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Sustaining learning design and pedagogical planning in CSCL

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This paper tackles the issue of learning design and pedagogical planning in the context of computer-supported collaborative learning (CSCL). In this sector, we witness the same variety of approaches and tools that we find in the technology-enhanced learning (TEL) research field. In particular, in the CSCL context, notions such as "Collaborative Learning Flow Patterns" (CLFP) or "collaborative scripts" have been used to describe and/or run online collaborative learning activities and, consequently, tools have been implemented to reify these concepts and visualise the designs. Despite the differences, most of the existing tools support the representation of learning designs that are already "in the designer's mind", while fewer tools specifically aim to provide guidance and support to CSCL designers in the early phases of the design process, that is, when they have to make critical decisions concerning the educational approach, the tools to be used, and the ways to engage the target population. This paper, while focusing on this gap in CSCL research, proposes a unifying model, aimed at supporting pedagogical planning and decision making in the CSCL design process based on the interplay of four model components: Task, Teams, Time and Technology.

Keywords: computer-supported collaborative learning; design process; 4Ts model; learning design

Introduction

Currently, the broad field of learning design and pedagogical planning, even though not at all new, is one which still attracts a lot of attention in the technology-enhanced learning (TEL) research area. According to Conole (2010), one reason for this is that the bewildering variety of technologies that have become available is making the design of learning processes possibly more powerful, but also more difficult, to the extent that "there is a gap between the potential of technologies for learning and their actual use in practice" (Conole 2010, p. 483). Olimpo *et al.* (2010) point out that nowadays the term "learning design" is intended in a number of manners in the literature and that researchers have delineated different concepts to denote the artefacts resulting from the learning design process (learning design, learning scenario, pedagogical scenario, didactical scenario, pedagogical plans, etc.). One of the broader definitions is the one provided by Pernin and Lejeune (2006) who state that the artefact resulting from a learning design process is "a description of the playing out of a learning situation or a unit of learning aimed at the acquisition of a

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precise body of knowledge through the specification of roles and activities, as well as knowledge handling resources, tools, services and results associated with the implementation of the activities''.

As is well known, a great impulse to research in this field was given by the creation of the IMS-LD specification (Koper 2006), which captures *who* does *what*, *when* and using *which* materials and services in order to achieve particular learning objectives. This specification describes the constructs of the language and gives a binding in XML. The XML document instance is ''loaded into'' an IMS-LD-aware application and ''played'' (Cameron 2009). Directly stemming from this and other educational languages, or in reaction to these, a number of tools have been implemented, aimed at producing and managing ''runnable'' design artefacts (e.g. Coppercore, RELOAD, LDshake, LAMS, etc.).

In addition to these systems, aimed at running and delivering the design to students, other kinds of tools have also been implemented in recent times, whose main aims typically range from *supporting* the design process itself to *documenting* it mainly for sharing purposes.

Conole (2013) makes a distinction between ''tools for visualising designs'' and ''pedagogical planners''. According to her, while the former kind of tools aim to support the visualisation and sharing of learning designs, the latter is mostly aimed at supporting practitioners in making informed learning design decisions. As a matter of fact, the boundary between the two categories of tools is not clear-cut, mostly because support to practitioners in learning design can also be provided (though not only) by facilitating the description and sharing of learning designs. On the other hand, the outcome of the ''pedagogical planning'' process, often called ''pedagogical plan'', tends to include information related to the enactment of a learning event, which is preferably left out of a learning design, to make it more abstract and therefore easier to reuse. Being aware of this blurred boundary, in this paper we will accept Conole's suggestion and will use the two terms (''tools for visualising designs or learning design tools'' and ''pedagogical planners'') as defined above.

Similar to the general panorama sketched above, also in specific fields, such as the computer-supported collaborative learning) (CSCL) research field (Dillenbourg 1999; Palloff and Pratt 1999; Scardamalia and Bereiter 1994; The Cognition and Technology Group at Vanderbilt 1991), we witness the same attention to the general issue of learning design and pedagogical planning, and – as a consequence of the discussion – we find a variety of different approaches and tools.

In the following, the paper illustrates in more detail the state of art of CSCL design and identifies a gap in this research sector. The paper then proposes a model to fill this gap, with the aim of suggesting further areas of investigation and research.

Learning design and pedagogical planning in CSCL

Research concerning online communities has produced important frameworks that help to understand online learning dynamics. One that is particularly renowned (Anderson *et al.* 2001; Garrison, Anderson and Archer 2001; Persico, Pozzi and Sarti 2010; Rourke *et al.* 2007) has provided the theoretical basis for tracking, analysing and evaluating three important components of online presence: social, teaching and cognitive presence. This line of research has informed Learning Design research and practice in that we now know that a well-balanced blend of these components is essential to ensure effective learning in online communities. However, this basic

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design principle is not enough to inform design decisions for CSCL. In particular, in-depth discussion about online presence has led researchers to focus on pragmatic questions, such as whether, to what extent and under what circumstances structuring the interactions between students enhances the effectiveness of the collaborative process (Demetriadis *et al.* 2009; Dillenbourg 1999).

While some studies support the claim that an excess of freedom in the way collaborative tasks are proposed may fail to engage all team members in productive interactions (Bell 2004; Hewitt 2005; Liu and Tsai 2008; all cited in Demetriadis *et al.* 2009), others maintain that there is also a danger of exceeding in scaffolding students, that is "over-scripting" collaborative learning activities (Dillenbourg 2002). According to these authors, too much guidance may hinder learners' creativity, flexibility and ability to self-regulate, therefore jeopardising the co-construction of knowledge and ultimately causing a loss of effectiveness of the learning process (Dillenbourg and Jermann 2007).

In response to such a debate, several concepts and approaches have been proposed, based on techniques for fostering collaborative learning processes, that lend themselves in different degrees to implementing social, teaching and cognitive presence (Kanuka and Anderson 1999; Pozzi and Persico 2011). These techniques are procedures and behaviours to be enacted by students in order to carry out a given task, during a learning activity. Collaborative strategies and techniques usually allow the organisation and scaffolding of activities (that is: they "structure" them), so as to help students to collaborate effectively in order to reach the learning objectives. Examples of these strategies are: Discussion, Jigsaw, Role Play, Case Study, Peer Review, Pyramid, etc.

Other researchers (Dillenbourg and Hong 2008; Dillenbourg and Jermann 2007; Kollar *et al.* 2006; Weinberger *et al.* 2004; Fischer *et al.* 2007) have oriented the issue of scaffolding online collaboration towards the definition and use of "scripts", that is a set of direct instructions (often provided through interaction prompts) guiding learners in the online activity.

Collaborative strategies, techniques and collaboration scripts are all complementary ways to support students while they carry out a collaborative learning activity: they can be combined with one another, at different levels, to improve both the design and the execution of the collaborative learning process.

Moreover, in the field of CSCL considerable research effort has been devoted to the issue of how to support the description and communication of CSCL designs among researchers, teachers and more in general among practitioners. In this thread, the notion of Design Patterns (Alexander 1997) has been adopted and the concept of Collaborative Learning Flow Patterns (CLFP) (Hernández-Leo *et al.* 2005) has been proposed as a way to describe and communicate the design of online collaborative learning activities in an effective way. To reify the concept of CLFP, some tools have also been implemented, e.g. Collage[1] (Hernández-Leo *et al*. 2006) and more recently CADMOS[2] (Katsamani and Retalis 2011).

Similarly, another tool, called CeLS (Ronen *et al*. 2006), is based on the concept of "building blocks".

Regardless of their differences, all of the above-mentioned tools allow the designer to build, visualise and then communicate the design of an online collaborative learning activity. It should be noted that other tools (e.g. CompendiumLD[3]) allow a similar visualisation of the design, but while the former have been implemented with the specific objective of representing collaborative activities, the latter is a generic tool for visualising designs, without a specific reference to collaboration.

However, by analysing these tools, it becomes clear that they are all aimed at supporting the visualisation of designs that are already clear in the designer's mind. In other words, they provide no guidance for the decision making process carried out by the designers, who should make their decisions "outside" the tool and then use the tool itself to describe and communicate the design to others. In other words, again using Conole's terminology (2013), all of the above-mentioned tools cannot be regarded as "pedagogical planners" for CSCL, but fall into the category "tools for visualising designs".

Unfortunately, the category of pedagogical planners in the CSCL context seems rather scarce. As a matter of fact, looking at some of the existing pedagogical planners, such as the Pedagogical Plan Manager,[4] ScenEdit,[5] the Learning Design Support Environment (LDSE),[6] the Pedagogical Pattern Collector,[7] one should acknowledge that, unfortunately, none of them are specifically intended to support the design of online collaborative learning activities. On the contrary, they are all "general purpose" pedagogical planners, which may be used by the CSCL designer (sometimes even with some difficulties). Such difficulties originate from the fact that in CSCL, there are peculiar decisions that the designer is required to take, concerning for example (as mentioned above) how and to what extent a collaborative activity should be structured. Such decisions should be made on the basis of the features of the target population, the objectives of the learning event, and the requirements of the context where the event is to take place (Palloff and Pratt 1999; The cognition and Technology Group at Vanderbilt 1991) and should lead to the choice between a micro-script approach vs. the use of other techniques. Furthermore, once the designers have made such a preliminary choice, they are also in charge of deciding *which* script or technique better fits with the learning objectives, the target population, the context, etc. Other critical choices concern the formation of groups, their size, composition, etc. which are recognised as being a critical aspect for fruitful collaboration (Wessner and Pfister 2001). Similarly, the choice about what technology to adopt to support interactions is a crucial one in CSCL design processes. Last but not least, planning the time component (i.e. making decisions about how long the various activities and sub-activities should last) cannot be regarded as trivial when designing collaborative activities.

All in all, there are decisions that the CSCL designer is required to make, calling for a conceptual as well as technological tool (let's say a "CSCL pedagogical planner") specifically intended to support the design process of an online collaborative learning activity. Such a model and tool should be able to support the design, independently of the approach used, that is to say that the tool should be usable to design a highly structured activity (based, e.g. on a micro-script), as well as in case of a moderately structured activity (based on a technique, such as Discussion). Therefore, the challenge is to define a model capable of encompassing the different visions and approaches, so as to build a "common backbone" for CSCL design.

In the following, the paper proposes a methodological model for CSCL pedagogical planning and reports on how this model has been developed by building upon the consensus of a team of experienced CSCL researchers.

Towards a model for pedagogical planning in the CSCL field

In this section, the paper first illustrates the methodology used to build the model and then presents the model itself. In the subsequent section, a discussion of the

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model and the way it might inform the development of a system capable of supporting the design of CSCL processes is presented.

Methodology adopted to build the model

As already mentioned, the authors' intention was to build a model capable of encompassing different design visions and approaches, to possibly create a tool to support CSCL design, independently of the design approach adopted. In other words, the idea was to identify the main conceptual variables to be considered when designing CSCL activities, those that are the main objects of the decision making process, and identify their interplay.

The idea originated during the editing of a book by the authors on these topics (Pozzi and Persico 2011). The book gathered several contributions from researchers in the field and it was on that occasion that the authors first acknowledged that it was possible to find a "common backbone" among approaches despite the existing differences. Drawing on this, the authors started elaborating a model on their own and produced a first draft. This tentative model was then discussed and used in parallel with a team of researchers working in the same field with a different CSCL approach in a different application context, to check its range of applicability (Pozzi *et al*. 2011). After this pilot study, the updated model was presented to and discussed with a larger audience of scholars during a face-to-face 3-day workshop held in March 2011, whose main aim was to gather feedback from the community of researchers working in the field and possibly attract consensus (Pozzi *et al.* 2011). The workshop turned out to be a useful opportunity to discuss the model and to test its effectiveness.

As a result of the workshop, the model was again modified and tweaked and a new version was produced.

The proposed model

As already mentioned, by looking at the existing approaches and tools, it was possible for the authors to acknowledge that these share some common dimensions. More specifically, an online collaborative learning activity (independent of the design approach) can always be regarded as a task to be accomplished by one or more teams of students and tutors within a certain time frame. Thus, we can state that the main decisions that CSCL designers are called on to make during the design process are mainly concerned with the nature of the task, the team and the time frame. For this reason, in its original formulation, the model identified Task, Team(s) and Time as the main dimensions along which one may look at an online learning activity. In this version of the model, the task was regarded as comprising information about the technology that should or could be used.

As mentioned above, the model, so conceived, was proposed and then discussed by the participants at the workshop, who were all expert CSCL designers, so that the authors were able to gather important feedback (Pozzi *et al.* 2011). Based on the outcomes of this discussion, a second version of the model was developed, where the technological choices were regarded as an important element that shapes and influences the learning process as much as the choices concerning the other three components. Consequently, technology was deemed to become one of the model dimensions. The new model therefore identifies four dimensions as the main elements

around which it is possible to design and structure an online collaborative learning activity: *Task*, *Team(s)*, *Time* and *Technology* (see Figure 1). The model can be referred to as the "4Ts model".

The idea underpinning the model is that – generally speaking – Task, Teams, Time and Technology can be considered the characterising elements of online collaborative activities.

Thus, a collaborative activity may be seen as the result of: a Task to be accomplished by students, which usually envisages the production of a final output; the Teams which students should be aggregated into in order to accomplish the Task and their mode(s) of interactions; and the Time schedule proposed to students to carry out the activity. The whole activity takes place within a Technology Enhanced Learning Environment, which also provided the communication channel through which interactions among participants occur.

While designing an online collaborative learning activity, the CSCL designers have to make decisions concerning these four elements, as well as concerning the relationships between them (see Figure 1), given that the choices for one element may affect the others.

With this in mind, the model can be used as a conceptual framework to support the design of any online collaborative learning activity, and it is general enough to encompass the existing perspectives and approaches in the field of CSCL design.

Applying the model: a use case

In order to clarify how the model can concretely support the design process of an online collaborative activity and help the designer through the decision making process, in this section we go through the design process as this was carried out in a real situation.

The context was a university course on e-learning, where the authors of this paper were asked to deliver a module devoted to "online collaborative activities". Thus, the main learning objective was that, at the end of the module, students should be aware of the main characteristics of an online collaborative activity, know some of the most common collaborative techniques, and be able to appreciate the differences between them. The authors were informed that the cohort of students would be composed of

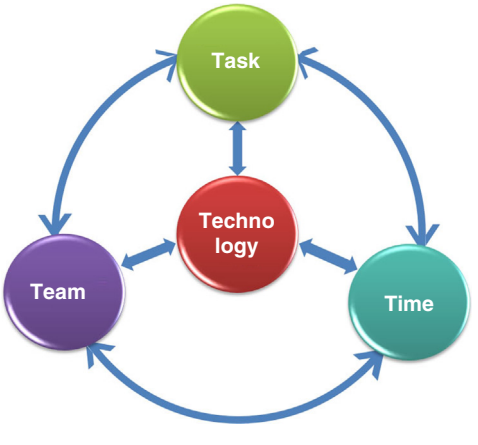

Figure 1. The proposed model for the CSCL design.

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around 25 people and that the module, starting with a face-to-face lesson, should then envisage a 3-week online activity. These were the main context constraints that were clear at the beginning of the design process.

In order to achieve the above-mentioned objectives, the designers started to focus on the Task and decided that students should experience some of the most common collaborative techniques directly. Given the Time constraints of the online activity (3 weeks), it was clear that it would be impossible to have all the students experiencing all the techniques, so a selection was made and three techniques were chosen. In order to optimise Time use, it was also decided to split students into Teams (one group per technique) and make each group experience one technique, assuming that a final joint discussion would allow all of the students to discuss all of the techniques and their differences.

In the end, the Task resulted divided into two Time phases: the first phase, where groups experienced the techniques separately, and a second phase of joint discussion.

Lastly, the Technology to support interactions was chosen: even though the platform provided by the university was Moodle, and this choice would have probably been handier to some extent, the nature of the Task and the separation in Teams, required the communication space to be highly structured (see Figure 2), so in the end another Computer Mediated Communication (CMC) environment was preferred (Centrinity FirstClass), as it allows you to create the discussion areas for each Team that are isomorphic to the Task/Time structure. So in this case, as often happens, both the Task and the Team dimensions seriously affected the Technological choice.

In conclusion, even though the Task was considered the leading dimension (as the design process started from its definition, as often happens), the Time dimension, due

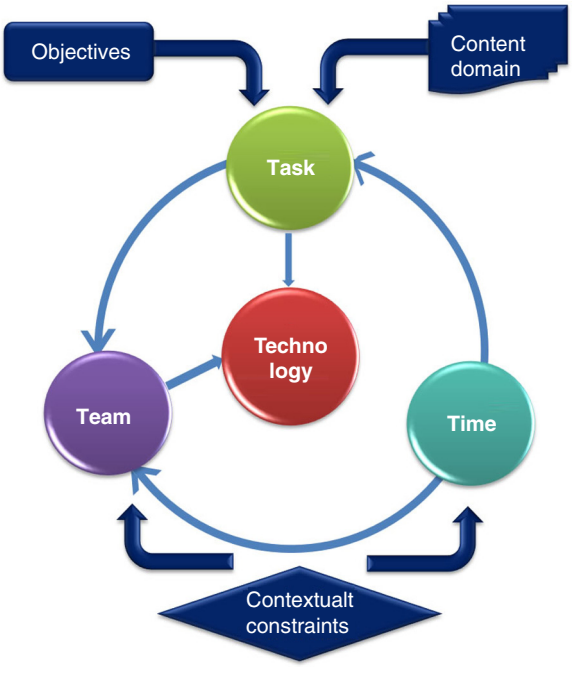

Figure 2. Interactions among dimensions in the use case.

to the constraints imposed by the university, heavily influenced choices concerning both the Team and the Task dimensions. More generally, the application of this model often entails starting with decisions concerning one or more leading dimensions (sometimes those considered most important or those that are constrained by the educational context, to proceed with consequential choices on some of the others, and possibly re-consider the original decisions where necessary.

The example just reported highlights on how the four dimensions interacted during the design process and how the designers had to handle them in a sort of cyclical process, i.e. started from one of them, touched the other(s), then came back to the previous one and so on. The model helped the designers to keep in mind all the dimensions, and played a maieutic function in supporting the expression and definition of the essential factors of the resulting activity design. A tool incorporating this model should be able to show the interdependences between the four model components and help the designers to find their way around through the decisions concerning each dimension.

Discussion and conclusions

In this paper, we claim that the field of CSCL would benefit from a unique, shared and flexible model capable of supporting the design process, whatever the approach and structuring techniques adopted. As already mentioned, the 4Ts model has been built on the basis of the discussion held within a community of experts in the field of CSCL. This is certainly one of its main assets: the results of the workshop and the data gathered during it (Pozzi *et al.* 2011) support the claim that the 4Ts model has been considered a good vehicle to study and represent a wide range of CSCL learning processes and to discuss some of the main tensions of the field.

Moreover, we argue that the model is also able to provide a sound basis for the development of a tool aimed at supporting CSCL designs, based on the four components that the designer can calibrate and orchestrate to obtain an optimal scenario. Of course, the four model components are not independent of one another. Choices concerning Task influence, what the Teams should be like, the Time needed, and the Technology that can be used. On the other hand, the reverse is also true: for example, if there are Time constraints, then the Task and the Technology should be chosen accordingly. These dependences (the links in Figure 1), are very important in the design process and a software system can support CSCL design by making them as explicit as possible, stimulating reflection on how decisions on one dimension impacts on the others. On the other hand, such a system should not force the designers to follow one pre-established order in their design decisions, reflecting the fact that the design process is a cyclic (and messy) process, and often requires designers to change their original assumptions and choices. As a consequence, designers should be able to start from the Task, the Time, the Technology or even the Teams, according to what the features of the learning context are where they operate. In many cases, the designer starts from the learning objectives, and therefore identifies Tasks that can support their achievements. However, the length in Time of the course is sometimes given from the very beginning, or the target population is already decided, and its size can heavily influence decisions on the Teams' composition, and in turn the Task. In other more techno-centric approaches, a designer may want to try out some interesting Technology to learn from experience how it works as a learning tool. So, the designers generally "juggle" around with

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these four components and a system that supports such a process should let them play around with them but also remind them of the consequences of their choices on the other components.

The added value of an authoring tool based on the 4Ts model in respect to other existing authoring tools, would be two-fold: on the one hand such a tool would be specifically thought up for CSCL contexts and not a general purpose one (such as for example the PPM, ScenEdit, etc.); on the other hand, unlike the existing CSCL authoring tools oriented to sharing designs (such as for example WebCollage, CADMOS, etc.) or to the delivery (e.g. CeLS), this tool could be oriented to support the decision making process, and particularly helpful to novice designers, student teachers, etc. The experts' feedback received by the model suggests that the 4Ts model is, in actual fact, implicitly used by expert CSCL designers, with no need for a tool that guides them through their decisions. In other words, it is a model of their design expertise. Once the decisions are taken, the design can be represented with any of the existing tools that allow you to produce representations and facilitate enactment.

In the future, the authors intend to specify the main features of a CSCL pedagogical planner based on the 4Ts model. It is very likely, of course, that further feedback on the model will emerge, therefore allowing us to tune and refine it.

Acknowledgements

The model presented in this paper was discussed and tuned during the "3Ts workshop", held in March 2011 at the STELLAR Alpine Rendezvous 2011.

Notes

1. http://www.gsic.uva.es/collage/
2. http://cosy.ds.unipi.gr/cadmos/
3. http://compendiumld.open.ac.uk/index.html
4. http://ppm.itd.cnr.it/
5. http://eductice.ens-lyon.fr/EducTice/projets/en-cours/scenario/scenedit/scenedit/view?set_language=en
6. https://sites.google.com/a/lkl.ac.uk/ldse/
7. http://thor.dcs.bbk.ac.uk/projects/LDSE/Dejan/ODC/ODC.html

References

Alexander, C. (1997) *Pattern Language: Towns, Buildings, Construction*, Oxford University Press, New York.

Anderson, T., *et al*., (2001) 'Assessing teacher presence in a computer conferencing context', *Journal of the Asynchronous Learning Network*, vol. 5, no. 2, pp. 1–17.

Bell, P. (2004) 'Promoting students' argument construction and collaborative debate in the classroom', in *Internet Environments for Science Education*, eds M. C. Linn, E. A. Davis, & P. Bell, Erlbaum, Mahwah, NJ, pp. 114–144.

Cameron, L. (2009) 'How learning design can illuminate teaching practice', *The Future of Learning Design Conference*. Paper 3. http://ro.uow.edu.au/fld/09/Program/3

Conole, G. (2010) 'An overview of design representations', in *Proceedings of the International Conference on Networked Learning 2010*, eds L. Dirckinck-Holmfeld, V. Hodgson, C. Jones, M. De Laat, D. McConnell, & T. Ryberg. http://www.lancs.ac.uk/fss/organisations/netlc/past/nlc2010/abstracts/PDFs/Conole_2.pdf

Conole, G. (2013) *Designing for Learning in an Open World*, Springer, New York.

Demetriadis, S., Dimitriadis, Y., & Fischer, F. (2009) 'Introduction to the SFC-2009 Workshop', in *Scripted vs. Free Collaboration: Alternatives and Paths for Adaptable and Flexible CS Scripted Collaboration*, CSCL Conference, Rhodes. http://mlab.csd.auth.gr/cscl2009/SFC-files/SFC-2009-WorkshopProceedings.pdf

Dillenbourg, P. (ed) (1999) *Collaborative Learning: Cognitive and Computational Approaches*, Pergamon Press, Oxford, UK.
Dillenbourg, P. (2002) 'Over-scripting CSCL: the risks of blending collaborative learning with instructional design', in *Three Worlds of CSCL. Can We Support CSCL*, ed. P. A. Kirschner, Open Universiteit Nederland, Heerlen, NL, pp. 61–91.
Dillenbourg, P. & Hong, F. (2008) 'The mechanics of macro scripts', *International Journal of Computer-Supported Collaborative Learning*, vol. 3, no. 1, pp. 5–23.
Dillenbourg, P. & Jermann, P. (2007) 'Designing integrative scripts', in *Scripting Computer-Supported Collaborative Learning Cognitive, Computational and Educational Perspectives*, eds F. Fischer, I. Kollar., H. Mandl and J. M. Haake, Springer, New York.
Fischer, F., *et al*., (eds) (2007) *Scripting Computer-Supported Collaborative Learning: Cognitive, Computational and Educational Perspectives,* Springer, New York.
Garrison, D. R., Anderson, T., & Archer, W. (2001) 'Critical thinking, cognitive presence, and computer conferencing in distance education', *American Journal of distance education*, vol. 15, no. 1, pp. 7–23.
Hernández-Leo, D., *et al*., (2005) 'Reusing IMS-LD formalized best practices in collaborative learning structuring', *Advanced Technology for Learning*, vol. 2, no. 3, pp. 223–232.
Hernández-Leo, D., *et al*., (2006) 'COLLAGE: A collaborative learning design editor based on patterns', *Educational Technology & Society*, vol. 9, no. 1, pp. 58–71.
Hewitt, J. (2005) 'Toward an understanding of how threads die in asynchronous computer conferences', *The Journal of the Learning Sciences*, vol. 7, no. 4, pp. 567–589.
Kanuka, H. & Anderson, T. (1999). 'Using constructivism in technology-mediated learning: constructing order out of the chaos in the literature', *Radical Pedagogy*, vol. 1, no. 2. http://www.radicalpedagogy.org/Radical_Pedagogy/Using_Constructivism_in_Technology-Mediated_Learning__Constructing_Order_out_of_the_Chaos_in_the_Literature.html
Katsamani, M. & Retalis, S. (2011) 'Making learning designs in layers: the CADMOS approach', *IADIS Multi Conference on Computer Science and Information Systems 2011*, Rome, Italy, 20–26 July.
Kollar, I., Fischer, F., & Hesse, F. W. (2006) 'Computer-supported collaboration scripts – a conceptual analysis', *Educational Psychology Review*, vol. 18, no. 2, pp. 159–185(27).
Koper, R. (2006) 'Current research in learning design', *Educational Technology & Society*, vol. 9, no. 1, pp. 13–22.
Liu, C. & Tsai, C. (2008) 'An analysis of peer interaction patterns as discoursed by on-line small group problem-solving activity', *Computers & Education*, vol. 50, pp. 627–639.
Olimpo, G., *et al*., (2010) 'Pedagogical plans as communication oriented objects', *Computers & Education*, vol. 55, pp. 476–488.
Palloff, R. M. & Pratt, K. (1999) *Building Learning Communities in Cyberspace*, Jossey-Bass Publishers, San Francisco.
Pernin, J. P. & Lejeune, A. (2006) *Models for the Re-Use of Learning Scenarios*, DSpace at Open Universiteit, Nederland. http://dspace.ou.nl/handle/1820/580
Persico, D., Pozzi, F., & Sarti, L. (2010) 'Monitoring collaborative activities in computer supported collaborative learning, Distance Education', vol. 31, no.1, pp. 5–22.
Pozzi, F., *et al*., (2011) 'Structuring CSCL through collaborative techniques and scripts', *International Journal of Online Pedagogy and Course Design*, vol. 1, no. 4, pp. 39–49.
Pozzi, F., *et al.*, (2011) 'Structuring online collaboration through 3Ts: Task, Time and Teams', *White Paper at the STELLAR Alpine Rendez-Vous 2011*. http://www.telearn.org/warehouse/ARV2011_WhitePaper_StructuringOnlineCollaborationthrough3Ts_%28006754v1%29.pdf
Pozzi, F. & Persico, D. (eds) (2011) *Techniques for Fostering Collaboration in Online Learning Communities: Theoretical and Practical Perspectives*, Information Science Reference – IGI Global, Harshey, PA, pp. 397.
Ronen, M., Kohen-Vacs, D., & Raz-Fogel, N. (2006) 'Structuring, sharing and reusing asynchronous collaborative pedagogy', Paper presented at the *International Conference of the Learning Sciences*, Indiana University, Bloomington, IN, 27 June–1 July.
Rourke, L., *et al*., (2007) 'Assessing social presence in asynchronous text-based computer conferencing', *The Journal of Distance Education/Revue de l'Éducation à Distance*, vol. 14, no. 2, pp. 50–71.

Scardamalia, M. & Bereiter, C. (1994) 'Computer support for knowledge-building communities', *The Journal of the Learning Sciences*, vol. 3, no. 3, pp. 265–283.

The Cognition and Technology Group at Vanderbilt (1991) 'Some thoughts about constructivism and instructional design', *Educational Technology*, vol. 31, no. 10, pp. 16–18.

Weinberger, A., *et al*., (2004) 'Cooperation scripts for learning via web-based discussion boards and videoconferencing', Paper presented at *EARLI SIM 2004*, Tubingen. http://www.cs.uu.nl/docs/vakken/b3elg/literatuur_files/weinberg.pdf

Wessner, M. & Pfister, H.-R. (2001) 'Group formation in computer-supported collaborative learning', in *Proceedings of the 2001 International ACM SIGGROUP Conference on Supporting Group Work*, pp. 24–31, Boulder, CO, USA, September 30 – October 03, 2001.