Adopt & Adapt: Structuring, Sharing and Reusing Asynchronous Collaborative Pedagogy

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Abstract: This paper presents a new approach for creating and conducting *structured asynchronous collaborative activities* and incorporating them in the existing instructional setting for all subjects and levels. CeLS is a web-based system designed to create and reuse Activity Structures; runable formats reflecting various collaborative instructional strategies e.g., creating and analyzing a common database, reaching an agreement, peer-product evaluation, contest, creating a group product. The unique feature in CeLS's design is its ability to use learners' products from previous stages and to conduct complex, multi-stage, structured activities. CeLS provides a sample of content-free Activity Structures and a searchable domain of all the activities that were implemented with students. Teachers can explore these examples, adopt them for personal use and adapt their structure and content to suit their specific needs. If none of the existing pre-designed resources seems to suit the needs, they can create new structures using basic building blocks.

Introduction: The Challenge

One of the declared unique advantages of technology for teaching and learning is its potential to support collaborative learning (CL). The first generation of e-learning, and systems designed to facilitate its implementation on a large scale, has regarded learning as an individual process mainly based on content resources. As a result, the corresponding standards developed for Learning Management Systems (LMS) focused on the organization of the resources. Additional tools for conducting free communication with the teacher and between peers (discussion group boards, chats, groupware) were provided, but these elements were not integrated with the other parts of the LMS.

New specifications for Instructional Management Systems based on the concept of "Leaning Design" (IMS-LD) have emerged only recently (Hummel et al., 2004). The IMS-LD engine (CooperCore) and editor (RELOAD) specifies a template that enables creation of synchronized and personalized workflow through a course. New management systems are developed according to these specifications, such as COWS (Peter & Vantroys, 2005) and Gridcole (Bote-Lorenzo et al., 2004). The new specifications support learning scenarios and the management of the activities assigned to students during a course, but they do not yet address the more complex needs of incorporating asynchronous collaborative activities into the instructional process.

Collaborative activities have existed and were successfully implemented by teachers well before the era of e-learning. These activities are not just free group discussions, but instructional strategies that comprise of *well-defined structures*, consisting of *distinct stages* that are *interconnected and based on each other* in various ways. Asynchronous collaboration is nowadays performed using generic tools such as group discussion boards or wikis (Cunningham, 1998). While these generic tools offer effective means for free communication and for collaborative editing (Guzdial et al., 2001), they are not very effective for performing *structured* collaborative activities such as the "scripts" presented by Dillenburg (2002). These needs led scholars to look for other solutions that will support online structured collaborative activities. One way to enhance the effectiveness of CL systems is to reify the scripts in the interface of the learning environment (Dillenburg, 2002). An example of such approach is the C3MS, that uses collaborative portal sites (Schneider, 2004) enabling the teacher to create "pedagogical collaborative scenarios" by combining existing "bricks" such as wikis, forums and interfaces designed for specific purposes.

The limitations of the present specifications for the design of environments that will enable the *execution* of complex CSCL scripts are discussed in the Kaleidoscope report (Hoeksema, 2004). These limitations are related to insufficient support to the modeling of groups, artefacts, dynamic features, complicated control flow and varied forms of social interaction. More specifically, when the different environments used to facilitate the actions involved in a pedagogical scenario are not integrated, it is difficult to follow and to support the flow of information in order to

reuse products created in previous phases. Since pedagogical scripts may be endlessly varied, complicated control flow relating actions to participants is crucial, in order to allow flexibility of the instructional design. Some of these issues were addressed by LAMS, a new learning activity management system that enables creation, customization and reuse of collaborative sequences (Dalziel, 2003).

Our goal was to design an *executable* XML-based model that will confront some of these challenges and will provide teachers with a practical tool for creating and conducting complex *structured collaborative activities* in the actual educational setting. Any attempt to design a collaborative learning system is subject to trade-offs (Dimitracopoulou, 2005). Our major concerns were: usability, flexibility, reusability and sharing between teachers. The design was primarily aimed at asynchronous activities that can be performed in large groups (classes). In this paper we shall present the CeLS (Collaborative e-Learning Structures) framework and general structure while focusing on its unique features.

CeLS: Collaborative e-Learning Structures - The Building Blocks

CeLS is a web-based system consisting of a server-side run-time engine and a client side Activity Editor. An additional server module is responsible for administrative aspects. An Activity Structure (AS) may include any number of stages of interaction between a learner and the system. Each stage comprises of any combination of distinct objects of *four different types* (Figure 1):

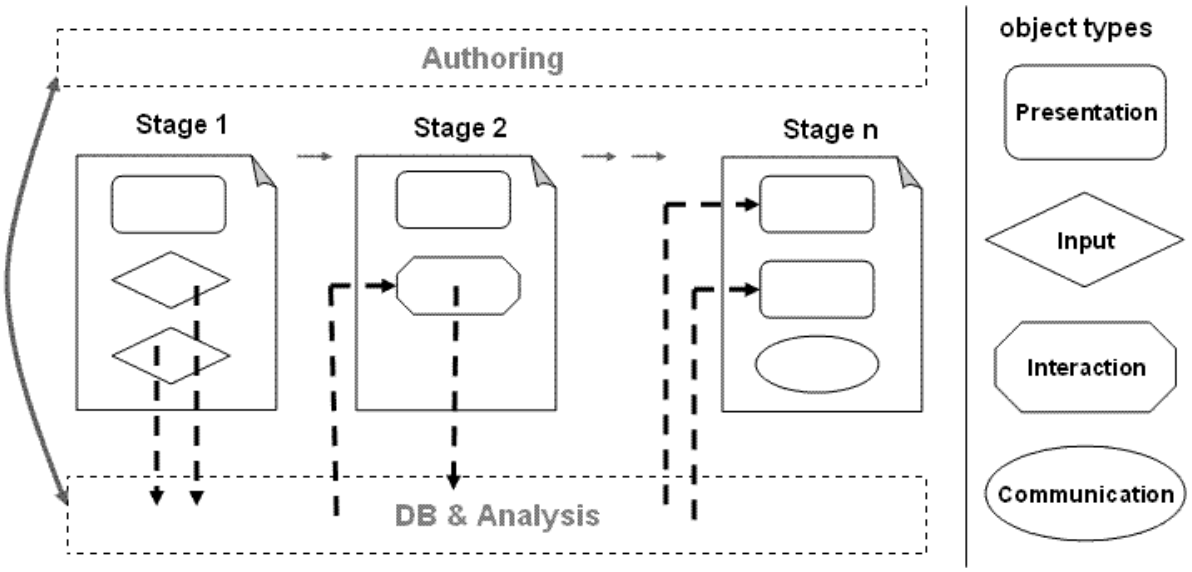

Figure 1: Schematics of an Activity Structure.

- **Presentation** objects are passive elements used to present information of any kind (text, hyperlink, media). This information can be provided by the teacher or consist of learners' *products* from previous stages. A product can be an organized collection of distinct items contributed by different participants (identified or anonymous) or a single item that results from the combined action of a group.
- **Input** objects are interfaces that allow the participant to submit *new data* to the system (text, hyperlinks, media or any kind of attached electronic file or as voting on various scales).
- **Interaction** objects are interfaces that allow participants to *interact with products* created in previous stages, in various ways: by grading, ranking, categorizing and editing or responding to these products via text or graphic manipulations.
- **Communication** objects are interfaces that allow participants to freely communicate with each other or with the teacher.

Each object has properties that can be adjusted by the author. Some properties are generic, for instance, if the completion of an object is mandatory or not, and others are particular to the object or to its type, for instance, maximum or minimum text length or the vocabulary used for a Text Input object.

These basic building blocks are merely technological and do not carry any pedagogical meaning. It is only their *combination* as an Activity Stage and or Activity Structure that creates such meaning.

An activity stage can consist of *any combination* of objects of various types. The functionality is determined by attributing properties related to groups to the stage or to specific objects, so that different participants may encounter different information and perform actions on different data items during the same activity stage. As a result, the process represented by the whole activity is not actually linear, though it may seem linear to each of the participants. A stage may be assigned "start" and "end" times, advance upon completion or according to other conditions defined by the author of the activity.

Groups and Subgroups

The CeLS master group is a class. Groups can be merged to form 'communities' or divided to *families* of subgroups representing subjects assigned to the subgroups or roles played by the subgroups. A family of subgroups has specific properties such as maximum and minimum number of members in a subgroup, number of subgroups, their generic or particular names. An Activity Structure may *use different families of subgroups* in its stages. For instance, in a Jigsaw structure, family A may represent the Projects groups and family B the Experts groups. The first stage of such activity can be performed within subgroups of family A, the second stage is performed within subgroups of family B, the third stage is performed within subgroups of family A using the products of families B, and the last stage is performed in the master group (class) using the products of family A.

The subgroups are only organizational definitions and they *do not have to be populated* (assigned with members) in order to create or to edit an Activity Structure. These organizational definitions are an *integral part* of the Activity Structure and are kept intact when the activity is duplicated for reuse with different learners. Assigning specific students to groups and subgroups can be done just before the actual use of the Activity Structure with students.

Students can be assigned to subgroups in one of three ways: randomly by the system, manually by the teacher, or by self registration within a specified period of time. These options are designed to suit different needs: Automatic population is useful for activities in which participants' identity is not relevant, and self registration suits activities that include face to face work. Manual teacher control is always available and can be applied along with any of the other options.

CeLS Author: Managing Activity Structures

Figure 2 offers a glance at the CeLS authoring capabilities. *My Activities* allows teachers to access their own activities (preview or participate), to manipulate them (edit or duplicate), or to view students' contributions and follow their actions without interfering. Groups and subgroups creation is handled by the *my Groups* options. The definitions of an activity can be edited after the activity has started, enabling the teacher to introduce modifications and adjustments 'on the fly', by adding or changing objects in a stage or adding stages. *Activity Structures* present the teacher with a collection of pre-defined generic structures. These Structures are content-free skeletons and include recommendations for their customization to various needs and settings. The *Sample Activities* option provides a searchable domain of all the activities that were *implemented* with students by the system users, in all institutions, contents and levels. Teachers can view and explore these examples, adopt them for personal use by duplicating them, then adapt their structure and content to their specific needs. If none of the existing resources seems suitable, the teacher can create a *New Structure* using the basic building blocks.

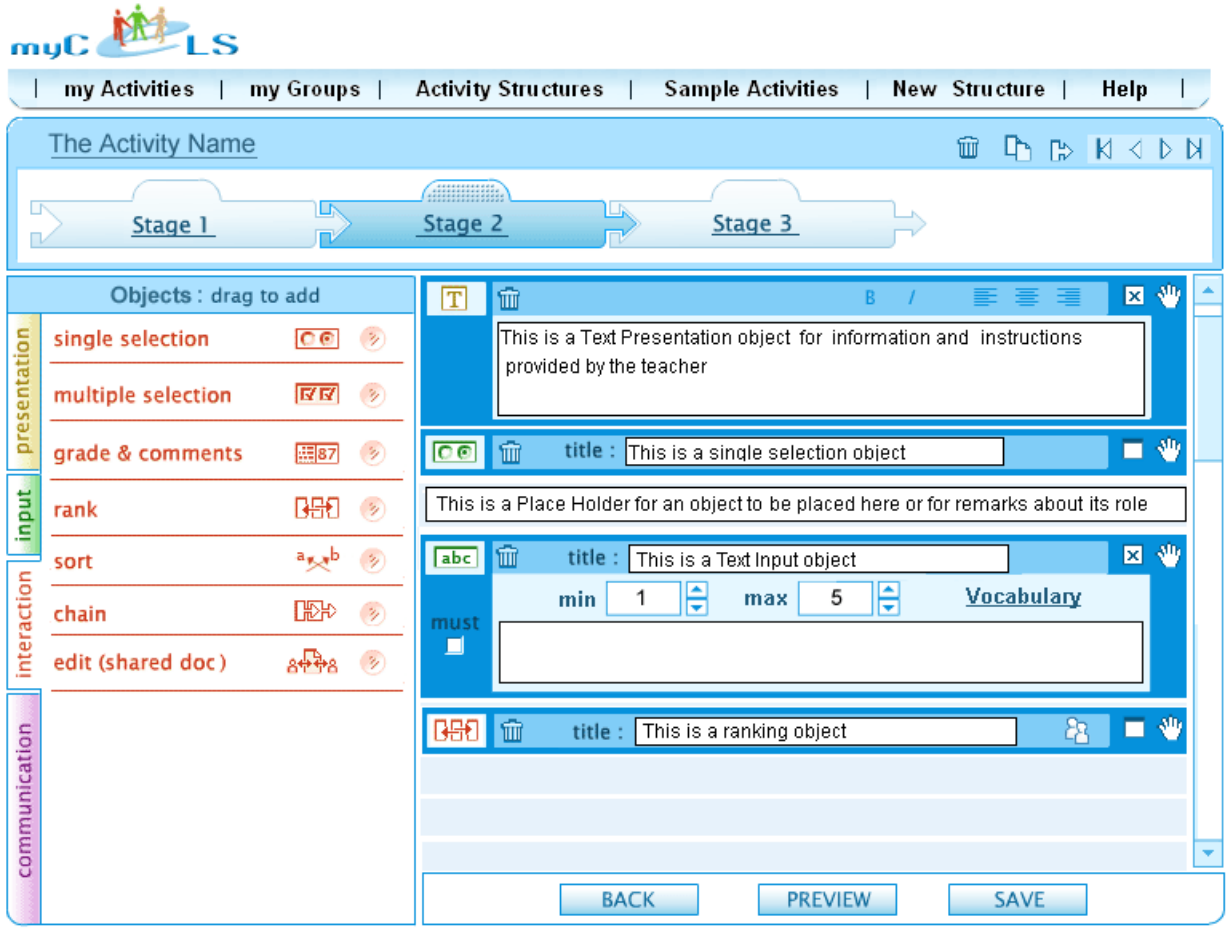

Figure 2: The CeLS Activity Editing. Sample screen showing some of the Interaction objects.

The Student Interface

The student interface is created according to the student's identity, enabling learners to access activities to which they are enrolled. The interface is kept as simple as possible, so that students can focus on the task at hand. The necessary instructions and information are an integral part of the activity stage. Previous peer products are gathered in one place (within Presentation or Interaction objects) in an organized manner, preventing the need to open and scan many messages. Figure 3 shows a sample screen from the second stage of an activity conducted in a photography course (Abrahamov & Ronen, 2005). In the first stage the students were challenged to create photographs with interpretative meaning and submit their products to the system. This stage used a "post before view" approach (Duffy et al., 1998). In the second stage each student was presented with three anonymous peer products out of the 25 items submitted by the class, and was asked to analyze them according to given criteria. In the following stages the analyses of each of the photos were presented, compared and discussed.

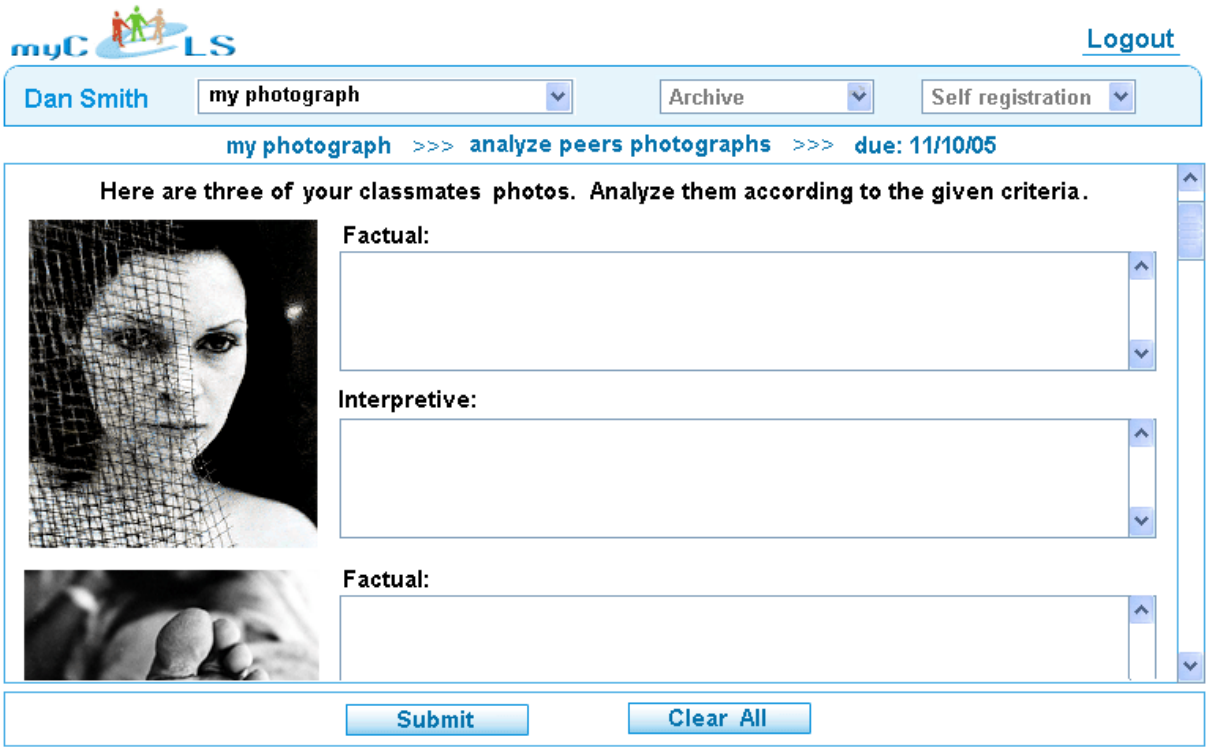

Figure 3: A sample student screen of an activity stage that involves evaluating peers' products.

Sharing and Reusing Activities

CeLS Activity Structures are not pre-programmed entities but are created by a client-side mechanism related to the system metadata. An Activity is tagged by three types of metadata:

- **Descriptive metadata provided by the author**: author identity, activity name, instructional goals and specific remarks and recommendations.
- **Runtime created metadata**: This metadata is *automatically produced* when the Activity Structure is defined or edited, for instance: the number and order of stages and their contents, groups' definitions and their attribution to each of the activities' objects.
- **Informational metadata produced by the system:** This data is extracted from the actual implementation of the activity with students, reflecting its history and evolution: how many times it was used, where and by whom, in which subject matter domain, how many students had participated, and how the structure was changed by users during its "life".

This design facilitates sharing and reusing of Activity Structures. A teacher can search for existing activities according to their content domain, target population, instructional goals, group size, and other characteristics included in the metadata. The teacher can view the activity's history and even contact the authors for personal advice.

First Experiences

CeLS prototype was piloted during 2003-4 in Israel by 25 teachers in 48 courses (1600 students) conducted in 9 universities and colleges, 5 schools and 4 in-service teacher courses. Class size varied between 15 - 64 students. Activities were also tested in a 'community' formed by 5 classes (30 students each) from three different schools. The structured asynchronous activities were used in a variety of subjects including: science, technology, education, medical professions, philosophy, IT and art. The activities tried were variants of AS developed for strategies such as: creating and analyzing a common database, conflict, contest, peer evaluation and peer product evaluation. The length of the activities ranged between 1-8 weeks. In some of the courses the system was used for conducting one activity and in others for up to 10 activities during one semester. Our preliminary findings indicate that overriding motivation for selecting and adapting an AS is the core structure rather than parameters such as age level and

content domain. For instance, a structure originally created for elementary school geography was adopted, transformed and used in a university education course.

Challenges of Sharing and Reusing Structured Collaborative Activities

The very flexibility provided by CeLS may become a double-edged sword. A large number of available structures may be confusing or even overwhelming; the limited prototype tested with a small group of teachers revealed more than 100 variants of several basic structures. How can we cope with this challenge, if, as our pilot study suggests, the activity's characteristics that may interest teachers are not necessarily the age group or the subject it is used for, but aspects related to the specific instructional design offered by an activity. Tagging an activity with a particular name is evidently ineffective. Classifying the activities by categories representing major instructional strategies, such as conflict, competition, jigsaw etc., may be a starting point. Such rough classification is not satisfactory for a large collection, since each of these categories can be implemented in different ways with many variants. Furthermore, an AS developed in CeLS may offer any combination of these instructional strategies. The first attempt in this direction was to create different types of sub-categories. An a-priori detailed classification may be useful for anticipated activities but it does not offer a solution for new structures that are developed by users and automatically added to the system database. The classification should be clear and usable to teachers and immediately related to their pragmatic needs. These needs are not necessarily related in the teacher's mind to learning theories or instructional strategies, but may possibly refer to other superficial characteristics. A typical example was a physics teacher looking for activities dealing with visual representations, while this approach eventually led her to find, then effectively adopt and adapt an activity created for an art course. Another challenge lies in following and making sense of the variations of a structure, since even a small detail in the design can make the difference (Kali & Ronen, 2005). One of our challenges is to define an effective method for categorizing the existing activities, as well as the ones that are continuously added, that will allow a teacher to take advantage of peer experience. This effort is based on research currently being conducted with teachers.

Concluding Remarks

We have presented a modest attempt to develop a technological approach and to design a tool that enables teachers to address some of the endlessly varied and complex needs of running structured asynchronous collaborative activities. CeLS is not a comprehensive LMS. It is currently used in conjunction with available LMS (Britannica, Moodle) or as an independent environment. It does not provide solutions for all types of online collaborative activities nor is it meant to replace groupware or collaborative environments designed for learning in specific subject domains. At this point we have not attempted to track or automatically support the individual learning process, though such mechanisms could be added. Rather it is a tool designed to *empower teachers*, enabling and encouraging them to incorporate online collaborative activities into their daily practice by providing them with a flexible tool and many examples that they can *explore*, *adopt* and *adapt*. The first cadre of CeLS's users are teachers, at all levels and subject matter domains, who are already trying to use the available tools for conducting asynchronous structured collaborative activities in their courses. CeLS has enabled them to design and implement activities that were very difficult or impossible to handle before. Judging by the teachers' reactions, we may expect many others to follow.

At this point we neither restricted, nor imposed any specific instructional design. An activity that may seem non-collaborative according to the common definitions of CL (Dillenburg, 1999) may still be pedagogically valid and effective in various ways. Dealing with aspects of students' and teachers' learning, that does or does not occur via the use of CeLS is beyond the scope of this paper. The research that accompanies the system's use will eventually reveal whether and how it affects students' learning and the effectiveness and popularity of the various instructional designs in diverse settings. The most interesting question for us is if, and how, the availability of such facility can contribute to the *professional development of teachers*. The findings will present more directions for improving the design of the next versions and a deeper insight into the potential and challenges of using technology for conducting complex asynchronous structured activities.

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