

Towards embedding assessment in CSCL scripts through selection and assembly of learning and assessment patterns

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Abstract. Assessment is one of the key elements of learning scenarios, both in individual and collaborative learning. Thus, embedding assessment in Computer Supported Collaborative Learning (CSCL) scripts can potentially enhance the enactment of collaborative learning sessions, by explicitly indicating how assessment is to be carried out. However, assessment design has also been recognized as a demanding task for non-expert instructional designers or practitioners. To tackle this problem, the use of learning and assessment patterns has already been reported as a way of supporting script design for non-experts. In this context, the combination of patterns of different nature (learning-oriented and assessment-oriented) can be regarded as an essential task of CSCL script design. This paper discusses how to support this task, focusing on the joint application of patterns, and describes an evaluation of the proposed approach.

Introduction

CSCL macro-scripts have shown to be an effective means to organize collaborative learning activities and in this way increase the chances of fruitful interactions among participants (Dillenbourg, 2002). Among the aspects that need to be defined in a CSCL script, we can highlight the assessment strategy. Assessment should be considered as a means to improve learning (Black & Wiliam, 1998; Shepard, 2000). Moreover, the specific characteristics of collaborative learning determine the appropriate assessment strategies (Boud, Cohen & Sampson, 1999), including the need of valuing adequately collaborative work or the interactions between students. In the context of the design of CSCL macro-scripts, assessment and other script components, such as activities, role distribution, or sequencing of activities (Kollar, Fischer & Hesse, 2006), are strongly interrelated. Therefore, it can be argued that assessment should be designed jointly with learning activities, and that collaboration scripts should contain information relative to its assessment plan (Villasclaras-Fernández et al., 2009).

However, embedding assessment in CSCL scripts adds a new layer of complexity to the design task, especially when the designer has limited experience of scripting or collaborative learning. Designing CSCL scripts has been the object of several research efforts. Among them, we can highlight the *create-by-reuse* framework (Hernández-Leo et al., 2007), that describes the approach of building complete CSCL scripts by reusing existing components. Different types of components can be employed, which may describe, for instance, resources, tools, or learning activities. Design patterns have shown to provide valuable support to this approach. For instance, Collaborative Learning Flow Patterns (CLFPs), a kind of pattern that capture good practices in structuring collaborative learning activities, such as *jigsaw* or *pyramid*, can be used to define the structure (sequence of activities and groups) of a whole CSCL macro-script or part of it (Hernández-Leo et al., 2006). Thus, CLFPs suggest structures of collaborative activities that can be applied in a wide range of learning scenarios.

Focusing on collaborative learning and this pattern-based design approach, Collage, an IMS Learning Design (IMS-LD, see IMS, 2003) authoring tool that supports the user in the design of CSCL scripts, was developed (Hernández-Leo et al., 2006). *Collage* encourages designers to browse the documentation of different CLFPs and select the pattern most suitable to their particular learning scenarios. The selected CLFP proposes the structure of a CSCL script, which then needs to be refined for the learning scenario. This includes detailing information about concrete roles, time schedule of the session(s), activity contents and resources (Hernández-Leo et al., 2007).

The usage of design patterns has been positively evaluated for CSCL script design, and actually has already been proposed for assessment design (see Mislevy et al., 2003; Delozanne et al., 2006). This paper focuses on the possibility of using assessment and learning patterns together to create complete CSCL scripts, each type of pattern addressing different design problems. In order to facilitate the access to this design approach for non-expert designers, this paper proposes a model for the integration of assessment and learning patterns. The results of the research undertaken will be the basis for the formulation of a complete design process of CSCL scripts, which continues previous efforts in order to include support for assessment design.

Therefore, the rest of the paper is organized as follows. Next section details the scope of the design patterns for assessment proposed here. The following section describes the approach to support and model the

application of assessment patterns within CSCL scripts. Then, the evaluation of the proposed approach is presented. The paper concludes with a discussion of the issues tackled in this paper.

Pattern-based design of embedded assessment in CSCL scripts

This section describes the problem of assessment design from the point of view of a pattern-based design approach. Before we discuss this, however, we need to define precisely the type of assessment pattern considered. A complete assessment plan is a complex entity that comprises several aspects. Several works have identified different pieces of information needed to define an assessment plan, such as the knowledge, skills and abilities (KSAs) that are to be assessed; observable variables or indicators; assessment types; or instructions for processing assessment data (Almond, Steinberg and Mislevy, 2002; Joosten-Ten Brinke et al., 2007). Nevertheless, other existing proposals emphasize the fact that, in spite of the mentioned contextual bindings of assessment design, it is possible to extract common assessment processes. These represent different activities or methods of carrying out assessment or delivering it to students. In further detail, it has been argued that there are several aspects that characterize assessment processes (Miao et al., 2007): (a) the description of the involved roles; (b) the definition of the activity types and sequencing; and (c) the description of the document flow.

Capturing configurations of these elements has already been the aim of different pattern-based approaches. For instance, the PADI Project (Mislevy et al., 2003) defines patterns which contain information about the scientific knowledge or skills that are to be measured, the specific observations that are needed to make inferences about that knowledge or skill, and the situations in which such evidence may be obtained. On the other hand, Delozanne et al. (2006) proposes a set of patterns to track students' know-how and strategies in a specific context in problem solving activities. This paper deals with patterns that capture the structure of assessment techniques, focusing on the requirements of CSCL settings. Such structures define different forms of carrying out assessment, in terms of the assessment process or the configuration of a certain aspect of it. Like CLFPs, they propose templates that can be reused and embedded in CSCL scripts. Examples of such techniques exist in the literature. For instance, *peer review* (Dochy, Segers & Sluijsmans, 1999) has been captured as a candidate pattern, describing a process which engages students in assessing their partners' work. Other forms, such as 360° feedback, self assessment, or performance assessment (Joosten-Ten Brinke et al., 2007) can be described in similar terms.

The selection of adequate assessment techniques is critical for their effectiveness in enhancing learning. Due to space limitations, this paper does not deal with the selection of assessment patterns, and is focused only on the integration of the selected assessment patterns with the rest of components of a CSCL script. Scripts themselves typically describe a learning process composed by several phases, activities and groups (Dillenbourg, 2002). Thus, it is necessary to describe how assessment is also part of that process. Sequencing, role assignment and document-flow, which were mentioned before to define the assessment process, are actually features shared between learning and assessment activities. In order to highlight the importance of the interrelationship between learning and assessment, the following section will discuss a form of support for the assembly of learning and assessment patterns to build CSCL scripts.

Assembly of patterns in CSCL scripts

Using several patterns in the creation of a CSCL script, some addressing learning design issues, other tackling the design of the assessment plan, means that the patterns (or, rather, the templates they propose and are applied in the script) have to be *assembled* (Hernández-Leo et al., 2007): the different aspects tackled by the each pattern need to be interrelated, in order to make sure that they are coordinated to achieve certain learning objectives. In other words, learning and assessment patterns can support or complement each other. In order to describe the coordination of assessment and learning patterns, this section discusses a model which structures the information that characterizes the integration of the assessment processes within the CSCL script.

There are some clear relationships between the components of a CSCL script and its assessment plan. First, assessment must address the learning objectives of the script, including those related to collaborative learning (Boud, Cohen & Sampson, 1999); this information should be explicit. Second, assessment embedded in the script occurs at specific moments and involves certain actors. As shown in Figure 1, assessment can be related to the following elements of the script: addressed learning objectives, data source activity (which provides data to carry out assessment) and assessor's activity (which indicates who processes assessment data, and when). Thus, both learning activities (performed by learners) and support ones (carried out by teachers or other staff) can be assessment activities. However, the most important information to characterize assessment is its purpose (Almond, Steinberg & Mislevy, 2002). Thus, we will define three possible purposes (see bottom-right of Figure 1) of the application of assessment patterns within CSCL scripts.

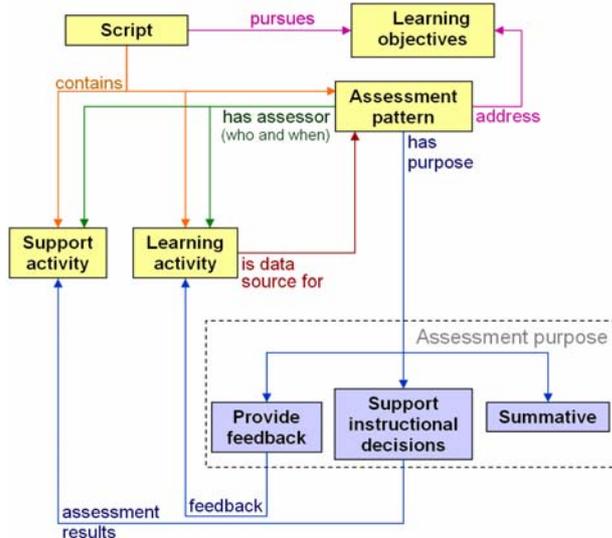


Figure 1. Model for the integration of assessment patterns embedded in CSCL scripts.

Figure 2. User interface of form for edition of assessment information in Web Collage.

First, assessment can be used for summative purposes, related to attainment decisions dealing with certification of students' achievements (Dochy & McDowell, 1997). Second, assessment can be used to perform monitoring and diagnosis, and thus support instructional decisions, which are related to the changes that the teacher may introduce in the teaching/learning process as it is conducted; adapting instruction during the learning activities, according to assessment results, offers a possibility to enhance learning (Stiggins, 2002). This author also highlights another relevant use of assessment: providing feedback to students, which will be our third possible purpose for assessment. This purpose of assessment deserves special attention. According to Black & Wiliam (1998), feedback is characterized by two actions: First, students must perceive the gap between the expected goal and his/her own actual state; second, they must carry out a remedial action to close the gap. These two actions constitute an important part of the related learning activities. The designer must therefore be aware of two issues: (a) feedback is given out to students in specific activities along the script (i.e., assessment is related to the document flow of the script), and (b) the learning activity will be affected by the delivery of feedback, as shown in Figure 1. Therefore, assessment has a relevant effect on the learning process, which has to be adapted accordingly to these issues.

The model shown in Figure 1 structures the identified relationships between assessment elements and other script components. Making these relationships explicit is intended to increase the designer's awareness of the complexity and importance of integrating assessment elements within a CSCL script. By using the model, the application of assessment patterns in the script can be explicitly defined, at least in terms of the purpose, temporal location of assessment elements, and assignation of assessment-related roles to groups and participants, of each assessment pattern. Moreover, this information is expected to help other actors involved in the life-cycle of CSCL scripts, by documenting the design decisions and the rationale of the script.

In order to enable users to include assessment patterns in these scripts, an extended version of Collage, called Web Collage, was developed. Web Collage allows a designer to assemble CSCL scripts by using learning patterns (CLFPs) and assessment patterns (the current version allows using assessment-centered CLFPs, such as Peer review, and patterns for assessment activities). These patterns define templates of components that can be combined to create complete scripts. Thus, for each assessment pattern, the tool creates the related activities and embeds them in the script. Finally, this tool allows the definition of the information included in the model described in this section, through a form-based interface, shown in Figure 2. Web Collage provides users with graphical representations of the resulting CSCL script, depicting also the position and purpose of applied assessment pattern.

Evaluation

This section describes the evaluation that has been carried out on the approach discussed in this paper. Our objective was to evaluate its adequacy to support non-expert designers in the creation of CSCL script, by promoting the awareness of the importance and facilitating the design of assessment. To this end, we were interested in the perception of such designers concerning the proposed approach. The evaluation was carried out through a case study in the context of a workshop on technology support for the design of collaborative learning scenarios. The workshop, carried out in July of 2008, was attended by 13 university teachers, who are considered to represent the target user for which the proposal is developed: teachers (though only in higher education),

non-experts on collaborative learning, but interested in applying both technology and collaboration to their own practice.

The workshop had a length of 8 hours, distributed in two sessions. These included lectures combined with hands-on activities to introduce the attendees to some of the issues behind the design of CSCL scenarios, as well as available technology solutions that can facilitate the design task. The workshop included a central activity consisting on the creation of a CSCL script with Web Collage. In this activity, the participants were not given a pre-assigned design task, but were encouraged to consider a case from their own teaching practice. This allows us to evaluate the usage and perceptions of the participants with respect both to the tool and the proposal.

The data gathered in the workshop can be classified in: questionnaires filled up by participants (at the beginning and the end of each workshop), logs generated by Web Collage, a final discussion between participants and the workshop staff, and observations taken by the staff. Both quantitative and qualitative data were analyzed in order to detect and understand trends in the participants' opinions and perspectives. The analysis of the data was focused on three issues: (a) usability of the tool: since the complexity of use of the application could preclude the expected benefits of the proposal, it was deemed necessary to analyze the intuitiveness and user friendliness of Web Collage; (b) adequacy of the support for the design task: whether the proposed approach facilitates the integration of assessment patterns in CSCL scripts; and (c) adequacy of joint design of learning and assessment: the perceptions of the participants concerning the design process that merges learning and assessment design.

With respect to the usability of Web Collage, the participants valued the tool quantitatively, giving it an overall slightly positive score: 3.31 (value range: 1 (no useful at all) – 5 (most useful), standard deviation 0.85). However, the participants pointed out in their qualitative comments in the final questionnaire several problems with the usage of the tool. It is especially relevant that 4 participants indicated explicitly that introducing assessment patterns is particularly complex. In spite of this, analysis of the logs generated by Web Collage shows that actually users actually were able to introduce a number of patterns: the scripts averaged 1,69 CLFPs per script (deviation: 0,94) and, more importantly, 2,46 assessment patterns (deviation: 1,94). Therefore, the participants were able to select and embed an important number of patterns by using Web Collage, though with high differences in the complexity of the created scripts. However, with respect to the second issue, the adequacy of provided support, we can also note that the participants generally judged that they could not complete the design of assessment: 62 % of participants indicated that their assessment process was left incomplete. It is clear that the model described in the previous section was found exceedingly complex: 4 participants expressed this opinion, versus only one who considered it clear (the rest, 8 participants, did not answer this question, which is also significant).

With respect to the third issue, the adequacy of joint process of designing assessment and learning together, the participants were divided: 4 (31 %) considered they should be done at the same time, while 6 (46 %) affirmed that learning design should precede assessment design. Only one participant chose first assessment design followed by learning design. However, the great majority of the participants agreed that they should appear together in a script (11 participants, 85 %), even though 2 of these were skeptic whether designing them at the same or not had actually any effect. Finally, the majority of participants agreed that assessment and learning are interrelated, and this should be reflected in the design, e.g., providing information about “[...] determining the moments of assessment”.

Discussion and conclusions

The objective of this paper has been to discuss some issues around the application of assessment patterns in the creation of CSCL scripts. This is an important problem, and proposing a complete solution is out of the scope of this paper. However, we have focused on a particular issue: the usage of assessment patterns jointly with learning patterns, following the principles of a create-by-reuse framework (Hernández-Leo et al., 2007). Within this context, we have studied the problem of assembly of combinations of patterns in order to create a CSCL script.

This paper argues that there is certain information that can be used to indicate the moment in which assessment is carried out, by whom, the object of assessment and its function in the pedagogical model of the script. This information, structured in the model described in this paper, is relevant both for the designer (in order to configure all the affected elements of the script accordingly), and the users of the script.

This proposed approach has been implemented in a software tool, Web Collage. The tool and approach have been evaluated in a case study which gives inexperienced university teachers the role of CSCL script designers. The evaluation results indicate that the tool itself plays a critical role in the evaluation of the proposals, as several usage problems were identified by the users. With respect to this, the case study provides valuable feedback to improve the tool. Despite these issues, the case study indicates that the proposed approaches described here can enhance assessment design. The participants were able to create the structure of CSCL scripts assembled by several patterns, including assessment ones, and valued positively having assessment information embedded in the scripts.

However, the difficulties found in the evaluation indicate that the proposal cannot be expected to be used by inexperienced designers in its current form. One factor that affects this is the lack of guidance in Web Collage

with respect to the needed tasks to complete a design. Future work is aimed at developing a detailed design process and its implementation in Web Collage, in order to provide further guidelines to non-expert designers; this is intended to overcome the complexity of the usage of assessment and learning patterns together, while at the same time keeping the advantages of pattern-based design. Finally, our objective is to integrate different tasks in a single design process, including the selection of patterns (which is done through a pattern language, not described here due to space limitations) and the refinement of patterns, which was not discussed in this paper either.

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