upon their arguments and the researchers to analyse the messages in real time.

Null passive participation is defined as absence of activity, the online participant registers without any further actions whatsoever. Passive participation is defined as visiting and reading posts, without posting themselves. It is categorised into three levels: low, medium and high. These levels are defined from the number of days when at least one visit is made, with respect to the length of the course. Low passive participation is where the average number of days is one fourth or less of the duration of the course. High passive participation is more than three fourths of the duration and medium passive participation is between these two categories.



The Avatars on the left hand side represent the 3 active participation levels. Online active participation is defined as presence of activity, the online participant registers, reads and posts. Active participation is categorised into three levels: low, medium and high. These levels are defined from the number of posts sent by the most active e-learner. Low active participation is where the average number of posts is one fourth or less of the total posts from the most active e-learner. High active participation is more than three fourths of the posts and medium

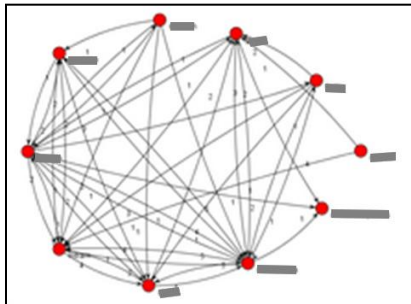
active participation is between these two categories.

Social Network Analysis (SNA) can be used to visualize communication and relationships between people and/or groups. It uses diagrams to depict social relationships between a set of actors (Baroudi, et al, 1986). The diagrams consist of nodes (the actors of study) and its relations (the strands between actors). The patterns produced as sub-graphs can describe the degree of centrality or isolation of each actor within one particular forum. Although descriptive SNA is usually conducted in retrospect as a static snapshot of the network at a specific time, real time SNA can facilitate students’ interactions and their coordination. However, when analysing descriptive SNA as researchers in data analysis, it SNA refers to structural and positional analysis of the actors.

Bakharia (2008) discovered a process for acquiring data from discussions forums almost in real-time. She used GreaseMonkey, a Mozilla Firefox add-on that allows users to install scripts, to inject client side JavaScript code. This extracts forum post-reply data and exports the social relationships to a format that SNA desktop application NetDraw is able to

visualise. These data are used by the SNA software to produce visualisation graphs. The non real-time nature of the process made it suitable only for post-hoc analysis. In order for the information contained to be useful to an e-learner it would have to be immediately available to them. This implies that the data would have to be captured and processed automatically if it were to be used for moderating or self organisation purposes.

However, an SNA real-time tool can support a learner's social awareness and depict actor's locality within the group, making visible the participant to herself and others in real-time.



The Visualisation of the Social Network tool was further developed by the third author. It is anchored in Social Network Analysis and represents the nodes between the e-learners (actors). The tool is used to visualize communication and relationships between people and/or groups, known as actors. It uses diagrams to depict social relationships between a set of actors has (Baroudi, et al, 1986). The diagrams consist of nodes represented as bullets (the actors of study) and their relationships represented as ties (the strands between actors).

These three tools were used in the course to enhance the e-learners' motivation anchored in self-regulation of participation and dialogue. It is needs to be noted that group work is 30% of their grade in their assessment for this particular workshop. The rest of the paper presents the case study.

## **BENDING TIME IN E-LEARNING: SCRIPTING IDEA GENERATION IN DL**

A detailed e-learning plan was developed anchored in both initial organisational activities and learning activities, and based on pedagogical design and the use of associated tools (Coyle, 2010). In order to ensure idea generation the learning approach was anchored in (a) both individualistic and collaborative learning, and (b), the multidimensional role of the e-tutor as moderator and orchestrator of activities, as well as being a model him/herself to the vicarious e-learners (Bandura, 1977). This process suits the relatively new use of scripts in the CSEL literature. The 'script' is the pre-description of the learning activities for the learning context organization and knowledge convergence (Dillenbourg et al., 2009). In their literature review, Dillenbourg and Tchounikine (2007) found that the term '*script*' has been previously used in cognitive psychology and refers to the mental representation of procedures we use in everyday situations such as entering restaurant, and has also been used for describing methods that structure face-to-face collaborative learning.

Collaboration scripts are the most important design element in CSCeL aiming to support the learning design by structuring it. A script describes the way students have to collaborate: task distribution or roles, turn taking rules, work phases, deliverables, etc. (Dillenbourg & Jermann, 2007). According to Kollar, Fischer and Hesse (2006), collaboration scripts consist of at least five components: learning objectives, type of activities, sequencing, role distribution, and type of representation. Moreover, collaboration scripts are sequences of

phases, each characterized by the following five attributes: type of task to be accomplished, group formation (and composition), distribution of the task within and among groups, type and mode of interaction (e.g., co-located vs. remote, synchronous vs. asynchronous, text-based vs. voice-based, etc.), and timing of the phase. There are two types of scripts, micro- and macro-scripts:

1. *Micro-scripts* are dialogue models, mostly argumentation models, which are embedded in the environment and which students are expected to adopt and progressively internalize (Dillenbourg & Hong, 2008). We used the Hybrid Synergy argumentation model (see Appendix I). Finer-grained scripts follow a more psychological approach on an individual level (Dillenbourg & Tchounikine, 2007).
2. *Macro-scripts* are pedagogical models, i.e. they model a sequence of activities to be performed by groups. For instance, argumentation can be triggered by collecting students' opinions and pairing students with conflicting opinions (Dillenbourg & Hong, 2008). These scripts aim to increase the quality of interactions that take place among group members linking the social part of learning with the actual learning (Dillenbourg & Tchounikine, 2007).

Also, the internal and external script definitions served the initial proposition for internationalisation and externalisation of knowledge related to both ontological and constructivist approaches. According to Kollar, Fischer, and Hesse (2006), the term *external script* refers to the pedagogical scenario that students are asked to play, while the term *internal script* describes the mental representation that students construct of the external script (Dillenbourg & Jermann, 2007). In other words, the external script functions as the storyboard and the internal script refers to mental structures that may have existed before the e-course.

The dialogical part of the micro script is presented in Appendix I. The following sections describe the macro scripts components for the DL e-course: resources, participants, groups and group formation, roles, activities, component distribution, and sequencing.

## **Resources**

Multimedia resources were used in the course; these were constructed by the tutor and also from students in previous courses in order to be used as examples of related work. Students were also encouraged to submit their own resources. More importantly, the students needed to exchange information and experience within the discussion forums in order to create their own group narrative as the background in order to elaborate their ideas. Resources were coordinated by their integration within the e-learning activities sequences.

## **Participants**

The ITIN students work in their companies and come to ITIN regularly to study in order to acquire an MSc. For this reason it is expected to have rich working experiences to exchange comparing to 'common' university students. The ITIN students belong to the SIBA group and

initially created the 3 teams the first day of the course. SIBA (in French: Systèmes d'Information pour la Banque et l'Assurance) is a course on 'Bank and Insurance Information Systems' on Master M2 level. SIBA students have been studying IT during 4 years and by following this option they get a double competency on Banking & Insurance Systems, mainly on concepts and processes, and only 5% on IT. In this e-course, there were 21 e-students, 1 e-tutor, 1 person technical support and 2 ITIN representatives (the second author as the ITIN Director and Laurence Gasquet, the ITIN Pedagogical Coordinator).

### **Dynamic Group Formation and Roles**

Depending on the number of students (N=21), 3 groups were formed. Dynamic group formation increases flexibility by allowing groups evolution based on fostering positive interdependence. Based on role play the students needed to pretend they come from different countries and had different roles. There was also one tutor (the first author). SIBA students created 3 groups: FT1, IMAGES, and Dream-ITIN-Team.

The students pretended that were from different cities and countries. Each team had to decide on a name, a vision statement, the headquarters location and members' roles. This information was sent to the tutor who inserted it on the interface.

### ***The Role of the E-Tutor***

During the post-modern era (Lyotar, 1984) the main preoccupation was complexity (Morin, 2005) uncertainty and controllability' with serious limitations for non physical problems and inability to control the learning process (Taleb, 2007). These limitations were even more evident when CSCL was introduced. The teacher becomes the orchestrator of such collaborative activities. Orchestration is the process of productively coordinating supportive interventions across multiple learning activities. It covers different forms of coordination related to (Fischer & Dillenbourg, 2006): (a) activities at different social, contextual and media levels; (b) scaffolds at different social levels; (c) self-regulation and external regulation and (d) individual motivation and social processes.

While working with new features, the e-tutor follows four overlapping stages of pedagogy that can be identified as: modeling, coaching, fading, and reflecting (Collins, Brown, and Newman, 1987):

1. Modelling (Observation of expert performances). At the modelling stage, the expert proceeds slowly, commonly separating the task into separate sub-components and using a simplified version of the task.
2. Coaching (Expert guidance and help). The coaching stage involves the "tutor/aid" paradigm. The expert can either act as a tutor and provide direct instruction or can act as an aid and provide hints.

3. Fading (Expert assistance is gradually withdrawn). Fading involves gradually withdrawing expert involvement in the learning process.
4. Reflecting (Self-monitoring and reflecting upon past performances).

Reflecting involves self-regulation by observing thyself and others and therefore enhances metacognition. Therefore, the e-learning design was scripted into 6 distinct phases, also considering activities before and after the e-course (social intelligence skills and researchers' evaluation) (Figure 1):

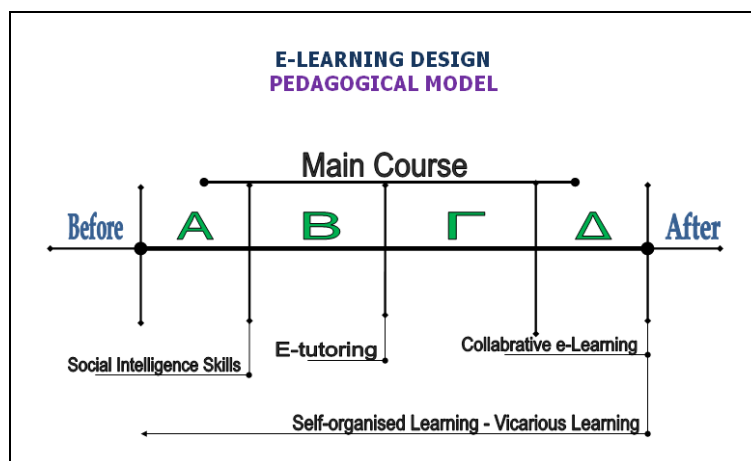


Figure 1. The Pedagogical Model for E-learning design

Figure 1 suggests the need for different teaching and learning styles. The tutor initially adopted an instructional approach and moved to the role of orchestrating the activities. The students considered to adapt to four different learning styles occurring simultaneously, instructional, collaborative and self-directed and vicarious learning. The teacher's/expert's roles were a combination of the expert, observer, intervener and overall conductor of ITIN students' participation. In this way there is matching of organisation and knowledge convergence in order to achieve students' cognitive convergence (Teasley et al., 2008). Sharan (1995) emphasizes the teacher's circulation/availability within the groups while offering help, support or redirection of the activities. It demands five major sets of strategies that were incorporated in the scripting plan according to Johnson & Johnson (1987):

1. Clearly specify the objective of each lesson
2. Making decisions about placing students
3. Clearly explaining the task and goal structure every time
4. Monitoring the effectiveness of the cooperative learning group and intervening to provide task assistance (such as answering questions and teaching task skills) or to increase students' interpersonal and group skills.
5. Evaluating students' achievement and helping students discuss how they collaborated with each other.

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## Activities

The activities were structured in a detailed way to facilitate the work and learning flow. The learning goals were clarified and articulated. After the completion of the course, the ITIN e-students would be able to:

1. Work on the Distributed Leadership principles
2. Create international teams with an edge
3. Lead global virtual teams successfully
4. Become team-players: actively participate in online collaboration and presentations

These were the learning objectives/outcomes and were visible on the interface. Assessment was associated with the learning objectives weighting 35% of the total grade for each student for individual coursework and active contribution to the group, 35% for the group project product and presentation as such, and 30% for individual evaluation. The activities sequences for the 2 days were created in cooperation with Laurence Gasquet and were also displayed on the interface one for each day. The first day was dedicated to learning about Distributed Leadership, familiarising with the Moodle interface, developing their social intelligence skills, presence and co-presence. The students used the enhance forums to follow the scripting procedure; for example, the team leader was posting appropriate messages and moderated the discussion to generate ideas for the group. Also, the e-tutor's role was changing from being an instructor, providing information and advice, to the orchestrator of the collaborative learning activities.

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**DAY 2 before the BREAK**


*Learning by doing activities in Day 2 (1st half of Day 2 starts here):*  
**A. Use the first part of Day 2a-b to learn how to lead international teams.**

1. Read the educational material
2. Work on a group project (one for each team)
3. Use the forums to discuss about the information on the wiki
4. Create 3 vision statements using the wikis, one for each team. A vision statement should include: the Project title, idea, aims, objectives & deliverables. See example from previous team Waterloo.
5. Display how your projects visions have incorporated DL principles.
6. **COMPULSORY:** *When you finish working on the wiki and have your Project Vision ready, then go to: Group-assessment assignment.* Participation and critical thinking levels on [Discussion Forum 2](#).
7. Use the Delphi technique to discuss the 3 Project Visions (it is explained in the forum).

**DAY 2 after the BREAK**

**B. In the second part of Day 2a-b (this is after the break):**

1. Present your projects visions on a ppt form as a team.
2. Present your project visions as a team in front of the class.



3. Evaluate and assess the (a) project visions and (b) presentations. Download the xls file, conduct the evaluation and send it to the tutor when all teams finish.

XLS Link location: <http://www.intelligentq.net/e-learning/mod/resource/view.php?id=484>

**COMPULSORY:** *Individual assignment.* Please complete the [10-Qs](#) on the course. This is also to ensure that the students who did not have time to come to the class in days 2 and 3 to be able to get a mark.

Fig. 2. Day 2 Activities

The second day (Figure 2) the students had to work on their own within their teams in order to construct a new project based on what they have learned the previous day. The tutor was always present online, however, only intervened when coordination problems occurred. After the break they presented their presentations to everyone and the tutor received photos and videos.

Overall, the students knew the exact sequence of the educational activities, the targets and the tasks. The first day the students familiarised themselves with the tools, observed how the most active students and the tutor work; on the second day the tutor's role faded out completely. In this way the tutor's was available for questions as well as coordinating the team leaders in order to organise their teams by themselves using the tools provided; in other words, work as if they were in 'real' working situations.

### Component Distribution

The components described above were distributed according to the changing teaching and learning styles related to roles and associated activities. For example, when working in teams,

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the students worked on a different part of the project as well as all together (cooperative and collaborative learning) depending on their role within the team.

### **Organisational Convergence: Coordination & Sequencing**

Coordinating and sequencing CSCeL activities and resources is of major importance to reach flow towards organizational convergence, especially in short e-courses. For this reason fixing the degree of coercion and tackling unpredictability is a delicate design choice (Dillenbourg & Tchounikine, 2007). Scripting such sequences can scaffold students' social and learning interactions in such a way so to achieve a peak collaborative and idea generation performance of each group. Specific linear sequence of activities and resources as well as repetition of activities with minor variations was used. Traversal and rotation was used in the 3 groups. The first is the repetition of the same educational material in the same order looped through, with only one element being in use at a time; the second is rotates the elements in a given set towards the same direction.

Fading was used for the tutor's activity and presence in reverse relation to the students. New features for the students were gradually added (faded in) or/and removed (faded out) and the same elements were removed or added to the tutor.

To conclude, e-learning design was scripted in detail, however, promoting individual and group flexibility, in order to enable students to act and collaborate on both an individual and group level. Specific descriptions of any intrinsic or extrinsic collaborative constraints as well as specific self-scripts for each student were not included in this script. In this way the students knew in advance about the educational material and the basic structure of their activities and roles as well as tutor's role used in each phase. Consequently, transaction cost and time was significantly saved and the e-course finished successfully the second day. The next section presents the implementation of these challenges in a case study and the results between the script description and what actually happened.

### **METHODOLOGY**

One 2-day average ITIN course was selected to be presented in this study. We used quantitative and qualitative data as well as the data extracted from the implemented tools. Causal research methods alone (effect-intervention) do not provide the holistic view (Andrews & Haythornthwaite, 2007) needed in this study. Consequently, diverse evaluation methods and tools aided in the identification, development, improvement and validation of the e-learning design defined by the scripts. The students completed a self-reported assessment questionnaire. Also, the text was extracted from each forum as well as all forums together and other interaction posts. Then we run an algorithm called Non-Negative Matrix Factorization which revealed the main themes, the main words used in the theme and the messages linked to the theme. In order to compare the results, we also conducted qualitative analysis in Atlas.ti using the Collaborative eLearning Episodes Matrix (Appendix I). Lastly, we compared the results with the data extracted from the HySynTag, the participation Avatars and the SNA tools.

This research has several limitations: the e-research nature as such; the sample was not representative and relatively small; and limited research in the field of measuring the motivation to promote Distributed Leadership as well as using the specific tools did not allow extended comparison of the results. There are also considerations about the Hawthorn effect. Lastly, the propositions need to be further tested and developed in different contexts to ensure their validity and reliability.

## **RESULTS & DISCUSSION**

Due to the diversity of the investigated issues this section presents both results and discussion in order to avoid confusion if discussion was a separate section. The results briefly presented in this section are grouped in quantitative, qualitative and tools-based data; quantitative results were collected with the non-negative matrix factorisation algorithm, the qualitative data were extracted from the forums, and the tools were the HySynTag, the Avatars and the Visualisation Network. Lastly, a final aim was to use as similar codes between the researchers and the students as possible so to observe and analyse the different perspectives the researchers and the students in order to involve the students' in the research process, however, without overcomplicating it.

### **Self-Reported Questionnaire**

The questionnaire checked whether the students actually acquired the Distributed Leadership principles and were able to articulate them in their own words. Despite the fact that the French students had some small problems with the use of English language, the results showed that all students grasped the DL principles. For example, Participant BD said: *'@ First, even if we work far away from each other, it is possible, using distributed leadership, to communicate as fast as if we were in the same room. Then, distributed leadership is making you build a database knowledge. To finish, DL means share your ideas with people from different cultures, and that's very good for innovation.'*

Some extracts from the open question on what the students will change in their practice based on what they learned from the -course are the following:

- That a one-man leadership is not always the solution to bring a project to the end; distributed leadership can be an interesting choice to manage a project.
- DL can be used effectively because the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem.
- Knowing people is a very important step for team works, for this, communication is the key.
- Communication is very important for good management
- The importance to have a team communicating and dynamic
- The tools which permit to succeed a project.

- The efficiency of collaborative tools for international project. All the online tools we discover in this lesson are very powerful and are a precious advantage for work as a team

Overall, it appeared that all students learned the DL principles. Also it is evident that they attached importance on the human factors such collaboration and coordination: for example, the distribution of tasks, working in the same task, clear communication and diversity between the team members, and the use of tools as the technical factors to facilitate DL. From a quantitative viewpoint, the overall number of messages and words are as follows (Table 1):

Discussions		FT1		Dream-ITIN-Team		IMAGES		Total
#	On DL	New DL tools	On DL	New DL tools	On DL	New DL tools	#	Average per discussion
<b>Replies</b>	34	18	27	18	35	55	187	31/6
<b>Words</b>	1,011	651	1,359	667	1,368	1,422	6,478	1,080/6

Table 1. Discussions Overview

The average number of posts was 31 per discussion and 8.9 posts per learner whereas the average number of words was 1,080 per discussion and 308.4 words per learner. The length (depth) of discussion posts varied in the number of replies. It is also visible that it was easier for the students to discuss on existing educational material and experiences than to completely innovate by suggesting new Distributed Leadership tools. Also, it is important to note that the team leaders actively engaged their team members resulting in the absence of lurking; in other words passive participation was zero.

From this first overview it appears that the quantity and quality of the posts met authors' expectations. However, more detailed analyses are needed to correlate the factors that contributed to the successful implementation of the short e-course. For this reason, both automated and researcher-oriented approaches were employed, these were algorithms, qualitative research and the results extracted from the tools in the enhanced forums.

### **Theme Discovery within Discussion Forums: Non-Negative Matrix Factorization**

We utilised a relatively new algorithm known as Non-Negative Matrix Factorization (NNMF) (Lee & Seung, 1999) that has successfully been applied to document clustering to find the key themes or concepts being discussed within a forum (Xu, et al., 2003). NNMF has two features that are crucial to the application of the algorithm within a collaborative discussion context. Firstly participant posts are allowed to correspond to multiple themes – this occurs as participants quite naturally may address or refer to multiple themes and concepts in a single post. Secondly NNMF produces results that are readily interpretable. The

main keywords as well as the top participant responses within a theme are produced as output from the algorithm. The input to the NNMF algorithm is a matrix with forums posts and the counts of words for each word found in the forum post. The NNMF algorithm outputs themes and the main keyword within the theme by relative weight, which indicates strength within a theme. The output can be interpreted as a bipartite graph which maps words and documents (in this case forum posts) to themes where the weights represent the link strength.

Themes discovered by NNMF are not automatically labelled (i.e. given a title). Labels can however be manually determined by analysing the prominent keywords and posts within a theme. The algorithm is also not able to automatically detect the number of themes present within a forum. It is up to the user to interactively specify the number of themes and review the results in order to find the best fit. A tool known, as the Thematic Explorer was developed to facilitate the required interaction with the NNMF algorithm within Moodle forums. While NNMF is able to group participant posts into coherent themes based on word usage, interpretation and further refinement of the results by the researchers is essential.

Distributed Leadership Course			
Group Work Day 1			
Discussions	Identified Themes	Keyword Weights > 1	
<b>FT1: Find new tools for DL</b>			
#Messages	18		
	Facebook	facebook [1.73]	people [1.06]
	Group Forum Discussions	discuss [1.01]	
	Instant Messaging		
	Wikis and Information Sharing		
<b>Dream-ITIN-Team: Find new tools for DL</b>			
#Messages	18		
	Social Networks	friend [1.25]	
	Management and Distributed Workflows		
	Friend Whell (tool)		
	Discussion and Facebook	discuss [1.18]	
	Distributed Leadership Resources		
<b>IMAGES: Find new tools for DL</b>			
#Messages	55		
	Project Management Software and Bug Reporting Software	PMS-BR [1.71]	compani [1.38]
	Open Source Collaborative Products	product [1.40]	
	Tools for Monitoring Tasks/Progress	task [1.68]	
	Accessible Software	softwar [1.16]	
	Time Management	time [1.31]	

Table 2. Non-Negative Matrix Factorization Results

Table 2 shows a sample of Day 1 themes and main keywords extracted from the course; the themes are determined by the word usage within the forums (i.e. the number of times a word was used).

A “Find new tools for DL” forum was setup for each of the three groups namely FT1, Dream-ITIN and IMAGES. Analysing the posts from each of the forums with NNMF, provides a high level overview of the distributed leadership tools being discussed within a group. We are also then able compare the content being discussed by each group. The FT1 and Dream-ITIN groups mainly discussed social networking tools and social software. The IMAGES group on the other hand was more focussed on project and time management software.

It is apparent that the most productive group was IMAGES in the initial discussion on the e-course. The discussion was oriented towards the implementation of the DL tools as 2 of the 5 themes refer to IT and Time Project Management whereas the rest were focused on social tools. Overall, the main keywords found in themes are shown next (Figure 3):

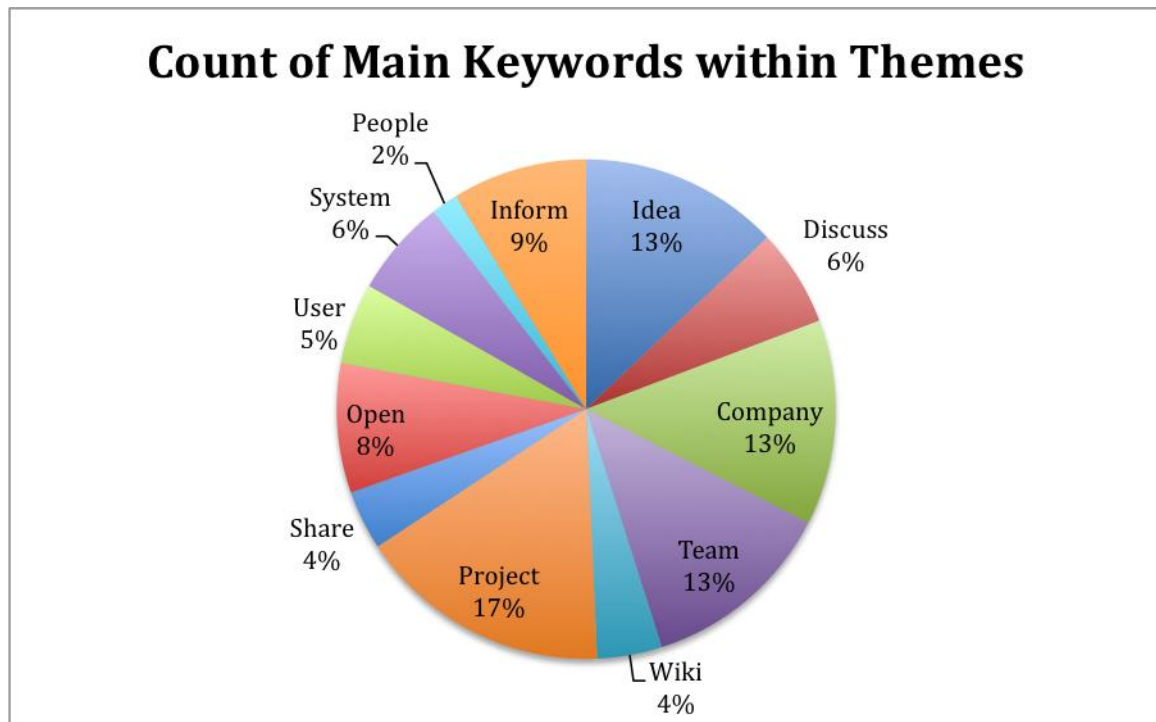
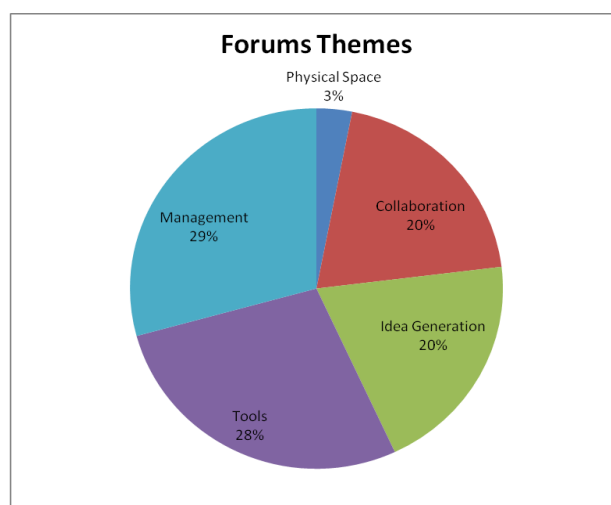


Fig.3 Forums themes

Figure 8 presents the most appeared words in the previous Table 2: 17% for the word project; 13% for idea, team, and company; 9% for inform; 6% for discuss and system; 5% for user; 4% for share and wiki and 2% for people. It appears that DL keywords and software tools towards idea generation are most commonly used.



#### Fig.4 Forums Themes

Figure 4 presents the most appeared word and percentage of appearance from the previous table on the basis of these words in the discussion forums: management (29%), tools (28%), idea (20%), collaboration (20%) and physical space (3%). As in the self-reported questionnaire, it appears that the students internalised the DL concepts and it is highly likely to incorporate the DL principles in their own practice, in both the virtual and physical space.

#### Qualitative Analysis using Atlas.ti

The same data were inserted into Atlas.ti in order to observe any differences in the ways the algorithm treated the data compared to the manual coding by the researchers. (Please note here that the stanzas numbers were automatically generated by Atals.ti.). Due to lack of space, only results from Day 1 (169 messages and 20 CeLEs) are presented here:

<b>CeLE Level</b>	<b>Number of Codes</b>	<b>Total</b>	<b>%</b>
<b>Social</b>	36	36	9
<b>Information</b>	53	98	24
<i>Question</i>	39		
<i>Answer</i>	6		
<b>Explanation</b>	25	25	6
<b>Agreement</b>	40	60	15
<i>Justification</i>	16		
<i>Disagreement</i>	4		
<b>Exploration</b>	69	69	17
<b>Evaluation</b>	64	92	22
<i>Justification</i>	28		
<b>Ideas</b>	20	20	5
<b>Summary</b>	9	9	2
<b>Total</b>		<b>429</b>	<b>100</b>

Table 3. CeLEs Code Network in Day 1 (Atlas.ti )

According to Table 3 the researchers found the following: 24% on information provision including questions and answers to questions; 22% on evaluation including justifications of the evaluation; 17% on exploration; 15% on agreement including justification of agreement and disagreements; 9% on social messages; 6% on explanation; 5% on ideas generation; and 2% on the summaries.

If comparing the results from the algorithm and the argumentation analysis it appears that the first can provide evaluation for the macro-script and the second for the micro-script. This means that the algorithm was able to acquire the most used words from great number of data and verify the success of the macro script and thus the success of the CSCeL pedagogical design. For example, the students used social software, IT and Time project management

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tools; they worked using ‘collaborative’ words such as team, idea or discuss; and the forums themes were also indicative to collaboration.

However, the algorithm alone cannot provide enough information for the micro-script, this means on a more cognitive and psychological level. It appears that the students concentrated on the DL study rather the social exchange as they knew each other already. They needed initial information provision based on the educational material, their own experiences and information derived from the Web in order to explore them and decide upon their usefulness. Based on researchers’ previous experience with similar research the percentage of idea generation was relatively high (Lambropoulos, 2010; Lambropoulos & Kamylyis, 2009).

The following quotes demonstrate the types of messages students exchanged as evidence of the DL principles from the team IMAGES:

**Stanza17.** Participant-BDR (Images, Forum#5) [INFORM]: *“in DL, the language is very important to avoid misunderstood.”*

**Stanza46.** Participant –JD (Images Forum#5) [EXPLORE]: *“And with IM [Instant Messaging], you lost the human contact between people and the work become monotonous.”*

**Stanza75.** Participant –PE (Images Forum#5) [EXPLORE]: *“Well, it's pretty expensive but I think I'm gonna propose this tool in my team”*

**Stanza80.** Participant –JB (Images Forum#5) [EXPLORE]: *“You're welcome my friend!”*

**Stanza199.** Participant –MB (Images Forum#2) [ ]: *“Open plan is the best and the simple way of exchanging informations of any type. But it's not the best solution, the confidentiality of datas and informations are in danger in that kind of organisation. I think the best solution is a mixed organisation”*

**Stanza202.** Participant –MB (Images Forum#2) [ ]: *“Yes of course, Many of companies used this system (collaborative). It permits to keep contact and share the documents, which we want to expose for partners and then applicate many rights (read only, write only...)”*

On group feedback in messages are (FT1 Forum#1) [ ]:

**Stanza184.** Participant –CBDV: *Have we great answered the question?*

**Stanza185.** Participant –XD: *I think it's great!*

**Stanza186.** Participant –SK *I think it's a very good answer!*

As with this conversation, it appears that overall the participants did not consider tagging the social messages.

The following short social messages exchange enabled the team member to elaborate on his/her contribution. Because the students knew each other they used their names in their interactions. It is also interesting to note that Participant-JW copied the structure of JD’s explorative message:

**Stanza122.** Participant – JD (Dream-ITIN-Team *In our company, in one hand, we can use collaborative website as Intranet, or forums which relate our discussion*

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Forum#3) [ ]: *about projects to improve productivity and answer about problems. In other hand, we can separate task in several leader. For example, one leader create planning, distribute tasks and role in the project, and the other leader execute the leader on his team.  
I share the same opinion with my team leader*

**Stanza124.** Participant – DB (Dream-ITIN-Team Forum#3) [ ]: *Thank you for your help J![...]*

**Stanza125.** Participant – JW (Dream-ITIN-Team Forum#3) [ ]: *I can say that in my campagny I have many roles: In the one hand, my main goal is to write codes lines (for news projects, news moduls or plug-in).But in a second hand, my manager can give me some responsibilities : lead my own project from the begining to the end : planning, ressources, an available software (for instance)...To conclude with my opinion : we can give many role or responsibilities to an employee to lead a project !*

In this discussion extract the students exchange experiences using examples in order to help their peers to understand their viewpoint and also increase their knowledge on the subject. Peer feedback is also evident as well as a reciprocity effect, a different team member reciprocated the initiated communication and argumentation style indicating peer vicarious learning.

The students also demonstrated repairing meaning (Sacks, 1992) to achieve common understanding:

**Stanza91.** Participant –PE *Excuse me Ja, but your question isn't clear, can you precise ??Thx*  
(Images Forum#5)  
[EXPLORE]:

**Stanza92.** Participant –JB *I'm sorry. The question is : Is this software easy to use ?*  
(Images Forum#5)  
[EXPLORE]:

**Stanza93.** Participant –ES *It's a good question Jb, but i'can't answer you directly, beacause i don't know very well this produt. Ask to P.*  
(Images Forum#5)  
[EXPLORE]:

Sharing and repairing meaning is of extreme importance in CSCeL as indicator of common ground and creating the basis for common knowledge in a group. Stahl (2003) suggests that 'meaning-making' is an essential part of learning as an essentially social activity that is conducted collaboratively. He advocates that it depicts individualistic and social learning.

An idea generation example (CeLE #06, stanzas 127-128) is the following:

**Stanza126.** Participant –DB (Dream-ITIN- *In the DL, I think that everybody must be equal. Actually, if you have a manager who works on the same office as you, I don't think*

- Team Forum#3) *it has something to do with DL. Do you agree ?*  
[EXPLORE]:
- Stanza** Participant – *DL put the focus on the team working. The main fact is to give to every member of the team the possibility to express their opinions.*  
GE (Dream-ITIN-Team Forum#3) [ ]: *It's permit to reduce the Hofstede's Power Distance ! DL purpose is to give responsibilities to every members of the team. It's permit to forget the idea of leaders/followers.*
- Stanza127.** Participant *I think you are right. You talk about the power distance. DL gives –DB the same hierarchic level to anyone in the team. What do you think (Dream-ITIN-Team Forum#3) about that ?Personally, I think that every project team should have a manager, otherwise everyone in the team tries to show that his [EXPLORE]: idea is the better one. Don't you think ?Talking about Hofstede's system, do you think that masculinity is an important factor in DL ?*
- Stanza128.** Participant *The problem if there is only one leader is when he is missing, the –JD (Dream-ITIN-Team Forum#3) team can't work at 100%. In the case where a decision must be do, [EXPLORE]: nobody would to take the responsibility to put the company in danger.So, if you use the DL, you can manage the project for all situation...*

This discussion extract provides evidence for students' active engagement, knowledge acquisition of the DL topic, the learner-generated text as the background for going beyond information given, and co-creativity as idea generation. Based on the power distance concept the discussion was enriched with more contributions about the hierarchical and security levels as well as team members' skills in a company. Participants active involvement in the discussion is evident on the use of exclamation marks as a Eureka experience (*It's permit to reduce the Hofstede's Power Distance !*), critical thinking in arguments and asking team members' opinions about their own thoughts about the topic. Furthermore, the multiple perspective of both 'pros and cons' were products of critical thinking in favour of DL.

Overall, the results from the researchers' qualitative analysis showed that the depth of the discussion allowed for different ideas in different sub-topics to occur; the learners' generated text provided greater information in knowledge acquisition from the educational resources as well as from the argumentation cues; peer support and vicarious learning were evident; there were fewer unsupported claims; and convergence towards consensus was evident in student's evaluations and summaries.

## HySynTag

The results from the HySynTag are summarised in the following Table 5 (please note that not all messages were tagged and some messages were tagged twice):

HySynTag	FT1		Dream-ITIN-Team		Images		TOTAL	
	On DL	New DL tools	On DL	New DL tools	On DL	New DL tools	#	%
<b>Social</b>	0	0	0	0	0	0	0	0
<b>Inform</b>	0	12	5	7	0	20	44	29
<b>Explore</b>	1	10	6	6	13	50	86	57
<b>Idea</b>	0	0		6	2	2	10	6
<b>Evaluate</b>	1	3	4	0	0	0	8	5
<b>Summarise</b>	1	1	1	0	1	1	4	3
<b>Other</b>	0	0	0	0	0	0	0	0
<b>Total</b>	<b>3/34</b>	<b>26/18</b>	<b>16/27</b>	<b>19/18</b>	<b>16/35</b>	<b>73/55</b>	<b>152/187</b>	<b>100</b>

Table 5. HySynTag CeLEs Results

In Table 5, it is apparent that the students tagged fewer messages than the researchers: 44 for information, 86 for exploration, 10 for idea generation, 8 for evaluation, and 4 summaries. HySynTag made the argumentation structure visible to the learners by facilitating their cognitive presence and co-presence. Comparing the manual and the automated results, it appears that the researchers found more codes than the students. This can be due to several reasons: first, the HySynTag tool is simplified to increase usability and resulted in having less distinct categories in students' results; the students could not tag different parts of the same message but they could tag the same message more than once; the students did not tag any of the social messages as they probably did not consider them important in their interaction; and the students tagged both explanation and exploration messages as exploration.

### Avatars

An overview of the Avatars levels of participation in Day 1 is provided for each student *and* for each discussion; the teachers' level was attributed to the highest poster who was the team leader (Table 6):

DAY 1 Team Discussion						
	1	2	3	4	5	6
Teams	FT1	Images	Dream-ITIN-Team	FT1	Images	Dream-ITIN-Team
Participant	Participation Levels: Low Medium High					
AA1	M			M		
AA2	L	L		L	L	
AM		M			M	
BJ						
BS	L			L		

<b>BD</b>			H			H
<b>BDVC</b>	H			H		
<b>BM</b>		M			M	
<b>CC</b>		H			H	
<b>BDRDM</b>			L			L
<b>DJ</b>			M			M
<b>DX</b>	L			L		
<b>EG</b>			L			L
<b>EF</b>		M			M	
<b>JA</b>	L			X		
<b>KS</b>	M			M		
<b>LM</b>		L			L	
<b>LFG</b>			L			L
<b>SE</b>		M			M	
<b>SJ</b>			L			X
<b>WJ</b>			L			L

Table 6. Avatars Participation Levels Results

Table 5 provides an overview of the participation levels of each team member on the 6 discussions (2 for each team) on Day 1. It appears that the participants kept the same participation level in both discussions. This may be an indicator of person's presence, co-presence, self-regulation and engagement. It also suggests the idiosyncratic character of the students and consequently the co-existence of different interaction and learning styles. Also the levels of participation may be an indicator of the number of interactions and thus, messages exchanged between the students. In other words, it can be implied that learning can be a by-product of participation and engagement.

### Visualisation Network

Until recently, real-time SNA was rarely used in education. In this study, only one sample is displayed due to lack of space. The IMAGES group had 4 ideas in 55 messages. An example of the Visualisation Network created by Bakharia for the group Images is presented in the following sub-graph here (Figure 5):



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In regard to technological factors, the tools facilitated presence and co-presence. The students also reported that the tools helped them to reach such awareness; however, they were also aware of their constraints. Traditional tools implemented in Moodle or other learning management systems are more teacher-oriented rather than student-oriented without revealing any interaction patterns. They also provide data for the teachers and researchers or policy makers to consider without taking into account students' reflections anchored in their awareness based on these results.

Lastly, in regard to research methodologies as such, if all results are triangulated, it appears that there was a high level of participation and engagement between the ITIN students. This can result in the high level of learning and understanding of the DL principles. Furthermore, the attempt to use the same codes and interaction sub-graphs for both students and researchers was found useful; however, more detailed research in multiple contexts is needed in order to find the 'perfect' level of agreement and complication of such codes for all frameworks. To conclude, it appeared that the solely used traditional research methods could not provide a holistic view; the diverse evaluation methods and tools aided in the identification, development, improvement and validation of the e-learning design defined by macro and micro scripts.

## **CONCLUSIONS AND FUTURE TRENDS**

This paper presented a case study focused on students' rich collaboration in short e-courses. The e-learning design of a Distributed Leadership (DL) 2 days' course was scripted in order to facilitate the flow of students' learning and work as well as the tutor's changing roles during the e-course. The effectiveness of the course was measured by the students' creativity and productivity; this is the quantity and quality of students' text that provided the background of their own learning based on idea generation. In this way the students had to take responsibility of their own learning. Diverse quantitative and qualitative data analysis methods and tools were used in order to provide a multiple perspectives of the same data and thus, a more holistic approach in data interpretation and triangulation.

The results showed that the use of algorithms can provide evaluation of the macro-scripts whereas the qualitative analysis, Avatars' active participation levels, the HySynTag and the sub-graphs of Social Network Analysis can give a rich picture of interaction between the students. Peer support was also evident. In addition, the real-time tools can support formative feedback supporting self-regulation, critical self-reflection and monitoring one's performance. Also these tools and techniques can indicate the different learning styles occurring in an e-learning environment. Consequently, they can help the tutors to deal with the diversity in e-learning environments by adjusting their pedagogical approaches and orchestrating students' activities, in other words, matching teaching and learning styles. Important finding in peer 'meaning making' suggests the existence of both individualistic and social learning which in turn is related to internalisation and externalisation of knowledge as such. Furthermore, such meaning making in collaborative learning in combination with the idea generation advocates the importance attached to CSCeL.

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Flexible macro scripting appeared to support learners' participation and engagement in the Distributed Leadership short e-course as vital in reaching organisational and personal objectives. Further improvements in e-learning design can be on: (a) comparing in detail the different effects of students' learning styles and teachers' pedagogical approaches depending on the timescale of an e-course; (b) the differences between real and blended learning environments compared to e-learning courses on the same time scale; and (c) whether DL scripts can be implemented in an adaptive system in order to completely omit the instructional intervention of the teacher and focus on his/her activities orchestration.

### **Future Research Challenges**

This experience of DL worked within specific pedagogical situations, here CSCeL, local teams, and simple IT deliverables as learning outcomes. Looking at this project from the point of view of a professional educational organisation it is a challenge to explore and analyse our main objectives for skills and competencies development and certification of our students via such learning activities. In future research we aim to explore these frameworks in *real* working situations, this means real IT projects, entrepreneurship projects, intercultural teams, and physical distribution of team members. We could explore and analyse activities of teams while they are working on a real project with real IT deliverables and constraints. It is also a challenge to use CSCeL macro and micro scripts within teams cooperating during the creativity and innovation phases of an entrepreneurship project.

For example a project manager must be able to manage activities like project management, for example, create, organise, make, test, deploy and evaluate a project within multiple constraints such as specific time, money and resources. Such activities require them to deal with technical and cultural issue as well as challenges related to a uncertainty & complexity of contexts. Therefore it would be valuable to explore the ways learning by doing the Distributed Leadership principles change workers' behaviours in realistic situations while using all acquired competencies simultaneously.

To finish, this is a case study and no identical studies are available in the literature for comparison. For this reason further research in multiple and diverse contexts is needed. Also, the analysis of qualitative data cannot easily be automated due to challenges of converting it into statistical measures. A new model to combine algorithmic approaches with argumentation frameworks in massive data is the target of our future research; furthermore, it may be feasible to implement the Distributed Leadership macro- and micro-scripts to support collaboration for idea generation in adaptive and intuitive educational systems.

There are also great challenges in 'packing' really challenging educational objectives and material into very short courses in order to match educational and working objectives. This is feasible by scripting and adjusting essential elements in educational goals directly related to working practice by being useful to the students for their progression in work and life. On a micro level, the essential elements are: attention to detail; identifying patterns of behaviour and adjust the course to the students (and not the other way around); assignments are referring to real situations; and most of all, encouraging each other within the group finding

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ideas based on both the common interests and goals that unites the group as well as the diverse skills and competences. Lastly it is an enormous research challenge to implement, investigate, evaluate and compare the suggested CSCeL tools, frameworks and techniques toward collaboration and idea generation in real working environments.

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## REFERENCES

- Agbor, E. (2007). Creativity and Innovation: The Leadership Dynamics. In the *Journal of Strategic Leadership (JSL)*, 1(1), pp. 39-45. Available at [http://www.regent.edu/acad/global/publications/jsl/vol1iss1/JSL\\_Vol1iss1\\_Agbor.pdf](http://www.regent.edu/acad/global/publications/jsl/vol1iss1/JSL_Vol1iss1_Agbor.pdf) last access 25/03/2010.
- Andrews, R. and C. Haythornthwaite (2007). Introduction to e-learning research. *The SAGE handbook of e-learning research*, 1-52.
- Ancona, D. & Bresman, H. (2007). *X-Teams: How to Build Teams that Lead, Innovate, and Succeed*. Harvard: Harvard Business Press Book
- Argyle, M. (1991). *Cooperation: The basis of sociability*. London: Routledge
- Argyle, M. & J. Dean (1965). "Eye-contact, distance and affiliation." *Sociometry* 28: 289-304.
- Bandura, A. (1977) *Social Learning Theory*. New Jersey: Prentice Hall.
- Bakharia, A. (2008). Visualising Social Network Formation. In the *Blackboard Asia Pacific Conference*, September 8-10, 2008, Adelaide, Australia.
- Baroudi, J., Olson, M. & Ives, B. (1986). An Empirical Study of the Impact of User Involvement on System Usage and Information Satisfaction. *Communications of the ACM*, 29(3): 232-238.
- Berger P., Luckmann Th., 1966, *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*.
- Bennett, N., Wise, C., Woods, P. & Harvey, J. (2003). *Distributed Leadership: A Review of Literature*. Report. National College for School Leadership.
- Bolden, R. (2008). Distributed leadership. In Antonio Marturano and Jonathan Gosling (2008), *Leadership: the key concepts*. London: Routledge, 2008.
- Boudon R. (1995). *Le Juste et le Vrai : études sur l'objectivité des valeurs et de la connaissance*. Paris : Fayard.
- Bruner, J. (1986). *Actual Minds, Possible Worlds*. Harvard: Harvard University Press
- Carini, R. M., Kuh, G. D., & Klein, S. P. (2006). Student Engagement and Student Learning: Testing the Linkages. *Research in Higher Education* 47(1), pp. 1-32.
- Brown, J.S., Collins, A., & Newman, S.E. (1989) "Cognitive Apprenticeship: Teaching the crafts of reading, writing and mathematics." In L.B. Resnick (Ed.), *Knowing, learning*

**DRAFT:** Lambropoulos, N., Gourdin, A. & Bakharia, A. (2011). Distributed Leadership Collaboration Factors to Support Idea Generation in Computer Supported Collaborative eLearning. Accepted in Lambropoulos, N. & Vivitsou, M. (2011). Distributed Leadership and Online Communities. Special Issue for the *Journal of Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*, University of Jyväskylä, Finland. <http://www.humantechnology.jyu.fi/>

and instruction: Essays in honour of Robert Glaser (pp. 453-494). Hillsdale, N.J.: LEA.

Comte, A. (1853). *Introduction to Positive Philosophy*. London: Chapman.

Clark, R. & Mayer, R. (2007). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. Pfeiffer.

Coyle, D. (2010). *The Talent Code: Greatness isn't born, its grown*. NY,NY: Arrow Books.

Crook, C. *Computers and the Collaborative Experience of Learning* (1994) London:

Routledge. Friedman T. (2007). *The World Is Flat: A Brief History of the Twenty-first Century*. London: Penguin.

Dillenbourg, P., Järvelä, S., & Fischer, F. (2009). The evolution of research on computer-supported collaborative learning: from design to orchestration. In *Technology-Enhanced Learning. Principles and products* (p. 3-19). Edited by N. Balacheff, S. Ludvigsen, T. de Jong, T., A. Lazonder & S. Barnes. Springer.

Dillenbourg, P. & Hong, F. (2008) The mechanics of CSCL macro scripts. *International Journal of Computer-Supported Collaborative Learning*, 3:(1), pp. 5-23.

Dillenbourg, P. & Jermann, P. (2007). Designing integrative scripts. In *Scripting Computer-Supported Collaborative Learning - Cognitive, Computational, and Educational Perspectives*, Computer-Supported Collaborative Learning Series, pages 275-301. Springer, New York, 2007.

Dillenbourg P., Tchounikine P. (2007). Flexibility in macro-scripts for CSCL. In the *Journal of Computer Assisted Learning* **23**(1) 1-13.

Dillenbourg, P. (2000). *Virtual Learning Environments*. Paper presented at the EUN'00 - Learning In The New Millennium: Building New Education Strategies For Schools, Workshop on Virtual Learning Environments, Brussels, Belgium. Retrieved 20/12/2005, from <http://tecfa.unige.ch/tecfa/publicat/dil-papers-2/Dil.7.5.18.pdf>.

Dillenbourg P. (1999) What do you mean by collaborative learning?. In P. Dillenbourg (Ed) *Collaborative-learning: Cognitive and Computational Approaches*. (pp.1-19). Oxford: Elsevier.

Dillenbourg, P., Baker, M., Blaye, A., & O'Malley, C. (1996). The evolution of research on collaborative learning. In E. Spada & P. Reiman (Eds.), *Learning in Humans and Machine: Towards an interdisciplinary learning science*. (pp. 189-211). Oxford: Elsevier.

Fischer, F., & Dillenbourg, P. (2006, April). *Challenges of orchestrating computer-supported collaborative learning*. Paper presented at the 87th. Annual Meeting of the American Educational Research Association (AERA), San Francisco, USA.

Fischer, F., & Mandl, H. (2005). Knowledge convergence in computer-supported collaborative learning: The role of external representation tools. *Journal of the Learning Sciences*, 14(3), 405-441.

Fredricks, J., Blumenfeld, P. & Paris, A.H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research* **74**(1): 59.

**DRAFT:** Lambropoulos, N., Gourdin, A. & Bakharia, A. (2011). Distributed Leadership Collaboration Factors to Support Idea Generation in Computer Supported Collaborative eLearning. Accepted in Lambropoulos, N. & Vivitsou, M. (2011). Distributed Leadership and Online Communities. Special Issue for the *Journal of Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*, University of Jyväskylä, Finland. <http://www.humantechnology.jyu.fi/>

- Hoadley, C. M. (1998). Scaffolding scientific discussion using socially relevant representations in networked multimedia. Unpublished Ph.D. Dissertation, University of California at Berkeley, Berkeley, CA.
- Hoadley, C. M., Hsi, S., & Berman, B. P. (1995, April). Networked multimedia for communication and collaboration. Paper presented at Annual Meeting of the American Educational Research Association, San Francisco, CA.
- Järvenoja, H., & Järvelä, S. (2009). Emotion control in collaborative learning situations – Do students regulate emotions evoked from social challenges? *British Journal of Educational Psychology* 79(3), 463-481.
- Jarvis, P. (1992) *Paradoxes of Learning: In Becoming an Individual in Society*. San Francisco: Jossey-Bass
- Jeong, A. (2005). Methods and Tools for the Computational Analysis of Group Interaction and Argumentation in Asynchronous Online Discussions. Paper presented at the *Technology and Learning Symposium*. 5-6 April 2006, New York, NY.
- Jonassen, D., Davison, M., Collins, M., Campbell, J., & Bannan Haag, B. (1995). Constructivism and computer mediated communication in distance education. *The American Journal of Distance Education*, 9(2), 7–26.
- Jonnaert Ph., 2002, Compétences et socioconstructivisme. Bruxelles: De Boeck.
- Johnson, D.W & Johnson, R.T. (1987) *Learning Together & Alone: Cooperative, Competitive & Individualistic Learning*. New Jersey Prentice Hall. Kuhn T., 1962, *The Structure of Scientific Revolutions*, University Of Chicago Press.
- Kollar, I., Fischer, F., & Hesse, F. W. (2006). Collaboration scripts - a conceptual analysis. *Educational Psychology Review*, 18(2), 159-185.
- Lambropoulos, N. (2010). *Tools and evaluation techniques for collaborative e-Learning communities*. Unpublished Ph.D. Thesis, Centre for Interactive Systems Engineering, London South Bank University. Available from <http://www.Lulu.com>, 2010.
- Lambropoulos, N. & Culwin, F. (2010). Group Awareness in Online Work, Learning & Games. In the Proceedings of the 24<sup>th</sup> HCI 2010 Conference, Dundee, Scotland.
- Lambropoulos, N. & Culwin, F. (2010). *Tools and evaluation techniques to support social awareness in CSCL*. EuroCAT workshop presentation, February 2010, Barcelona, Spain.
- Lambropoulos, N., Kamylyis, P., & Bakharia, A. (2009). User Innovation Networks & research challenges. Paper accepted for the HCI International 2009, San Diego, U.S.A.
- Lambropoulos, N. & Culwin, F. (2009). Tools to Support Interaction & Cognitive Awareness in CSCL . Workshop presentation in the *8th International Conference on Computer Supported Collaborative Learning*. CSCL2009: CSCL Practices. June 8-13, 2009, University of the Aegean, Rhodes, Greece.
- Lambropoulos, N., & Kamylyis, P. (2009). Fostering collaborative creativity and metacognitive awareness in e-learning framework - The case of Hybrid Synergy Tag

**DRAFT:** Lambropoulos, N., Gourdin, A. & Bakharia, A. (2011). Distributed Leadership Collaboration Factors to Support Idea Generation in Computer Supported Collaborative eLearning. Accepted in Lambropoulos, N. & Vivitsou, M. (2011). Distributed Leadership and Online Communities. Special Issue for the *Journal of Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*, University of Jyväskylä, Finland. <http://www.humantechnology.jyu.fi/>

- tool. The 3rd International Conference of Greek Association of Primary Education Music Teachers, Athens, Greece.
- Lehtinen, E., Hakkarainen, K. & Lipponen, L., Rahikainen, M. & Muukkonen, H. (1999). *Computer supported collaborative learning: A review*. The J.H.G.I. Giesbers Reports on Education, No. 10. The Netherlands: University of Nijmegen.
- Lee, DD & Seung, HS (1999). Learning the parts of objects by non-negative matrix factorization. *Nature* **401**, 788–791.
- Lemoigne J.L. (2003). *Le constructivisme*. Paris : L’Harmattan.
- Lyotar JF, 1984, *The Postmodern Condition: A Report on Knowledge*, University of Minnesota Press.
- Marshall, (1995). Collaborative Workplace. *Management Review*, June, pp. 13-17.
- Martínez, A., Y. Dimitriadis, et al. (2003). "Combining qualitative evaluation and social network analysis for the study of classroom social interactions." *Computers & Education* 41(4): 353-368.
- Mercer, N. (1995) *The Guided Construction of Knowledge: Talk amongst Teachers and Learners*. Clevedon: Multilingual Matters. Meyer, K. A. (2002). *Quality in distance education: Focus on on-line learning*. San Francisco, CA, Jossey-Bass.
- Morin E. (2000). *Les Sept Savoirs nécessaires à l'éducation du futur*. Paris: Seuil
- Morin, E. (2001). *Seven complex lessons in education for the future*. Paris: UNESCO
- Morin E. (2005). *On Complexity*. Cresskill, NJ: Hampton Press
- Newmann, F. (1992). *Student Engagement and Achievement in American Secondary Schools*, Teachers College Press, 1234 Amsterdam Avenue, New York, NY .
- Piaget, J. (1995). *Sociological Studies*. London: Routledge.
- Piaget J., 1988, *De la pédagogie*, Éditions Odile Jacob, Paris.
- Raivola R. , Kekkonen K., Tulkki P. & Lyytinen A. (2001). *Producing competencies for learning economy*. Sitra report series 9, Helsinki.
- Sacks, H. (1992). *Lectures on conversation*. Oxford, UK: Blackwell.
- Schrage, Michael. *Shared Minds: The New Technologies of Collaboration*. New York: Random House, 1990.
- Sharan, Y. (1995) "Music of Many Voices: Group Investigation in a Cooperative High School Classroom." In J. E. Pedersen. & A. D. Digby (Eds) (1995). *Secondary Schools and Cooperative Learning: Theories, Models, and Strategies*. London: Garland Publishing, Inc.
- Short, J., E. Williams & Christies, B. (1976). *The Social Psychology of Telecommunications*. London, U.K., John Wiley & Sons.
- Silva, D.Y., Gimbert, B. & Nolan, J. (2000). Sliding the doors: locking and unlocking possibilities for teacher leadership. *Teachers' College Record*, **102**(4), pp.779–804.
- Sparrowe, R. T. & Liden, R. C. (1997). Process and Structure in Leader-Member Exchange. *The Academy of Management Review*, **22**(2): 522-552.
- Stiglitz J. (2007). *Making Globalization Work*. London: Norton
- Suthers, D.D. (1998). Computer aided education and training initiative. Technical Report (12 January 1998)

**DRAFT:** Lambropoulos, N., Gourdin, A. & Bakharia, A. (2011). Distributed Leadership Collaboration Factors to Support Idea Generation in Computer Supported Collaborative eLearning. Accepted in Lambropoulos, N. & Vivitsou, M. (2011). Distributed Leadership and Online Communities. Special Issue for the *Journal of Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*, University of Jyväskylä, Finland. <http://www.humantechnology.jyu.fi/>

- Taleb N.N. (2007). *The Black Swan: The Impact of the Highly Improbable*. Random House.
- Teasley, S.d., Fischer, F., Weinberger, A., Stegmann, K., Dillenbourg, P., Kapur, M. & Chi, M. (2008). Cognitive convergence in collaborative learning. Proceedings of the 8th international conference on *International conference for the learning sciences - Volume 3 table of contents*, Utrecht, The Netherlands, Pages 360-367.
- Teasley, S. D., & Roschelle, J. (1993). Constructing a Joint Problem Space: The Computer as a Tool for Sharing Knowledge. In S. P. Lajoie & S. J. Derry (Eds.), *Computers as Cognitive Tools*.
- UNESCO (n.d.) Technology & Learning definitions: Collaborative Learning. Retrieved 12/07/2004, from <http://www.unesco.org/education/educprog/lwf/doc/portfolio/definitions.htm>.
- Vygotsky, L. S. (1981). The development of higher forms of attention in childhood. In J. V. Wertsch (Ed.), *The concept of activity in Soviet psychology*. Armonk, N.Y.: Sharpe.
- Vygotsky, L.S. (1978). *Mind in Society*. Cambridge, Massachusetts: Harvard University Press.
- Wenger, E. (2010). CoP Boundaries. Presentation at the JISC workshop: *Mediating Boundaries: traversing the landscapes of online communities of practice*. Hosted by London College of Communication, University of the Arts London and JISC Advance: Business and Community Engagement, 12/05/2010.
- Wiener, M. & Mehrabian, A. (1968). *Language within language: Immediacy, a channel in verbal communication*. New York, NY: Appleton-Century-Crofts.
- Xu, W., Liu, X., Gong, Y., 2003. Document-Clustering based on Non-Negative Matrix Factorization. In: Proceedings of SIGIR'03, July 28-August 1. Toronto, CA, pp. 267–273.

# APPENDIX I

Collaborative e-Learning Episodes Codes Matrix for Idea Generation/Identification			
LEVELS OF ABSTRACTION			
	Level 3	Level 2	Level 1
	CeLE Elements	Analytical Corroboration Definitions	Indicators for classification
0	Initiation & Social cues	Initiations, additions or superficial amendments, repetitions, uncritical information, social cues, etc.	<i>Information, statement, definition, emoticons, abbreviations, lexical items, quoting, images, audio etc</i>
1	Question - Information	Question, proposition, instruction, opinion, history of something, , etc	<i>Recommendation, question, bullet points, I think, I believe, instruction, I know, have worked, I prefer.</i>
2	Explanation	Explanation and self-explanations, requirements, examples, summaries, etc	<i>Because, this is why, thus, therefore, example, further explanation, help, nice behaviour &amp; suggestion.</i>
3	Agreement	Agreement, confirmation, corroboration, etc.	<i>It is very interesting, refer-to-a-name, same, Yes, I agree &amp; you are right.</i>
3a	<i>Disagreement</i>	Disagreement, difference, discrepancy, flaming, etc.	<i>But, however, on the contrary &amp; different.</i>
4	Exploration	Hypothesis, comparison, example, argument, resource interdependence, critical information, competition of ideas, reasoning, argument, etc.	<i>Alternative, I have an idea, something else, what about, what do you mean, I tried if, might, could, would, should, think &amp; suggestion.</i>
5	Evaluation	Comparison, assessment, best practice, etc.	<i>Best, it is important, comparison, easiest, worst, unfortunately &amp; having no meaning.</i>
6	New ideas - Co-construction	Strategy, plan, method, plan, procedure etc..	<i>New idea, innovative approach, new solution.</i>
7	Summarise	Synthesis	<i>Summary, overall, we agreed &amp; finally.</i>