Learning to Learn Together through Planning, Discussion and Reflection on Microworld-based Challenges

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Abstract. This demonstration will highlight the pedagogy and functionality of the Metafora system as developed by the end of the second year of the EU-funded (ICT-257872) project. The Metafora system expands the teaching focus beyond domain-specific learning to enable the development of 21st century collaborative competencies necessary to learn in today's complex, fast-paced environment. These competencies — termed collectively as "Learning to Learn together" (L2L2) — include: distributed leadership, planning / organizing the learning process, mutual engagement, seeking and providing help amongst peers, and reflection on the learning process. We summarise here the Metafora system, its learning innovation and our plan for the demonstration and interaction session during which participants will be introduced to L2L2 and Metafora through hands-on experience.

Keywords: CSCL, learning to learn together, planning, discussion, microworlds

1 Introduction

The EU funded Metafora project (ICT-257872), launched in July 2010, is focusing on the development of a Computer-Supported Collaborative Learning (CSCL) system to scaffold a process referred to as "Learning to Learn Together" (L2L2). Recognising that collaborative work and training of meta-cognitive skills are better practiced and learned in environments where students face serious and difficult challenges, Metafora's pedagogical designers organize each Metafora classroom scenario around one of several lengthy or real-world challenges. The challenges encourage students to interact with microworlds (including simulators and games) where they either build digital artifacts (models) that allow them to engage in collaborative problem solving or simply test hypotheses or theories related to the challenges. The pedagogy behind the Metafora project and the activities that can be undertaken have been described in detail in project deliverables[6] and other publications [1–4]. As a brief summary, we first acknowledge that L2L2 is a complex competency, not easily decomposed into a clear-cut division

[6] See http://www.metafora-project.org

of independent underlying skills. However, the Metafora project has identified several key skills that are necessary to any process in which students are learning together, and on a higher level, learning how to become better group learners. These competencies include: distributed leadership, mutual engagement, help seeking/giving and reflection on the group learning process.

We present in Section 2 how the Metafora platform and tools are designed to support the L2L2 process while Section 3 summarises our learning innovation. Section 4 offers our plan for the demonstration and interaction session.

2 The System

2.1 The platform

The Metafora platform (shown in Fig. 1) serves both as a toolbox of various learning tools and as a communication architecture to support cross-tool interoperability. The tool-box facet of the system provides a graphical container framework in which the diverse learning tools can be launched and used in similar ways as their stand-alone usage. Basic functionalities that are globally available are user management (login / logout, and group membership for both local groups of students sitting at one computer as well as remote, collaborative groups), a chat system to discuss and organize work between group members, and a help request function that is present across the entire platform. We now describe the various tools that reside within the platform container.

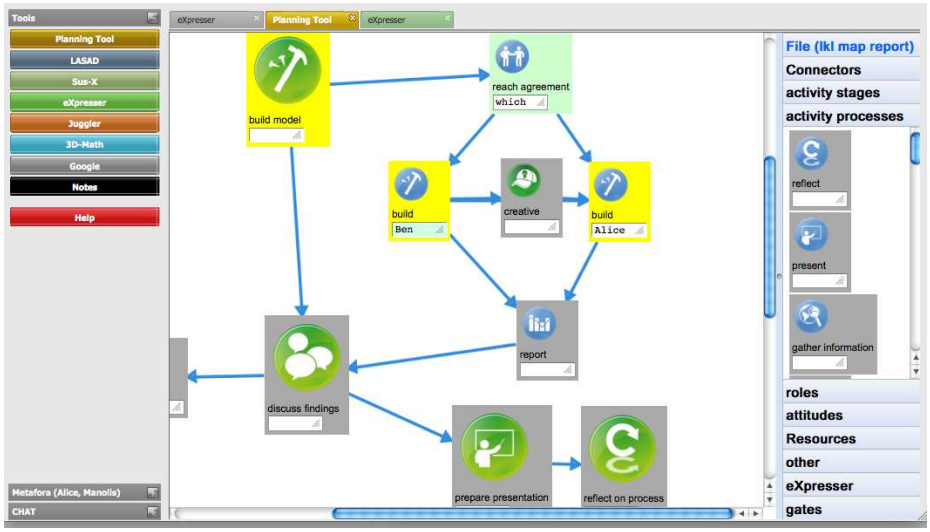

Fig. 1: Fig. 1: Screenshot of the Metafora platform with several learning tools opened (see tabs on the upper border). The current focus is on the planning tool (started activities are marked yellow, finished activities in green). In this example the teams of Ben and Alice are each building their own model in a microworld.

2.2 The planning / reflection tool

The planning/reflection tool (see Fig. 1) is a web-based application offering a visual language for planning, enacting, and reflecting on Metafora learning activities. Even though it is built as a stand-alone web application it is central to Metafora as it acts as an entry gate and a pivot to the other tools. Students can create or modify plans for facing a challenge. Their plan then provides a method for students to enact their planned steps, offering an automatic login to the various tools for their planned activities, and providing the work context needed to tackle specific tasks within the challenge. The tool acts as a shared space where students mark activities as started and finished, thereby making the plan also a visual representation of their achievements and current status. In that sense it also acts as a shared artifact for reflection on students' L2L2 process.

2.3 Discussion tools and referable objects

Metafora provides discussion tools to allow general communication and collaboration for teams, but also aimed specifically to support the L2L2 process by allowing discussion and argumentation spaces to integrate artifacts created in other tools. Two discussion tools serve different purposes. First, the chat tool offers a quick and ever-present space for students to gain each other's attention and share informal thoughts in situ as they are working with any of the Metafora tools. Second, LASAD [5] offers a more structured approach to discussion through argumentation graphs (see Fig. 2) which has been shown to improve discussion and argumentation skills [6].

Both the chat functionality and the LASAD system are customized to display and offer links to *referable objects* from other tools. These referable objects are artifacts shared from other tools that can be viewed (text or thumbnail images) as components of the discussion, but can also be accessed in the context of the original creator tool through return links (see an example in Fig. 2).

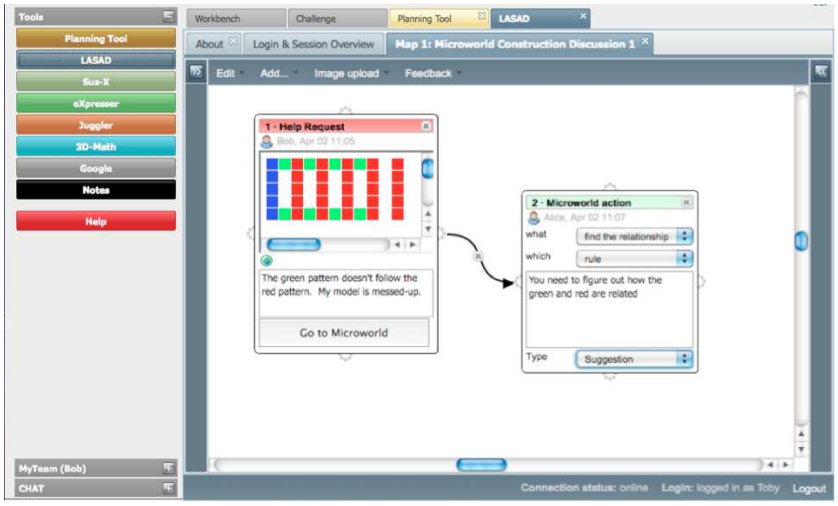

Fig. 2: A sample discussion map in LASAD. A referable object from a microworld (eXpresser) is embedded as a thumbnail within a Help Request box.

The requirement behind referable objects emerged from early experimentation with the system and was supported by previous related research e.g. [7]. By using referable objects, students can include planning cards or microworld objects in their discussion without the need of anaphoric or deictic language. This allows continuous dialog that is explicitly linked with and contextualized by the students work in other tools. This kind of dialog promotes L2L2 activities such as offering help to one another, and reflecting on ideas in an ongoing processes of negotiation of new meaning for the referenced artifacts.

2.4 Analysis and Visualization

As each tool stands as an independent learning application, these systems offer their own analysis of student work. This automated analysis ranges from low-level activity indicators (such as indicating the creation or modification of artifacts) to high-level analyses (such as identification of whether a student is struggling). The intelligent components of the tools that create these various analyses report them to a centralized analysis communication channel for the entire Metafora platform. A central analysis agent can then monitor this channel, and offer higher-level analysis of student work. Defining and creating these high-level analyses is an on-going effort based on prototypes and Wizard of Oz experimentation. The theory behind this work and first implementation steps can be seen in more detail in [4]. This analysis information is used to offer both direct feedback to students (through a notification system) and useful summary information to students and teachers (through visualization tools that filter and aggregate information). The specifics of what information should be displayed, to whom, and when, are — at the time of this writing — under investigation. We will present the functional demonstration of the work in progress as it stands for the demonstration.

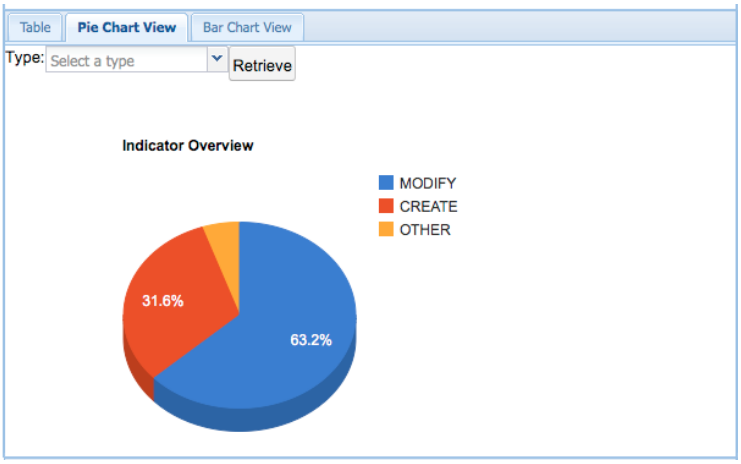

Fig. 3: An example of a filtered set of indicators showing different types of activity (creation, modification, etc.) for the discussion tool.

3 Learning Innovation

Successive versions of the Metafora prototype have been used in several pilot experimentations in 4 countries by the various project teams including: the Hebrew University of Jerusalem, Israel; the London Knowledge Lab, the Institute of Education, UK; University of Exeter, UK; and the Educational Technology Lab, National and Kapodistrian University of Athens, Greece. The results of these pilots have been used to improve Metafora in an iterative fashion and also to refine the underlying L2L2 pedagogy and theory. This design-based approach has helped us pinpoint L2L2 behaviours that are enabled and encouraged by the Metafora platform and tools while students are undertaking challenges.

For example, the availability of referable objects (text or thumbnail images) from other tools to the discussion space meets the key requirements of mutual engagement as it allows students to bring individual work into a collaborative space. This functionality also offers the ability for students to seek and offer help to one another, allowing them to share individual artifacts and to exemplify problems or concepts that need to be mutually understood in order to offer support. Lastly, it also offers opportunity for reflection, on both learning activities (giving students a space to compare and discuss the artifacts they have created) and on group dynamics (providing opportunities for students to discuss their overall workflow, contributions, etc.). In short, the availability of the discussion space and its enhancement with referable objects promotes group meaning making [7]. Similarly, students' interaction with the visual language, in the shared space provided by the planning tool, encourages both the orchestration of activities but also fruitful meta-level discussions. When students collaboratively reflect upon the work undertaken to solve a challenge (i.e. task assignments, leadership distribution) they engage in co-construction as well as self- and other-directed explaining — three key mechanisms responsible for learning from collaborative problem solving (c.f. [8]).

4 Demonstration Plan

During the demonstration and interaction session the conference participants will be first and foremost introduced to the theory of learning to learn together through hands-on experience with the Metafora platform. As they interact, we will share our insights on how students and teachers experience and practice these higher-level learning skills through use of the system in various activities in science and mathematics.

The Prototype-SLAM presentation will focus on key technical and conceptual innovations of the system such as the visual language for orchestrating collaborative activities and the referable objects. Following the presentation, we will make available handouts and leaflets that describe the Metafora system, the breadth of learning topics covered by our current scenarios, and our results from the second year of the project. We will also have a dedicated laptop to display videos from actual use in school studies.

In the provided booth we will have 2-3 connected laptops to simulate a collaborative session. Members from the Metafora team will demonstrate the system and act as guides for the participants who will be able to make and modify plans, experiment with referable objects, and see the summaries of their work and types of feedback offered. We will scaffold users to interact with particular challenges that requires them

to use microworlds such as the eXpresser microworld [9]. The collaborative task will encourage them to share and discuss their work with others. Through this interaction, participants will be able to appreciate how the integrated tools of Metafora create novel opportunities for collaboration and peer tutoring by allowing students to easily share and discuss their work. Throughout this experience, the system as a whole and the provided feedback will demonstrate the meaning of "Learning to Learn together", and how the system monitors and scaffolds this L2L2 process.

Requirements: internet access and —if possible— a projector.

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