Fostering CSCL Adoption: An Approach to Professional Development Focused on Orchestration

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Abstract: Conceptual barriers are often cited as an important obstacle for the integration of innovative, ICT-enabled practice (such as CSCL) in authentic educational settings. Although professional development (PD) can be used to overcome these barriers, there is a dearth of descriptions of PD programs that foster change towards CSCL practice. This paper presents an approach to PD centered on the notion of orchestrating CSCL activities, and exemplifies it through teacher workshops. The evidence from a mixed methods evaluation of two such workshops highlights the potential of this approach in driving conceptual change, and increasing the perceived feasibility of using CSCL, even in limited-time PD interventions. The results also show the limitations of the approach when used in isolation, hinting at multi-level coordinated actions (e.g. institutional, policy-level ones) to further foster CSCL practice.

Introduction

There exists an increasing concern within the CSCL community about the lack of perceived impact of CSCL research advancements in the everyday practice of our educational institutions (Looi, So, Toh & Chen 2011; Chan, 2011). Within the possible reasons for this lack of adoption, the CSCL community has acknowledged the complexity that coordinating CSCL activities entails, especially for teachers, in authentic educational settings. This coordination has been commonly referred to by researchers as *orchestration* (Prieto, Holenko-Dlab, Abdulwahed, Gutiérrez, & Balid, 2011b; Dillenbourg et al., accepted).

Existing literature on the endeavor of changing the classroom towards ICT-enabled practice has exposed different kinds of barriers, some of them obvious like the lack of ICT infrastructures, but others less apparent, such as teacher beliefs, attitudes and other conceptual obstacles (Ertmer, 1999). In order to overcome such barriers, very often teacher professional development (PD) programs have been proposed (Kagan, 1992; Zhao, Pugh, Sheldon & Byers, 2002; Chai, Hong & Teo 2009; Roschelle et al., 2011).

However, in the particular case of fostering CSCL adoption among teachers, there is a dearth of studies depicting concrete PD approaches and programs. Existing studies generally lack concrete descriptions of the PD actions involved (Chan, 2011; Looi et al., 2011), or do not examine the impact of the PD actions in the teachers' conceptions and actual practice (Zhao & Rop, 2001; Lin, Lin, & Huang, 2008).

In this paper, we propose a PD approach centered on enabling practical application of CSCL in a certain technological and pedagogical context, throughout the different facets and moments of CSCL activity orchestration, combining both conceptual and technological tools. In order to illustrate the approach, we describe in detail one short PD action formed by two workshops. These workshops were aimed concretely at fostering the orchestration of blended CSCL activities in higher education, using Virtual Learning Environments (VLEs, e.g. Moodle (1)) and other web-based tools. We also present a mixed methods evaluation study of the workshops' enactment with 36 teachers from multiple disciplines, focusing on the kind of conceptual change that the PD action brought about (e.g. in beliefs, perception of feasibility and self-efficacy), and assessing the impact in the teachers' actual everyday practice once the PD intervention finished.

Conceptual Change and Fostering CSCL Practice Through PD

Despite huge investments by governments in applying Information and Communication Technologies (ICT) to Education, technology is mostly used to support established practices rather than transform them (Cuban, 2001; Conlon, 2004). Research has shown that providing effective training opportunities for teachers to learn how to effectively redesign education by incorporating ICT is not simple (Lawless & Pellegrino, 2007), and that such training should be embedded into their daily practice (Löfström & Nevgi, 2008; Lawless, et. al., 2007).

Teacher beliefs (e.g. about learning, about technology) have been extensively linked to the integration of ICT in classroom practice (Ertmer, 1999; Orlando, 2009; Prestridge, 2012), including studies in the context of integrating CSCL environments in the classroom (Song & Looi, 2012). Thus, a challenge in fostering CSCL adoption is how to enable teachers not only to overcome technology barriers, but also conceptual ones (Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, in press), empowering them to integrate appropriate technology into the learning process (Mishra & Koehler, 2006).

Kagan (1992) noted the potential of teacher education and PD programs to promote belief change among teachers. Teachers should experiment with the innovation that could involve technology, by means of critical issues discussion with peers and researchers, observing exemplary models, as well as providing them with opportunities for reflecting on the pedagogical beliefs and teaching practices (Chai, et al., 2009). Thus, there is a need to empower teachers to understand and deal with the complexities involved in implementing innovative practices in Technology Enhanced Learning (TEL) settings. PD strategies could provide the catalyst of change in engaging the teachers in collaborative knowledge building, leading to a deep understanding among them about teaching in a CSCL environment (Chai & Tan, 2009).

There is a certain shortage of research examples which describe PD programs in detail, and examine the impact that such actions have in helping teachers to conduct innovations in technology-enhanced learning scenarios. In the CSCL field, there have been efforts in PD that encourage teachers to work collectively through a design-based approach (Putnam & Borko, 2000). Others support teachers' inquiry in TEL settings, from a knowledge building community perspective (Chan & Song, 2010). There are studies of practicing teachers' collaborative online interaction for PD that report quantitative data about teachers' rate of participation (Zhao & Rop, 2001), while others portray the process of knowledge sharing and creation for teachers participating in virtual teams of a teacher professional community (Lin, Lin, & Huang, 2008). Taking an ecological perspective, Chan (2011) proposes actions at different levels to bridge the gap between CSCL research and practice in the context of scaling up and sustaining a knowledge building model. In similar multi-level proposals, from a design research approach, Looi et al. (2011) indicate the empowerment of teachers to orchestrate the classroom as an essential feature of meso-level actions towards CSCL practice.

Roschelle et al. (2011) note that there is a "need to have a new kind of professional development for teachers which [...] aims to develop teachers' potential as innovators". However, none of the aforementioned works depict how such concrete PD actions should be implemented, or study the impact of these meso-level PD actions on teachers after the intervention finishes.

An Orchestration-Focused Approach to PD Towards CSCL Adoption

The professional development approach proposed here draws on several principles and studies outlined above. However, the central concept behind the proposed approach is that of *orchestration*, which has been defined as "the process of productively coordinating supportive interventions across multiple learning activities occurring at multiple social levels" (Fischer & Dillenbourg, 2006). This notion captures the increased complexity of applying CSCL into authentic educational settings, even if there is a lack of general consensus about its main components (see Dillenbourg et al., accepted). Orchestration typically covers the whole lifecycle of the CSCL activity implementation, from its design and preparation to the actual enactment in the classroom (Prieto et al., 2011b). Despite the lack of consensus, researchers are reaching a common understanding that it provides a more holistic view of the problems and constraints involved when applying CSCL principles and technologies to authentic (formal) educational settings in everyday practice (as opposed to dealing with those aspects separately, e.g. in lab settings).

Thus, we propose to take the kind of holistic approach to the application of CSCL that orchestration represents (already hinted by Looi et al., 2011), combining it with PD frameworks such as TPACK (Mishra & Koheler, 2006) and the advice from previous PD research efforts regarding the need for integration into teachers' everyday practice (Löfström et al., 2008; Lawless et al., 2007). The main characteristics of our proposed approach are:

1. **Multi-aspect**: The PD action should address all (or, at least, as many as possible) of the different aspects and dimensions that conform the orchestration of CSCL in the concerned educational setting (e.g. Prieto et al., 2011b mention up to eight orchestration aspects). For example, it should not focus only on assessment techniques, disregarding other aspects like class management or how to adapt the activities in the face of such assessments.
2. **Whole lifecycle**: The PD action should address the whole lifecycle of CSCL activities, from their preparation and design, through their implementation with ICT and their enactment in the classroom, as well as its eventual evaluation and redesign afterwards (as opposed to e.g. centering the PD action only in design, disregarding how such design is afterwards implemented).
3. **Pedagogical and atomic patterns**: One of the main distinctive features of this approach is the way in which orchestration knowledge is made available to teachers. In order to provide starting points in the complex interplay between technology, pedagogy and content that innovative teacher practice requires, we propose to provide teachers with pedagogical patterns (Fincher & Utting, 2002) and atomic patterns (Prieto, Villagrá-Sobrino, Jorrín-Abellán, Martínez-Monés, & Dimitriadis, 2011) elicited from successful (authentic) CSCL practice. These patterns cover and combine the different aspects and phases of orchestration, at multiple levels of granularity.

4. **Technological tools for orchestration**: The PD action should not remain at the level of conceptual change towards CSCL (however important it is), but rather it should also provide hands-on experience with technological tools that are compatible with the principles being taught (and with the educational setting in which the teachers develop their practice).
5. **Modeling**: In order for teachers to get a more accurate idea of how the CSCL activities are enacted, and how the experience is like for the students, the PD action itself should be modeled using the same patterns, techniques and technologies that are being taught in the PD action.
6. **Authentic problems**: During the PD action, teachers should be able to work on problems that are authentic and relevant for themselves, e.g., defining how the orchestration strategies and technologies could be applied to a concrete course they teach, within their current contextual constraints.

In order to illustrate how this approach may be applied in practice to develop a PD action, Table 1 depicts the activities of two PD workshops developed following this approach, which aim at promoting blended CSCL practice at the university level, using interactive digital whiteboards, Virtual Learning Environments (VLEs, e.g. Moodle) and other Web 2.0 tools as the main technological support. These workshops combined Collaborative Learning Flow Patterns (Hernández-Leo, Villasclaras-Fernández, Dimitriadis & Asensio-Pérez, 2010) and atomic patterns elicited from blended CSCL practice with VLEs, as well as specific technological tools for the orchestration of such activities: the WebCollage (2) authoring tool and the GLUE!-PS system (3) to deploy and manage learning designs in VLEs. The concrete form of this design was also influenced by local contextual settings such as the emphasis on Moodle (the official institutional VLE), or the time-frame of the workshops (12 hours each, agreed with the university PD agency). Indeed, these workshops have been actually enacted in 2012, and the following section describes a mixed methods study performed during such enactment, to explore the potentialities and limitations of the approach.

Table 1: Design of two workshops as example of the orchestration-centered approach to foster CSCL practice.

Workshop 1 – conceptual emphasis		Workshop 2 – technological emphasis	
Task/Phase	**Notes**	**Task/Phase**	**Notes**
1. Read a sample CSCL scenario, answer questionnaire on initial thoughts	Online. Scenario is hypothetical, but plausible for the audience's teacher practice	1. Read a sample CSCL scenario and design, answer questionnaire on initial thoughts	Online. Scenario is hypothetical, but plausible for the audience's teacher practice. Learning design is derived from previous workshop (Pyramid pattern)
2. Brief explanations, design using the Pyramid pattern and design- and deploy-time atomic patterns	Face-to-face. Teachers activities in the session follow several phases that conform a Pyramid pattern similar to the one they are designing. Use of pen, paper and atomic pattern cards	2. Brief explanations, design with WebCollage and deploy with GLUE!-PS, on Moodle	Face-to-face. Teachers use the technologies involved in dyads. Teachers are scaffolded with a worksheet detailing tool usage
3. Propose similar design for each teacher's own courses	Online. Teachers work individually. Design is expressed freely, but should involve Moodle+Web 2.0 tools. Facilitators provide formative feedback on individual designs	3. Propose similar design for each teacher's own courses, and implement it in WebCollage	Online. Teachers act individually, using the provided WebCollage tool and worksheet. Facilitators provide formative feedback on the designs' feasibility and alternatives
4a. Reflect/debate on main features of submitted designs	Face-to-face. Multiple parallel debates following Think-Pair-Share pattern. Debates are traced through ICT tools mentioned in the workshop (e.g. Moodle, Google Docs)	4a. Finish deployment of individual design using GLUE!-PS and favourite VLE	Face-to-face. Teachers act individually, supported by the worksheets and facilitators
4b. Role-play scenario enactment, supported by enactment-time atomic patterns	Face-to-face. Represent a set of problematic situations (e.g. latecomers, ICT failure). Teachers in 6-people teams with different roles (teachers, students, observers/critics)	4b. Face problematic situations, and adapt designs supported by GLUE!-PS tool	Face-to-face. Teachers work in dyads. Worksheets of the changes needed are not provided until *after* the session (for future reference)
5. Second iteration of individual design, and questionnaires for reflection and evaluation	Online. Again, facilitators provide formative feedback on the submissions	4c. Reflect/debate on applicability to everyday practice	Face-to-face. Teachers form 6-person focus groups which discuss in parallel, and report their conclusions to the whole group (orally and through a shared document)
		5. Second iteration of individual design, and questionnaires for reflection and evaluation	Online. Again, facilitators provide formative feedback on the submissions

Studying CSCL Adoption in Teacher Workshops

Context and Methodology of the Study

Multiple CSCL researchers have highlighted the adequacy of using mixed method approaches (Creswell, 2012) in order to explore the different perspectives and multiple factors that affect CSCL situations (e.g. Strijbos & Fischer, 2007). This advice is also provided by the Evaluand-oriented Responsive Evaluation Model (CSCL-EREM, see Jorrín-Abellán and Stake, 2009), which we have used to design and structure our evaluation. Regarding the data gathering and analysis, we have adapted the mixed method evaluation approach described by Martínez-Monés, Dimitriadis, Gómez-Sánchez, Jorrín-Abellán, Rubia-Avi & Marcos-García (2006), in which quantitative and qualitative data gathering techniques are combined, triangulating the available evidence to enhance its credibility. The concrete flow of data gathering and analysis techniques used is depicted in Figure 1, including multiple techniques and data sources used before, during and immediately after the two workshops (e.g. eight interviews with participants, parallel focus groups during the workshop, observations, questionnaires, teacher-generated artifacts). Additionally questionnaire was provided to the participants six months after the second workshop, in order to assess medium-term effects of the PD action.
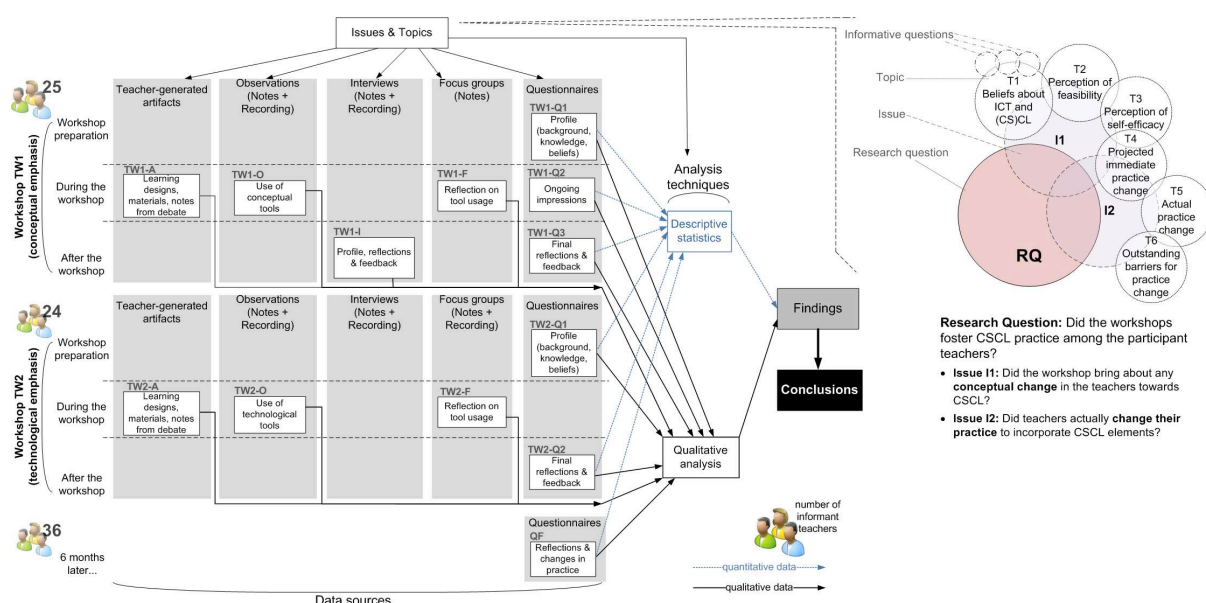

Figure 1. Data gathering and analysis flow of the study (left), adapted from Martínez-Monés et al. (2006); also includes an "anticipated data reduction" diagram (right), inspired from Miles and Huberman (1994).

Also, following the recommendations by Dillenbourg (2009) regarding research on orchestration, we have tried to evaluate the effects of our approach in authentic PD actions, situated within the usual activities of teachers. In this case, the two workshops, designed as described in the previous section, were enacted by a team of 5 researchers, between February and April 2012, as two separate 12-hour teacher workshops aimed at in-service university teachers at University of *(anonymized for review)*: the first one aimed at conceptual training on CSCL and its orchestration; the second one centered on technological tools to make such orchestration possible, in blended learning scenarios using the official university Virtual Learning Environment (VLE). The workshops followed a blended learning format and were open for teachers from any discipline (although it was recommended that, in order to take the second workshop, teachers should have completed the first one, or an equivalent training in basic CSCL concepts). As indicated in Figure 1, 25 teachers from different disciplines (from Engineering to Medicine, Education or Law) attended the first workshop, and 24 attended the second one (with partial participant overlap between them – in total, 36 different teachers attended at least one of the workshops). This lack of consistency between the workshop's participants was due to the situatedness of the PD action, which prevented the researchers from restricting access or enforcing attendance to both workshops.

Within this context, our main research question in this study ("did the workshops foster CSCL practice among the participant teachers?", see Figure 1) is explored through two main evaluative tensions, or issues, regarding the conceptual change towards CSCL (I1) and the actual changes in teacher practice (I2) that the workshops brought about. These issues are in turn explored through the evidence gathered, which is grouped around six topics: teachers' beliefs about ICT and CSCL (T1), teachers' perceived feasibility of CSCL practice (T2), teachers' perceived self-efficacy to orchestrate CSCL (T3), the immediate practice changes that teachers expected (T4), the actual teacher practice changes (T5) and the outstanding barriers for change towards CSCL practice (T6). This kind of "anticipated data reduction" schema (Miles et al., 1994) has been used to analyze the quantitative and qualitative evidence.

Findings and Supporting Evidence

In general, both workshops were considered a success by both the facilitators and the participant teachers (e.g. the two PD actions were valued at 8.42 and 9.23 respectively, in a 10-point scale [TW1-Q3, TW2-Q2], see Figure 1). Let us examine the evidences of conceptual and practice change brought about by the workshops:

Conceptual change towards CSCL adoption (I1)

Concerning the topic of the conceptual change achieved by the workshops in the area of the teachers' beliefs and attitudes towards ICT (topic T1), a majority of the participants in the first workshop reported some kind of conceptual change regarding (computer-supported) collaborative learning (17 out of the 22 participants that answered the post-workshop questionnaire - 77%) [TW1-Q3]. Among these, a majority expressed changes in their concept of collaborative learning in general (65%), like for example: *"[to the question: Did the workshop change your view of collaborative learning?] Totally. I had always reduced collaborative work to working in dyads, and essentially, I thought they were worthless. The success of this course is that I have seen that they can be really useful – if well designed – for the learning processes."* [TW1-Q3], a fact that was also confirmed in the interviews: *"[when asked about usage and knowledge about CL prior to the workshop] I have seen that, if you do it well, you can learn a lot with it [...] designing it with time, thoughtfully, and applying these patterns, you can get more outcomes from a subject matter."* [TW1-I]. Others highlighted the down-to-earth view given by the workshop, which made inherent difficulties of collaborative work surface (24%), or the importance of making a careful pedagogical design (17%): *"[to the question: Did the workshop change your view of collaborative learning?] [...] Maybe the most interesting was [learning about] the preparation of collaborative activities and seeing what difficulties they entail."* [TW1-Q3]. Regarding those participants that reported that their views had not changed, in some cases it was because their views were already favorable to CSCL, while others voiced unchanged concerns on the efficiency and uncertainty of such methods, e.g.: *"[when asked about the feasibility of using the provided pedagogical patterns] It demands a time that I am not sure I have, and a big effort in collaborating, all to reach uncertain results."* [TW1-Q2].

There was also evidence of teachers changing their perception of the feasibility of using CSCL in their everyday practice (topic T2), from the qualitative responses to the questionnaires, as well as from the in-depth interviews *"[to the question: Did the workshop change your view of collaborative learning?] The most important aspect is that real cases are presented and, from them, it is easier to gather ideas that are easily transferable to my courses. I came out with the impression that I can put in practice a collaborative activity, really; up to now it did not occur to me anything other than ordering a report and making students present it in class."* [TW1-Q3]. Many participants emphasized the role of atomic patterns in this perception: participants in the first workshop valued the different kinds of atomic patterns as useful (averages of 4.30, 4.13 and 5.31 in a 1-7 Likert scale), and this was also brought to attention in some of the interviews *"[when asked about the main value of the workshop] the catalogue of patterns and the catalogue of routines [...] as a reference guide or a skeleton to structure activities, to begin making things"* [TW1-I]; *"[when asked about the added value of atomic patterns] It is the founding, the structure, the skeleton [...] you may have some ideas, but if you don't know anything about what to do [...] it is like LEGO blocks"* [TW1-I]. Others highlighted the fact that the workshop itself was modeled as the same kind of blended CSCL activity that was being promoted: *"[when asked about the workshop's usefulness] [...] Very useful, playing the "guinea pigs" like students in class, enables you to see points of view that you had forgotten."* [TW1-Q3].

Regarding the teachers' perception of self-efficacy (topic T3), we observed how all the participants were able to orchestrate the example scenario given (in the first workshop), and implement such orchestration through the provided technological tools (in the second workshop). This ability was then transferred to the individual exercises of application to each teacher's courses in a large majority of the cases (100% and 75%, respectively) [TW1-A, TW2-A]. Even if we look solely at the evidences of the first workshop, we can see how the self-perceived ability to orchestrate the design they were doing throughout the workshop raised from an average of 4.83 (in a 1-7 Likert scale) to 5.23 after the first workshop [TW1-Q2, TW1-Q3]. Teachers mentioned the advantages of the workshop's practical orientation: *"[to the question: Did the workshop change your view of collaborative learning?] Now I have a much clearer idea of what is a collaborative activity and, especially, which patterns to use to encourage that those activities are really collaborative. [...] how to complement these learned [strategies] with the use of ICT, the ICTs that can be used and some of their affordances."* [TW4-Q4]; *"[when asked about the changes brought about by the workshop] now I'm more convinced [...] because now I know how to put it in practice [...] up to know you never saw concrete examples, tasks."* [TW4-I]. It is also worth noting that many teachers viewed the presented atomic patterns as not very novel, and reported using common sense rather than the provided strategies (especially in the role-played enactment, which required a timely response to events), a view that seems to be somehow tied to prior teacher experience: *"[when talking about the usage of enactment-time atomic patterns during roleplaying] I think we went directly to common sense [...] I also did the same when doing the individual [design], I used common sense and then asked myself*

'how is this called in the routines?' [...] and, as you look through them, you also see other [routines] and you open your mind a bit [...] expand common sense." [TW1-I] [18 years of teaching experience].

Actual Changes in Teacher Practice (I2)

Regarding the actual changes in teacher practice towards CSCL since the second workshop ended (six months, as of this writing), the evidence is less conclusive, and can be analyzed at different levels. If we look at teachers' perception and intentions of changing their practice immediately after the workshops (topic T4), we find that teachers scored atomic patterns as close to their everyday practice (average of 5.22 in a 1-7 Likert scale) [TW1-Q2], and that teachers asserted they would likely use the proposed tools in their everyday practice in the immediate future (in a 1-8 Likert scale, avg=6.19, std=1.63) [TW2-Q2]. Moreover, teachers asserted they would be moderately likely to use the designs they deployed in Moodle in the immediate future (in a 1-8 Likert scale, avg=6, std=1.64) [TW2-Q2]. Qualitative responses included favorable assertions such as: *"[when asked about using the patterns/routines when doing a CL design in future teaching practice] Sure. Now that I have them, I would take a look at them [...] I would use this [method] I know"* [TW4-I], but also critical voices of the most skeptical about collaborative work: *"[when talking about the usage of routines in the individual design] The truth is I didn't [use them] [...] people want to appease the teacher who ordered the exercise [...] if you taught 15 things, they think they should introduce at least 10 of them"* [TW4-I].

The evidence of actual changes in teachers' everyday practice (T5) are much less prominent. Only one teacher reported putting the strategies into practice immediately after the first workshop: *"[when asked about the eventual usage of atomic patterns in real practice] Yes, yes... in fact, the next day I tried, not this [the individual design] but I did a pyramid in class [...] With pen and paper"* [TW4-I]. The questionnaire taken 6 months after the workshop reveals that not many teachers (5 out of 14 respondents – 35.7%) had incorporated elements of the workshop into their everyday practice [QF]. This apparent lack of significant impact can be attributed to recent massive lay-offs and subsequent re-organization at the university (*"[when asked whether the workshop's strategies had been put into practice] No. Without knowing the courses I was going to teach [...] The changes in the courses and their quantity [...] prevented me from trying new techniques."* [QF]), or to the lack of institutional support for some of the technological tools provided in the workshop.

However, leaving aside those circumstantial events, we can also look at which barriers teachers see for the adoption of CSCL strategies and technologies such as the ones presented in the workshops (topic T6). Some of the barriers mentioned are well known, such as the lack of adequate ICT infrastructures, training or technical support. Others relate more to teacher beliefs about ICT technologies in general (*"[when outlining one focus group's conclusions about whether they would use WebCollage/GLUE!-PS in real practice] some of us would not use it because we think [using ICTs] is complex and not necessary, versus other simpler ways of doing collaborative work"* [TW2-FG]), or towards collaborative learning (*"[when outlining one focus group's conclusions about run-time problems in blended CSCL] we have also considered whether these collaborative activities may subtract from the [content] learning [...] we should not mistake the means with the goals"* [TW2-FG]). Teachers were especially concerned with regard to the increased time and effort needed to apply (CS)CL in practice: *"[when talking about doing CSCL in a VLE as in the example courses shown] When I see all those links, folders, etc [...] I think it is too much work, non-pedagogical work involved [...] does it all compensate in order to reach what? To make a summary? [...] I'm a skeptic."* [TW1-I]. Many others expressed beliefs more related to students, especially their attitudes towards collaboration, or the sheer number of participants in some of the classes (*"[In the debate, when asked about collaboration in large groups] Too much effort for the teacher"* [TW1-A]).

Discussion

The quantitative and qualitative evidence provided above shows how a PD action based on the proposed approach can bring about conceptual change in teachers at different levels (in their beliefs about CSCL, as well as their perception of feasibility and self-efficacy). This is even more remarkable given the limited time-frame of the PD action (24 hours of blended work). There are, however, comparatively few instances of actual practice change towards CSCL practice among teachers (six months after the workshops).

Our evidence also found hints of the influence of multiple factors in the amount and nature of such conceptual change (as it is often the case in the "messy" environment of an authentic situation): the amount of teaching experience, prior beliefs about ICT, collaborative learning and CSCL, or how the workshop itself was orchestrated by the facilitators. Teachers also voiced several barriers for the adoption of the concerning CSCL practices, some of which are well known (teacher beliefs, ICT infrastructure, lack of training or support). Other barriers, however, are more striking, such as teachers' perception of students attitudes towards collaborative work, or the general consideration that collaborative work requires lots of effort and might not be feasible in larger student groups.

Our findings seem to support Looi et al. (2011)'s consideration that multiple factors limit teacher innovation in the classroom (which they adequately illustrate with the metaphor of a broken barrel which only

holds as much water as its shorter wood board). In the concrete case of our workshops, we could speculate that the potential for conceptual and practice change of the PD action is trampled over by other factors that such a short intervention cannot overcome (e.g. current instability of teaching loads at the university, tendency towards larger classrooms). This points towards the convenience of actions coordinated at different levels (policy, institutional, classroom) (Chan, 2011). Interestingly, the persistence of perceived barriers regarding the effort needed to setup and manage collaborative activities seems to indicate that further efforts on technologies and strategies for easing such orchestration are needed, in order to make CSCL practice less cumbersome, especially in large cohorts.

Naturally, due to the fact that it was gathered by observational methods in a situated PD action, these findings are hardly generalizable (nor was it our aim to make them so) to other contexts. The lack of consistency in the attendance to the two workshops is another weakness which limits our ability to trace clear evolutions of individual teacher conceptions and practices. Our naturalistic evaluation, however, provided hints of several factors influencing the impact of this kind of PD actions, which should be examined more thoroughly in later studies.

Also, the evidence from our study, along with the current evolution in many university settings towards larger cohorts, prompt us to iterate over the format and materials of this workshop, modifying the strategies and the technologies we are developing, e.g., in order to make more efficient the orchestration of large student groups. This is one of our main directions for future work in the near future, in accordance with a recently approved international R&D project.

Overall, we have presented a novel approach to teacher professional development that intends to foster CSCL practice within authentic formal educational settings, with an emphasis on the holistic approach known in CSCL as orchestrating learning. This emphasis is reified in the usage of conceptual tools that highlight possible synergies applicable to teachers' contexts (e.g. atomic patterns extracted from successful CSCL practice in authentic settings), and by the problem-orientedness and authenticity of the PD activities. By presenting an example of such PD action and initial evidences of its usefulness for conceptual and practice change, we highlight the potential usefulness of this kind of actions to foster CSCL adoption, even if coordinated actions at other levels are needed as well in order to provide long-standing impact in our educational systems.

Endnotes
(1) http://www.moodle.org (Last visit: 25 Oct 2012)
(2) http://pandora.tel.uva.es/wic2/ (Last visit: 25 Oct 2012)
(3) http://gsic.uva.es/glueps/ (Last visit: 25 Oct 2012)

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