# The added value of implementing the Planet Game scenario with Collage and Gridcole

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**Abstract:** This paper discusses the suitability and the added value of Collage and Gridcole when contrasted with other solutions participating in the ICALT 2006 workshop titled "Comparing educational modelling languages on a case study." In this workshop each proposed solution was challenged to implement a Computer-Supported Collaborative Learning situation (CSCL) posed by the workshop's organizers. Collage is a pattern-based authoring tool for the creation of CSCL scripts compliant with IMS Learning Design (IMS LD). These IMS LD scripts can be enacted by the Gridcole tailorable CSCL system. The analysis presented in the paper is organized as a case study which considers the data recorded in the workshop discussion as well the information reported in the workshop contributions. The results of this analysis show how Collage and Gridcole succeed in implementing the scenario and also point out some significant advantages in terms of design reusability and generality, user-friendliness, and enactment flexibility.

**Keywords:** IMS Learning Design, Computer-Supported Collaborative Learning, authoring, enactment.

**Interactive Demonstration:** Collage authoring tool is published in SourceForge and can be also downloaded from http://gsic.tel.uva.es/collage

# 1   Introduction

The suitability of IMS Learning Design (IMS LD) (IMS 2003) specification for modelling Computer-Supported Collaborative Learning (CSCL) situations in the form of CSCL scripts (Kollar, Fisher and Hesse 2006) has raised interesting controversy during the recent years (see for instance (Miao 2005) and (Hernández-Leo, Burgos, Tattersall and Koper 2007) and new Educational Modelling Languages (EML) are being proposed (see other articles in this special issue). Nevertheless, any conclusion on that debate is incomplete without considering whether the additional complexity of collaborative learning situations and the associated requirements is properly tackled by existing authoring and enacting computing tools (compliant or not with IMS LD). The ICALT 2006 workshop on "Comparing educational modelling languages on a case study" (Vignollet, David, Ferraris, Martel, and Lejeune 2006) provided an excellent opportunity to carry out such an assessment by comparing not only modelling approaches for CSCL scripts but also key capabilities of associated tools in terms of observation functions, trace/log generation, and re-use/adaptation support.

For the aforementioned workshop, the authors of this paper proposed a design-based approach to the "Planet Game" scenario, introduced in the first paper of this special issue, based on the usage of "Collaborative Learning Flow Patterns" (CLFP) (Hernández-Leo, Asensio-Pérez and Dimitriadis 2005). CLFPs are implemented as IMS LD templates which seek to capture the essence of good practices in arranging participants in collaborative learning situations, sequencing types of collaborative learning activities, etc. Examples of good practices captured by CLFPs are Brainstorming and Jigsaw (Aronson and Patnoe 1997; Johnson and Johnson 1997). CLFPs provide a way of

communicating collaborative learning expertise to other (novice) practitioners: instead of trying to create their own collaborative designs from scratch, practitioners can reuse CLFPs as templates or guides for structuring their own collaborative situations (Hernández-Leo, Harrer, Dodero, Asensio-Pérez and Burgos 2007).

Regarding the tool support for the proposed modelling approach based on patterns, the Collage authoring tool (Hernández-Leo, Villasclaras-Fernández, Jorrín-Abellán, Asensio-Pérez, Dimitriadis, Ruiz-Requies and Rubia-Abi 2006) provides a user-friendly way of selecting and completing one or several CLFPs so as to generate an IMS LD Unit of Learning (UoL) that models the targeted collaborative learning situation. Collage enables educators to select CLFPs by indicating the pursued learning objectives (both attitudinal and procedural) as well as by deciding the task type to be carried out in the designed collaborative scenario (see Figure 1). Collage then recommends those CLFPs whose associated best practices are more suitable to fulfil the educator's requirements. Once one or several CLFPs have been selected, the educator simply has to customize the flow of collaborative learning activities proposed by the CLFPs by defining the description of the activities, activity completion policy, roles, and group-size limits. Finally, it is necessary to determine and configure the resources to support the activities so that Collage can pack them all into the final IMS LD Unit of Learning. The educator performs all those steps by means of a Graphical User Interface (GUI) that hides the complexity of the XML-based formalism of IMS LD.

IMS LD UoLs generated by Collage are then intended to be enacted by the Gridcole tailorable CSCL system (Bote-Lorenzo, Gómez-Sánchez, Vega-Gorgojo, Dimitriadis, Asensio-Pérez, Jorrín-Abellán 2008). In addition to the interpretation of the IMS LD UoL, Gridcole is capable of providing the participants with the set of learning materials and computing tools needed for the completion of each collaborative learning activity. Gridcole differs from other well-known Learning Management Systems (LMS), such as Moodle or .LRN, in that it does not incorporate a limited set of learning computing tools. On the contrary and following the principles of Service-Oriented Computing (Papazoglou, Traverso, Dustdar and Leymann 2007), Gridcole provides a framework in which third-party web-based learning tools are offered to students in an integrated fashion. The only constraint associated to this type of system is the availability of third-party providers offering the needed tools. This way of enhancing and customizing Gridcole functionality is called "tailoring by soft integration" (Morch 1995). LMSs are not tailorable, in the respect that they do not integrate existing tools (beyond those already available in each specific system) in order to support educational scenarios satisfying their specific needs. Having a limited set of tools limits or constrains the teacher when designing the educational scenario. For example, (Bote-Lorenzo et al., 2008) describes a real collaborative learning scenario framed in a "Computer Architecture" course where Gridcole integrates a benchmarking tool. This tool is specific to the learning situations of this subject matter and is not offered by LMS's.

Figure 1 sketches the authors' proposed solution for the "Planet Game" scenario pointing out to the role played by Collage and Gridcole in both the design of the "Planet Game" scenario (the creation of the desired IMS LD UoL and its enactment by integrating external tools).

In addition to detailing the authors' proposed modelling and implementation approach to the "Planet Game" scenario, this paper expands on the results of the ICALT 2006 workshop by analysing them as a case study intended to contribute to the validation of the CLFP-based approach enforced by Collage and Gridcole. This case study is of special research interest as it tries to answer the key question on whether the proposed approach is capable of satisfying the requirements of a learning scenario designed by a third-party (the workshop organizers, who are not biased by previous knowledge on the capabilities of the challenged approach). Additionally the case study provides a straightforward means of identifying the added value of the approach, as well as its weaknesses, with respect to other significant research works in the field, thus enabling the identification of adequate improvement efforts and redundancies.
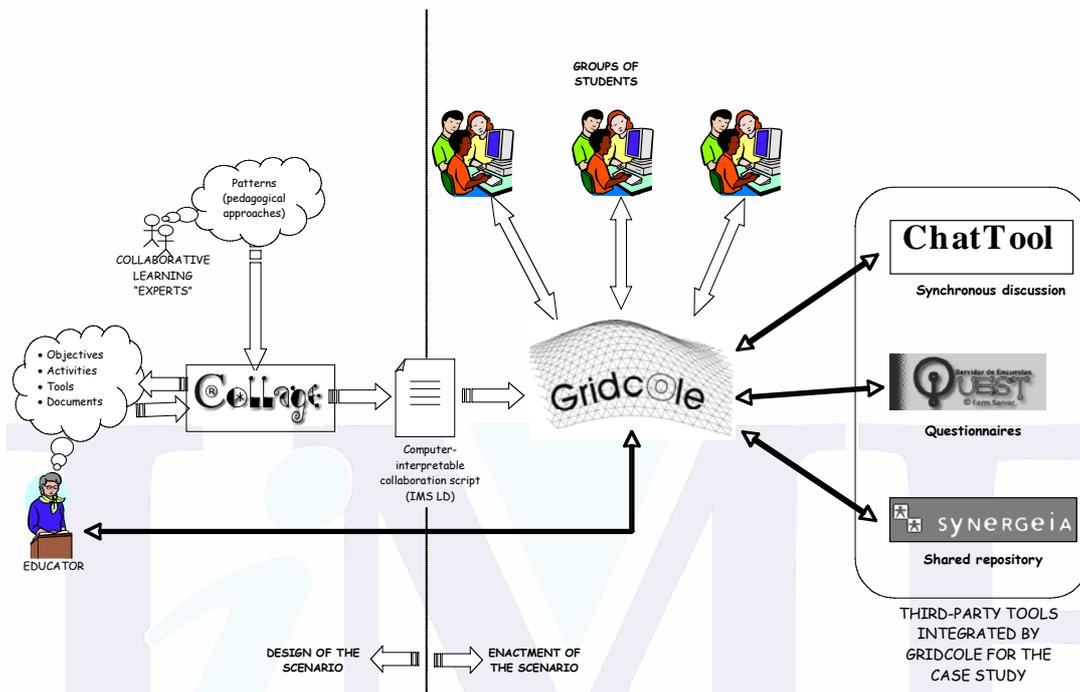
Figure 1: Global outline of the implementation approach

Therefore, the paper presents in section 2 the methodology adopted for analysing the ICALT workshop as a case study. The methodology guides the collection of data and its subsequent analysis for the drawing of comparative conclusions which is undertaken after the implementation of the "Planet Game" scenario, being both aspects (implementation and data analysis) described in section 3. Finally, section 4 concludes the paper by presenting the main research results and the current and future related work.

## 2 Methodology: the ICALT workshop as a case study

As described in the introduction, the case study entails the participation in a workshop integrated in the ICALT 2006 conference (Vignollet et al., 2006). The motivation of the organizers, as indicated in the introductory paper of this special issue, is concerned with whether existing EMLs (including IMS LD) and their associated tooling can be satisfactorily used in the design and enactment of CSCL situations. Nine participants proposing different approaches to solve the scenario contribute in the workshop. The introductory paper of the special issue lists the workshop participants and describes in more detail their proposed solutions, that is to say, the language used to specify the script and the tools employed to author and execute them. In the paper we only consider those participants present in the special issue for readability purposes: Collage and Gridcole (use IMS LD, Hernández-Leo et al., 2006b), Reload LDE and Coppercore (use IMS LD, Tattersall, 2006), MOT+LD (use IMS LD, Paquette and Léonard, 2006), F-logic complemented with the use of Reload LDE and Coppercore (Amorim, Lama and Sánchez, 2006), LAMS (Dalziel, 2006), ModX and LDI (using LDL Martel, Vignollet and Ferraris, 2006), CPM with Objecteering and UML profile (Nodenot and Laforcade, 2006). Extended explanations of each solution can be found in the corresponding paper of this special issue.

Due to the particular characteristics of this case study, three types of data sources are used:

- Papers written by the participants regarding their general approach and their application to the script proposed by the workshop organizers.

- Regarding our approach, the UoL package created with Collage is also available [1]. Consequently, the conclusions and screenshots of resulting from its design and execution are also used as supporting data.

- A video that records the session in which the discussion takes place.

The data have been analyzed an interpreted following the "triangulation" method devoted to gaining assurance of the interpretations. Triangulation has to do with redundancy (Guba, 1981). It is the comparative analysis and critical review of evidence proceeding from different data sources and/or from different participants. The data has been aggregated in accordance with the focuses of interest outlined in the case study (the conceptual structure as defined by Stake, 1995).

In particular, the topics on which the case study focuses are: testing the application of the authors' pattern-based design process for the creation of LD scripts, as it is implemented in Collage, to a scenario proposed by a third party, and understanding the pros and cons of the approach compared with the related approaches that participate in the workshop. The concrete information questions that derive from these topics are:

- Topic 1: Implementing the scenario
    - To which extent is it possible to design a script proposed by a third party using Collage?
    - Can the script created with Collage be enacted by an actual LMS?
- Topic 2: Comparison of the authors' proposed solutions with related approaches
    - What are the pros and cons of the authors' approach compared to other approaches regarding computational representations?
    - What are the pros and cons of the authors' approach compared to other approaches regarding design?
    - What are the pros and cons of the authors' approach compared to other approaches regarding enactment?
    - What are the pros and cons of the authors' approach compared to other approaches regarding re-use/adaptation aspects?

# 3   Implementing the scenario and data analysis

The results of the case study are discussed through this section which is organized consistent with the conceptual structure of the case study.

## 3.1   Implementing the Planet Game scenario

### 3.1.1   *The main aspects of the scenario can be designed with Collage*

It is possible to apply the authors' pattern-based design process for the creation of LD scripts, as it is implemented in Collage, to designing the Planet Game scenario. Though the script is not rigorously a JIGSAW-based situation (students do not collaborate to jointly solve a problem but they "compete to propose individually the solution"), its learning flow structure is inspired in its essence. That is, the script considers a "Jigsaw group", which is the whole class, that is divided into two "Expert groups" representing teams A and team B, each of which accesses complementary information. Therefore, the IMS LD template representing JIGSAW CLFP [2] can be selected in Collage and particularized as illustrated in figure 2 and figure 3.
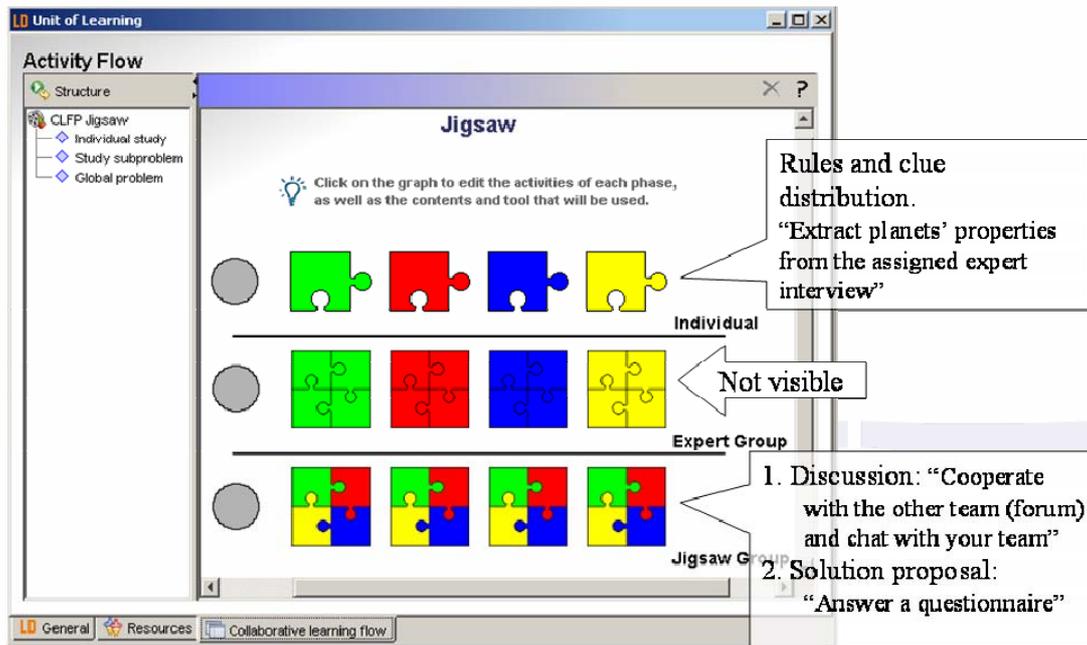
Figure 2: Authoring the script with Collage
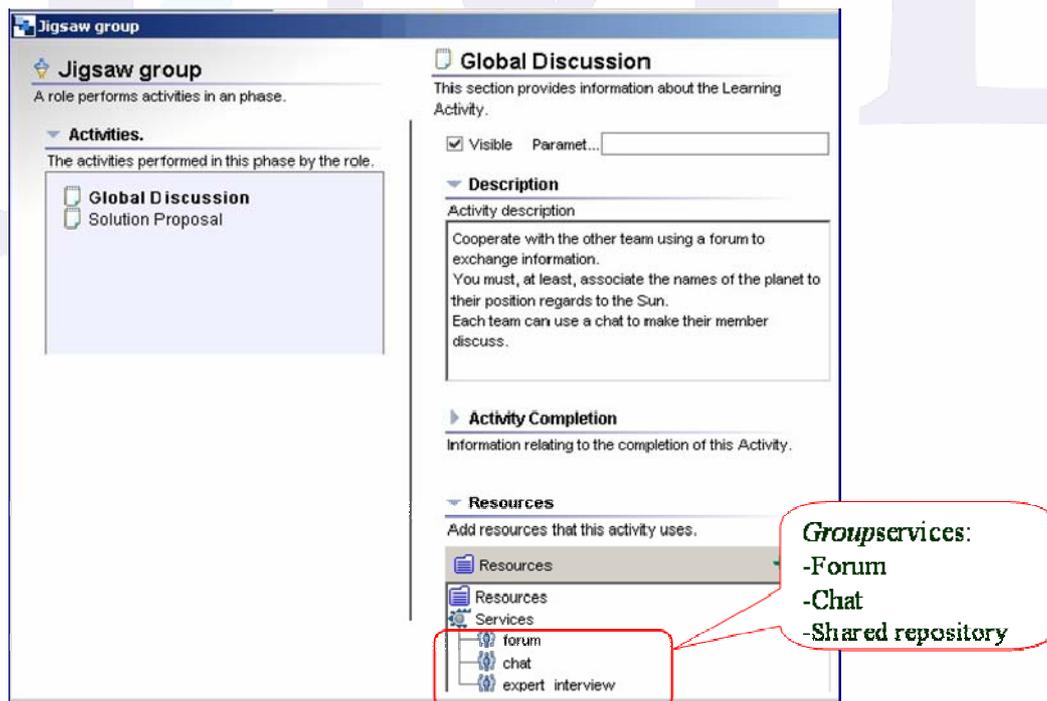


Figure 3: Refining the JIGSAW-based template with the description of the activities and the collaborative tool supporting the activities

The "Individual" phase of JIGSAW is devoted to present the rules of the Planet Game and clue distribution depending on the team to which each student belongs. In this respect it should be noticed that although the expert group phase of the JIGSAW is not strictly considered in this scenario, the corresponding expert-group role must exist to differentiate between members of team A and team B. This is needed for providing the right expert interview (through a shared document repository) and the specific chat room in the discussion activity of the "Jigsaw Group" phase. The particular solution adopted in this script regarding a general way of specifying a group-service (not necessarily dedicated to conferences) is using the conference service element of IMS LD and an external binding document

that indicates which groups need a different instance of the service (Bote-Lorenzo et al., 2008). Therefore, a differentiated instance of the chat and the shared repository will be available only to the members of a particular team (each team is an instance of the expert-group role, thanks to the use of the created-new attribute of the IMS LD role element). Each instance of the group-service that models the repository storing the interviews will be also available to the teacher, so that s/he can add new clues. An analogous approach is adopted for the forum, which is available to all the participants, and the questionnaire tool that will be answered in the last activity (solution proposal) of the JIGSAW. Table 1 shows a summary of the resulting UoL as created by Collage (it also generates this table).

| JIGSAW CLFP phase | Group/ role | Activity | Activity description | Resources |
|---|---|---|---|---|
| Individual study | Jigsaw group | Individual study | At the end of this game you have to be able to classify the planets according to their distance to the Sun (from the nearest one to the most distant). **Extract planets' properties from the assigned expert interview**. (Team A members' interview contains planets' order and some properties (without names) and team B's interview informs about planet's names and some properties.) | *expert_interview |
| | Teacher | Activity control | You have privileged access to the expert interviews | *expert_interview |
| Subproblem | Expert group | Empty! (NOT VISIBLE) | | |
| | Teacher | | | |
| Global problem | Jigsaw group | Global discussion | **Cooperate with the other team using a forum** to exchange information. **Each team can use a chat** to discuss. | *forum *chat *expert_interview |
| | | Solution proposal | **Fill in** (individually) **a questionnaire** about the planet classification. | *questionnaire tool |
| | Teacher | Activity control | You have access to the forum, and you can participate to discussions. You can also add new clues in any expert interview. You have to nominate a winner according to the questionnaires. | *questionnaire tool *chat *expert_interview |

Table 1: Summary of the UoL (based on JIGSAW CLFP) created using Collage

Concluding, the main aspects of the script can be modelled with Collage. There are only two details that cannot be rigorously authored. It is not possible to specify that "the teacher decides when the exchanges are finished" because the IMS LD elements that enable its computational representation (the teacher makes the activity visible setting a property or the act is completed only when the teacher finishes her/his activity) are not included in the JIGSAW-based template. However, it is possible to add the necessary IMS LD constructs to the script using Reload LDE or another non-constrained IMS LD compliant editor (even a plain XML or text editor). Similarly, an additional activity to describe that "the game finishes when a winner is nominated" cannot be added in the current version of Collage. In any event, this can be solved by simply using the forum for the nomination of the winner or by manually modifying the script. Instead of using a new activity to model this requirement, it is possible to design it as the feedback (viewing a property value) of the solution proposal activity of the last phase of JIGSAW.

### 3.1.2   The UoL created with Collage can be enacted using Gridcole

Gridcole system, whose prototype includes the CopperCore IMS LD engine (Vogten, Martens, Nadolski, Tattersall, van Rosmalen, Koper, 2006) and other modules in charge of integrating the external tools (Bote-Lorenzo, 2008), is capable of interpreting the UoL created using Collage. Making use of the UoL and an external binding document that indicates which groups need a different instance of a service, Gridcole provides the required service instance to users. Therefore, this system guides users through the flow of collaborative learning activities integrating the tools needed to support them. In this scenario (see table 1) the selected collaborative tools are the GSIC-UVA chat, Synergeia (a shared repository for the interviews and the forum [3]) and the Quest tool (for the final questionnaires, (Gómez, Rubia, Dimitriadis, and Martínez, 2002)). Figure 4 is a screenshot of Gridcole giving access, to a student of team A, to the repository folder that contains the expert interview assigned to her/his team. The top left frame of the interface indicates the sequence of activities that should be performed

by the user. If the user clicks on the name of the activity, its description is shown in the right frame. Also, in the bottom left frame students can see the documents and tools available for the support of the activity (in this shared repository). When the user selects a web-based tool or a document, the selected resource is provided by the system using the right-hand frame.
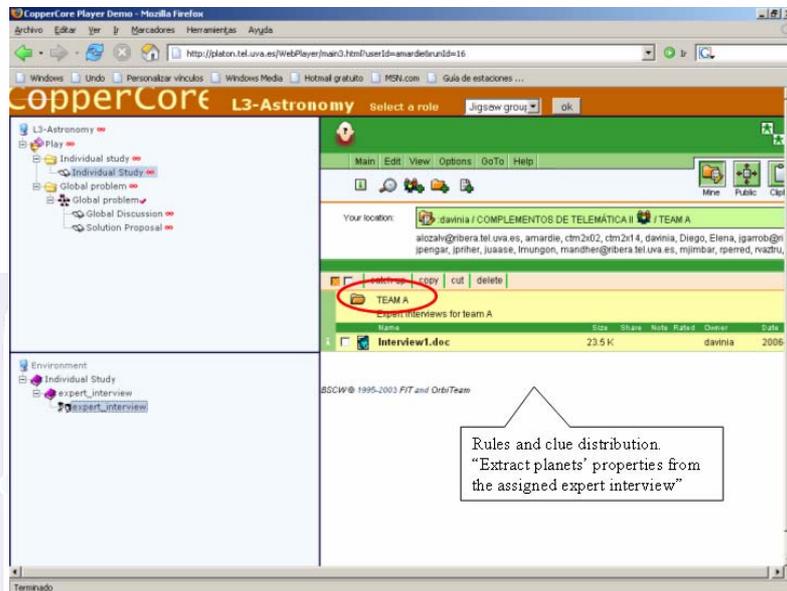


Figure 4: Enacting the Planet game script created with Collage using Gridcole integrating a shared repository: clue distribution

Figure 5 shows how Gridcole makes available the common forum for exchanging information with the other team and the particular chat room that students can use to discuss with their team's members. In this case the integrated chat is a grid service-based tool which is installed, configured and launched (as a Java client in the user's machine) by Gridcole.
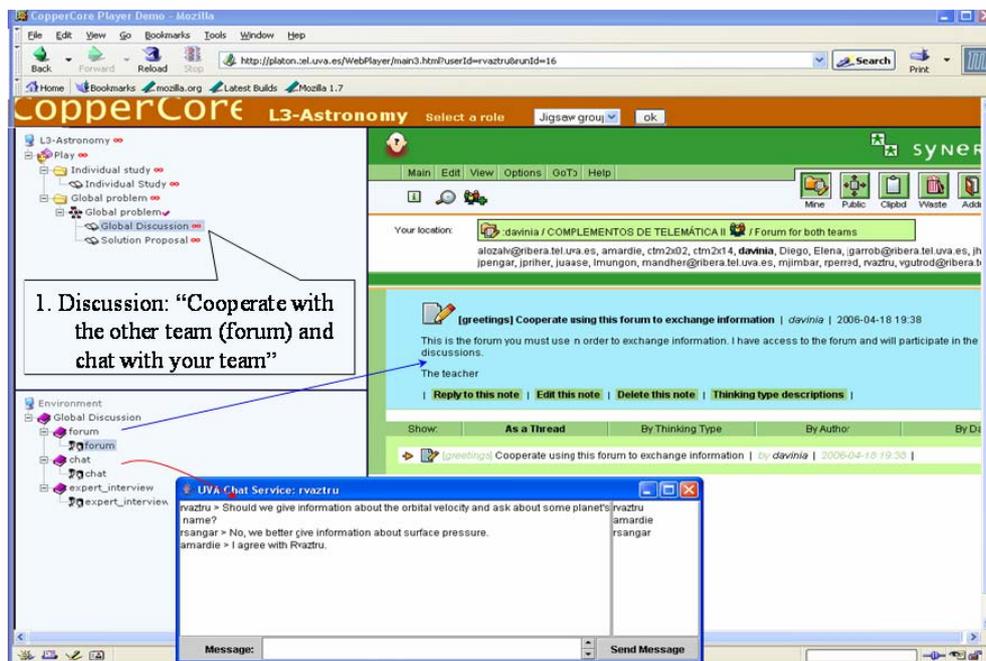


Figure 5: Enacting the Planet game script created with Collage using Gridcole integrating a discussion forum and a chat: cooperative phase

Similarly, Gridcole provides direct access to the questionnaire published in Quest in such a way that students can use immediately the tool to indicate the answer of the game (figure 6).



Figure 6: Enacting the Planet game script created with Collage using Gridcole integrating a questionnaire tool: proposing the solution

## 3.2   Comparing with other approaches

### 3.2.1   Computational representations

It is straightforward to compare the author's proposed solution with related approaches defended in the workshop since they are applied to the same example. In this respect the contributions of (Tattersall, 2006; Paquette et al., 2006; Amorim et al., 2006) confirm the statement that IMS LD supports the implementation of this script, with the interoperability advantages that it implies. However, it is worth mentioning that the way of modelling the script using IMS LD notation diverges. This shows the many possibilities of the specification which is flexible enough to describe scripts with the same core design but with different details open to author interpretations, intentions, authoring tool design constraints or features of the available runtime systems.

For example, while (Tattersall, 2006; Amorim et al., 2006) and the Collage-based design use two IMS LD acts to model the script, (Paquette et al., 2006) employ four acts. Another example refers to the definition of roles. The Collage and Gridcole solutions do not follow the approach adopted by the other participants using IMS LD that consists of defining a role for each team at design time (Tattersall, 2006). In contrast, the JIGSAW-based template, used as a basis to create the script with Collage, undertakes a challenge that is also pointed out by Tattersall: "*One interesting challenge with respect to the approach is to generalize to several teams depending on the cohort size. As the approach stands, the number of roles is fixed, but a solution which allowed any number of teams would clearly require a different approach.*" In effect, only one role (*expert-group*) is defined in the UoL created with Collage and the two occurrences of the role (*Team A* and *Team B*) are determined when the script is instantiated. This is a possibility enabled by the attribute "create-new" set to "allowed" of the IMS LD role that incorporates the JIGSAW-based template as implemented in Collage. The determination of the actual number of groups at instantiation time provides flexibility and generality, however a service making available the clues to users depending on their group is necessary. In this respect we include a reference to this service at design time (shared folder with the interview in a repository) generalizing the way of specifying a collaborative tool. Using external tools the Collage and Gridcole approach also takes advantage of their special functionalities (e.g. adding comments to the expert interviews) and of

the familiarity that users may already have with the tools. Only few details cannot be formally expressed using the LD notation itself, such as the automatic random allocation of participants to groups, which on the other hand it is not required by the scenario. In LAMS "*the "Grouping" tool – set to divide students randomly into two groups (Dalziel, 2006).*"

### 3.2.2    Design

Tattersall uses the basic design procedure recommended in (IMS, 2003) and Reload LDE to create the UoL representing the script (Tattersall, 2006). As he comments (in the discussion session, recorded in the video), "*Reload and CopperCore are tools at the notation level […] it is nice to see other approaches here ... that makes easier to use LD...*" Again, the Collage approach is pioneering in this trend: hiding the concepts of IMS LD by providing a design process that offers templates based on sound educational practice. The authors of LDL (and the associated Learning Design Infrastructure, LDI) also accept the need of this kind of design processes implemented in authoring tools: "*The building phase is not completely achieved yet in the current version of LDI. Indeed, a user-friendly scenario editor destined to the teachers is required...* (Martel et al., 2006)." The possibilities of MOT+LD (Paquette et al., 2006) to specify knowledge/competency are rich; however the target users of MOT+LD are learning designers familiar with the specification and its capacity to represent CSCL scenarios is limited. CPM provides a rich graphical formalism to designers of PBL situations from the initial requirements phase to the detailed design steps (Nodenot et al., 2006). However, though it is an independent language of IMS LD (and other EMLs), UML-based CPM is also intended for users with advanced technological skills.

Collage implements a design process that fosters the reuse of patterns capturing successful CL flow structures. However, other types of reusable elements are possible in general (Hernández-Leo et al., 2007a). Reusable elements can be of different level of granularity - exemplars (ready-to-run) vs. templates (incomplete exemplars, such as the Collage patterns) - and completeness - chunks (portion of exemplar) vs. building blocks (incomplete chunks, such as the LAMS activity tools). Systems providing different types of reusable elements that can be assembled or combined will offer further design functionalities to the user. The very easy way of assembling LAMS activity tools is complementary to the refinable Collage templates. Building blocks similar to LAMS activity tools could be assembled in Collage templates to refine its activities or as new ones that enlarge the learning flow. Adding different types of reusable elements and constrained connecting rules between them to the design process behind Collage would provide more design options without endangering the principles of the reused element. However, not only do design constraints limit flexibility at design time, the available enacting system can also influence this effect. This idea is also pointed out by Dalziel (in the video), "*...quite different approaches of modelling the scenario […] limited to the features of the available tools,*" and discussed next.

### 3.2.3    Enactment

There are two different perspectives in the approaches participating in the workshop that include execution environments. LAMS is an integrated system for authoring and execution, while the approaches of (Tattersall, 2006; Amorim et al., 2006; Martel et al., 2006; Hernández-Leo et al., 2006b) employ different systems for design and enactment. Besides, Gridcole and current developments around CopperCore advocate the integration of external tools according to service-oriented technologies.

The first conclusion in this respect is that the differences in the enacted scripts of the different approaches are influenced by the available tools. This conclusion supports one of the ideas behind the design of Gridcole: having a limited set of tools constrains the teacher when designing the educational scenario. Teaches may end using some tools because they are available in an LMS, but they may prefer using other tools which satisfy in a better way the needs of their educational situation. (Tattersall, 2006) indicates that service integration (according to a Service-oriented Architecture) into Coppercore-based environments can solve the problem of limited availability of tools. This approach is also

implemented by Gridcole system with especial emphasis in CSCL requirements (integrating CSCL tools according to the user's group) and the possibility of using tools requiring super-computing capabilities potentially available in a computational grid. This service-oriented approach is more general (though not very different and probably more ambitious) than the solution of LAMS V2.0 to tackle this problem. The approach of LAMS consists on a new architecture based on a "tool contract" that specifies the requirements for activity tools that can be integrated in LAMS.

On the other hand, an aspect that is not satisfactorily covered by current IMS LD tooling is user-friendly administrative facilities needed when instantiating UoLs. As Tattersall (2006), we use the "command line" Clicc functionality of Coppercore to manually associate users to groups (in our case also to create the occurrence of groups). In contrast, LDI includes such facilities so that they can be easily used: "*This consists in putting at the teacher's disposal an interface allowing him to choose the participants, to attribute the roles, and to select the services and contents required by the scenario...* (Martel et al., 2006)" On the other hand, further advances regarding enacting UoLs are envisaged. They are related to a tighter integration of design and enactment systems to increase flexibility at runtime: "*A tighter integration of design-time and runtime perspectives on IMS LD will occur, so that designs can be critiqued and improved on the basis of log data* (Tattersall, 2006)".

### 3.2.4    Re-use/adaptation

Most of the approaches participating in the workshop declare that the resulting script can be easily re-used by changing the content associated to the activities: "*Though this UoL is planned for a study of the solar system, it can be reused for other subjects by changing document titles and associating different item locations* (Paquette et al., 2006)." The contribution of the authors' approach is however that Collage already allows the reuse of a general structure (JIGSAW CLFP). Besides, since the JIGSAW-based template implemented in Collage specifies the groups in a general manner (the actual groups need to be created at instantiation time, allowed by the use of the IMS LD "create-new" attribute), the possibilities of re-using the script increase (forming more teams or several (jigsaw) groups, i.e. mixing different members of team A and team B for cooperating in different forums. That would allow, for example, the study of several negotiation strategies. In both cases it is only necessary to create more instances of the corresponding roles). The idea of using the structure of the script as a template is also pointed out in (Tattersall, 2006), "*… the Unit of Learning can easily be turned into a template by modifying the resources to address a different topic […] In essence the Unit of Learning could be used for many different areas.*"

## 4    Conclusion and current work

This paper has described the authors' proposed solution for the ICALT 2006 workshop "Comparing educational modelling languages on a case study". Also, the paper has detailed how the results of the workshop itself have been analyzed under the considerations of an evaluation case study aimed at answering a set of questions regarding the authors' research. It is noteworthy that the case study showed how the authors' proposed solution for designing CSCL scripts using the pattern-based approach, enforced by the Collage tool and enacted by the Gridcole system succeeded in implementing a CSCL situation posed by a third-party. Other case studies have been carried out in workshops with teachers where they have used Collage to create their own scripts according to their educational requirements and situations (Hernández-Leo et al., 2007c). Each of these scripts is different and represents challenges drawn from real practice. Additionally, and when compared with other research initiatives presented at the ICALT workshop, the authors' proposed solution showed to have significant advantages in terms of facilitating the authoring and reuse (thanks to the create-by-reuse approach inherent to the CLFPs (Hernández-Leo et al., 2007a)), as well as enabling the enactment (thanks to the functional flexibility offered by the tailorable nature of Gridcole).

The comparison among the different works presented at the ICALT 2006 workshop refers to the status of the proposed solutions as of 2006, including that presented by this author. Improvements to those proposed solutions presented in the other papers of this special issue have not been considered as the

main goal was to analyze the data derived from presentations and discussions that took place at the workshop itself. Regarding the authors' proposed solution, several improvements have already been made to the Collage and Gridcole tools. For instance, one complementary tool to Collage (called InstanceCollage or iCollage, Hernández-Gonzalo, Villasclaras-Fernández, Hernández-Leo, Asensio-Pérez and Dimitriadis, 2008) has been developed so as to assist educators in the task of assigning students to groups at instantiation time. It provides an intuitive GUI using similar visualizations to those employed in Collage. The possibility of dynamically changing the assignation of students to groups at runtime is an important research line of future work. Additionally, Collage itself has been upgraded with new CLFPs and new ways of combining them. Furthermore, the design process implemented in Collage is being extended so that it explicitly considers assessment aspects (Villasclaras-Fernández, Hernández-Leo, Asensio-Pérez, and Dimitriadis, in press). With respect to Gridcole, its architecture has been complemented with the functionality of automatic exchange of learning outcomes from different activities among groups (Palomino-Ramírez, Bote-Lorenzo, Asensio-Pérez, Dimitriadis and de la Fuente-Valentín 2008) and with a semantic searcher of CSCL tools that supports the teacher when looking for services to be integrated by Gridcole (Vega-Gorgojo et al., 2008). All these works are part of an ongoing effort devoted to the development of educator-friendly and tailorable technological settings covering the whole lifecycle of flexible scripted collaborative learning scenarios.

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## 6 Footnotes

[1] The ready-to-run IMS LD compliant Unit of Learning: http://gsic.tel.uva.es/~dherleo/icalt06workshop/l3astronomy.zip

[2] Jigsaw CLFP: http://gsic.tel.uva.es/~dherleo/clfp/jigsaw-en/

[3] *Synergeia Website*: http://bscl.fit.fraunhofer.de/ (last visited: May 2008)