Monitoring pattern-based CSCL scripts

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Abstract. Since in CSCL scenarios learning occurs largely through interactions between participants, promoting effective collaboration is one of the main concerns. Two strategies have been long discussed in the research community to foster effective collaboration: structuring the learning scenario by means of collaboration scripts, and monitoring interactions among participants in order to detect and regulate potential deviations from the initial plan. In order to help teachers in this endeavor, this document presents an ongoing doctorate research whose aim is to combine these two approaches. The result is an abstract view, automatically obtained, about the evolution of the learning process, integrating the data gathered from the different ICT tools involved in the learning scenario. This document briefly presents the context of the research problem, the goals of the thesis and the methodologies that will be used. It also summarizes the findings obtained so far and highlights some of the problems that the author expects to deal during the Doctoral Consortium workshop.

Keywords: CSCL, scripting, monitoring, Collaborative Learning Flow Patterns

1 Introduction: context and motivation

In the field of Computer-Supported Collaborative Learning (CSCL), one of the main concerns is the promotion of effective collaboration [4]. *Scripting* and *monitoring* are two techniques long discussed in the research community aimed to foster effective collaborative learning interactions [14]. On the one hand, CSCL *scripting* structures the learning scenario and provides students with a set of instructions that guide potentially fruitful collaboration; on the other hand, *monitoring* the collaboration facilitates the intervention in order to redirect the group work in a more productive direction.

Within the wide range of CSCL scripting techniques, we can find the category of *macro-scripts* [8] (scripts hereafter), which mainly describes how groups and individuals should perform a set of interrelated activities [5]. Since modeling potentially effective CSCL scripts is a difficult task, the use of patterns that reflect best practices in structuring collaborative learning has proved to be helpful [7] [20] [26]. For instance, *Collaborative Learning Flow Patterns* (CLFPs) are a particular type of CSCL scripting patterns that describe well-accepted ways of arranging activities in collaborative learning scenarios [12]. Among other elements, CLFPs describe what types of interaction among learners and teachers should occur within activities.

Even though design is one important factor in building effective collaborative learning [10], there is no guarantee that desired collaboration occurs [3]: eventualities require

modifications of the course of the learning situation, leading teachers to adapt the original design [4]. At this point, monitoring the learning scenario and comparing its actual and expected states may provide useful information that the teacher can use to regulate collaboration [23].

In these scenarios collaboration takes place, at least in part, through computers. Analyzing these computer-mediated interactions may help to better understand collaboration [23]. This has been a strong trend in CSCL in the last years, but it has mostly focused on detailed interaction-analysis approaches aimed at letting researchers gain insight into the collaborative processes [16]. However, teachers need a more abstract idea of collaboration, easier to interpret so that they can react on time if needed. Additionally, the use of diverse ICT tools in the classroom would force teachers to integrate data from all the tools and environments where the learning process takes place. This task is time-consuming and error-prone, if not unfeasible.

This thesis proposes a method to get, automatically, a high level view about the evolution of the learning process by combining pattern-based scripting (to be more precise, supported by CLFPs), and collaboration monitoring. We propose to use the knowledge about the expected collaboration provided by the script, together with the data provided by the different sources in the technological infrastructure used for the enactment (VLEs such as Moodle [1], LAMS [2] or .LRN [3]; Web 2.0 tools, e.g. Google Documents [4], Media Wiki [5] or DropMind [6] ...). We hypothesize that monitoring at a coarse level (that of the pattern) using these data is enough to provide teachers with relevant information about the current state of the learning process, helping them to react in time to redirect the course of the learning situation.

The remaining of this document is structured as follows: section 2 introduces the proposal; section 3 is devoted to explain the research design (paradigms, methodologies and research methods); results achieved so far are summarized in section 4; finally, the document closes with a summary of the open questions and problems that the author would like to explore during the Doctoral Consortium workshop.

2 Goals of the research

This PhD proposal aims to enhance collaboration, providing teachers with relevant information about the current state of the learning process, enabling them to react in time to redirect the course of the learning situation. Thus, we could formulate the main goal of this thesis as:

"To design, implement and evaluate a method and the required tools to get automatically a high level view about the evolution of the learning process by combining both pattern-based scripting and collaboration monitoring, especially in those CSCL scenarios characterized by the use of diverse ICT tools."

[1] http://www.moodle.org
[2] http://www.lamsinternational.com
[3] http://openacs.org/projects/dotlrn/
[4] http://docs.google.com
[5] http://www.mediawiki.org/
[6] http://web.dropmind.com/

To achieve this goal, we could define a number of partial objectives of the thesis:

1. *Identify the interdependencies between scripting and monitoring and their roles throughout the CSCL learning lifecycle (design, particularization and instantiation, enactment and evaluation) [11].* First of all, we should identify those especial requirements posed by monitoring that the design must take into account [19] (e.g. how will the teacher check the collaboration processes?, which are the critical points to be monitored?, do the selected tools provide information about collaboration?). During the enactment, it will be necessary to define how to guide the monitoring data gathering in order to collect collaboration evidences of those critical points identified in the design. Finally, during the evaluation, the actual monitoring results are expected to be contrasted with the monitorable collaboration schema, obtaining graphical visualizations of the progress of the learning situation, with the aim of helping teachers to detect potentially critical situations (e.g. there is no evidence of collaboration between two participants that should work together).
2. *Analyze CLFPs to identify critical points that should be monitored.* One key issue in the process described in the previous step lies in the identification of the script constraints since this information is expected to guide the whole process. Though several authors [6] [2] [17] have analyzed scripts in order to identify which features are modifiable (extrinsic constraints) and which ones have to be accomplished in order to maintain their pedagogical intentions (intrinsic constraints), we will focus on determining which collaborative interactions should take place in order not to compromise the fulfillment of the intrinsic constraints of the script. Since the scripts considered in this work are based on CLFPs, the requirements that the script must satisfy in order to achieve the learning objectives derive from the pattern constraints. Then, we will centre our work on the analysis of CLFPs.
3. *Design and implement an architecture that guides the retrieval of monitoring data from decentralized learning environments.* Once we have identified the requirements of the script, we will need to define and develop an architecture that supports the pattern-based guidance of the monitoring data, especially oriented to learning environments that involve different ICT tools. By means of the particular characteristics of the script, it will be possible to specify the sources that provide useful evidences about the collaboration among participants, the periods of time that should be taken into account, and the interactions that need to be registered. Therefore, the envisioned architecture must support these needs.
4. *Propose a structured representation of the evolution of the learning process based on the patterns, and develop a tool to show the results.* During the last phase, actual and expected monitoring results will be compared. The final purpose of this comparison is to provide teachers with useful and understandable information about the progress of the learning situation. Then, it will be necessary to explore and propose a structured representation of the evolution of the learning process based on the script properties and, consequently, inspired by the pattern that implements the script.

3 Research design

Since this research is focused on the difficulties experimented by teachers when they want to put CSCL scripts in practice, it is located under the multidisciplinar **CSCL paradigm** [18] [24]; on the other hand, the thesis proposed in this document is in line with the **pragmatic paradigm** where the objective of the study defines the research method and techniques [15].

From the goals presented in section 2, the aim of proposing and developing solutions to existing problems points to the **engineering research method** [1] [9] as the most suitable framework for the purposes of this thesis. This method describes four main phases: *informational*, *propositional*, *analytical*, and *evaluation*. For each one of the objectives presented in the previous section, the four phases are being followed iteratively, each cycle informing subsequent cycles along the same objective, but also providing valuable information to the other lines of work.

To evaluate the achievement of the particular objectives of each iteration, we have decided to use **mixed methods** research designs, an increasingly common trend in CSCL [13]. By means of workshops with experts, we expect to evaluate both the analysis of the patterns constraints (objective 2) and the graphical representations (objective 4). Several case studies [25] in authentic CSCL scenarios will be carried out to verify the implementation of the method (objective 1) and tools (objectives 3 and 4), as well as the evaluation of the approach. Some parameters that will determine whether the proposal has been successful are:

- Does it help teachers to understand what is happening and detect undesired situations?
- Does it help teachers to regulate collaboration?
- Does it provide information that the teacher would not have discovered?
- Is it time efficient?
- Are the visualizations understandable for teachers?

4 Preliminary results and current status

There have been a number of preliminary results on the different objectives of the thesis presented above. A paper to be presented at this conference [22] proposes a first approach where pattern-based scripting and monitoring methods and tools are combined to enhance collaboration (first partial objective). This paper shows how the analysis of pattern constraints, mainly focused on CLFPs, helps to identify those aspects of collaboration that should be looked after when monitoring the activity (second partial objective). This way, monitoring can focus on these aspects, which are easier to detect and to follow than fine-grained analysis of the activities. This proposal of PhD thesis has been evaluated through a case study, carried out in a higher education learning scenario, that has shown initial evidence on the suitability of the approach for the detection of potentially critical situations.

In relation to the technological infrastructure for the harvesting of monitoring data (third partial objective), a service-based architecture for such deployment has been proposed [21]. However, the implementation work on this deployment infrastructure has not been started yet.

5 Problems to explore at the DC Workshop

As it can be seen from the previous section, though there are several lines of open work, the ideas that conform this thesis are maturing and some results have been obtained. Up to now, it has been proposed a method to get automatically a high level view about the evolution of the learning process by combining CLFP-based scripting and monitoring. Therefore, receiving feedback from the research community on the objectives and the global framework of the envisioned thesis will be very helpful.

Though a first attempt to select a theoretical and methodological framework for our work has been done, the author hopes that this kind of methodological concerns (both for this concrete thesis and in general for CSCL research) will be addressed during the Doctoral Consortium workshop. Along the same lines, we are still considering which is the best way of evaluating the achievement of each particular objectives of this thesis, so any comments or suggestions on this topic will be very useful.

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