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PROJECT FINAL REPORT

Grant Agreement number: 257872

Project acronym: METAFORA

Project title: Learning to learn together: A visual language for social orchestration of educational activities

Funding Scheme: STREP

Period covered: from 1.7.10 to 31.8.13

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Project website Error! Bookmark not defined. **address:** http://www.metafora-project.org/

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1. Final publishable summary report

This section must be of suitable quality to enable direct publication by the Commission and should preferably not exceed 40 pages. This report should address a wide audience, including the general public. The publishable summary has to include **5 distinct parts** described below:

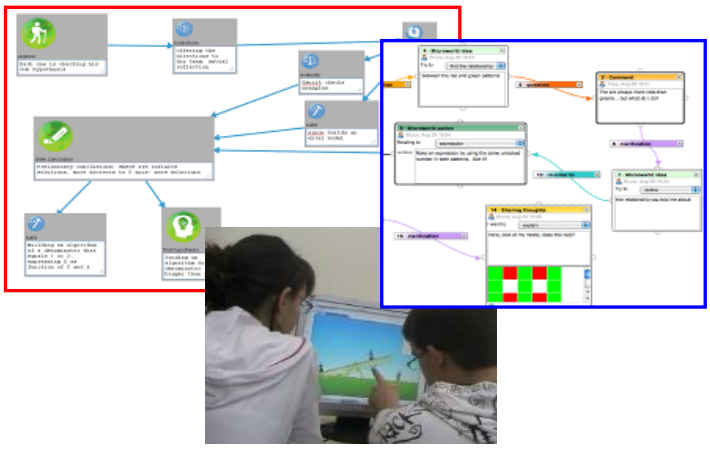
- An executive summary (not exceeding 1 page).
- A summary description of project context and objectives (not exceeding 4 pages).
- A description of the main S&T results/foregrounds (not exceeding 25 pages),
- The potential impact (including the socio-economic impact and the wider societal implications of the project so far) and the main dissemination activities and exploitation of results (not exceeding 10 pages).
- The address of the project public website, if applicable as well as relevant contact details.

Furthermore, project logo, diagrams or photographs illustrating and promoting the work of the project (including videos, etc…), as well as the list of all beneficiaries with the corresponding contact names can be submitted without any restriction.

Executive summary

Launched in July 2010, the purpose of the Metafora project has been to create a CSCL system to enable 12 to 16-years-old students to learn science, mathematics and environmental issues in an effective and enjoyable way. Using Metafora, the students would, first and foremost, learn to learn, collaboratively addressing an assignment posed by the teacher involving a relatively complex problem: the "challenge". Working in groups of 3 to 6 during periods typically ranging from one day to a couple of weeks, the students would plan the work and tackle the challenge. The Metafora platform would offer a discussion workspace where the students would gather and discuss their findings and arrive at an agreed solution, using also other available tools, such as microworlds. The use of a visual language would permit the students to reflect on and be precise in their planning and then later in enacting the planned activities, while also allowing the system to intelligently track those activities and produce useful information and feedback for both students and teachers.

Metafora has reached its end as an R&D project, following three years of multidisciplinary collaborative work. It has achieved all its objectives, resulting in the creation of a consolidated prototype, usable for stable experimentation, of the promised CSCL system, and in much advance in the knowledge and cumulative experience of the partners in the utilization of that system in the classroom to foster learning and learning how to learn together – L2L2 – science and math. A significant body of theory has grown in the project in support of this process, at first informing the initial stages of the development work, then feeding from the field results as they started to gather and contributing to a more sharply focused experimental activity, and finally – especially in the last year of the project – making sense of all what happened and framing the assessment work. The knowledge has been extensively disseminated, and the access to the system is being made freely available to all, for use and for further development through an open source licensing scheme.



In the figure: Planning and reflecting – on the work done and to do, on the plan itself, on aspects of the interaction – using the Planning Tool (upper left side), discussing using the LASAD tool (upper right), and playing and experimenting with a micro-world (bottom) that can be invoked from (and lend back status information to) the other tools, are three important elements of any Metafora-supported activity.

The distinctive elements envisioned for Metafora already at its initial development stages find full expression in the system created in the project, which, compared to pre-existing tools, offers:

- Extending and enriching the interaction – from a single, one-time activity (e.g., a discussion) to a series of activities to be carried out over a relatively long period;
- Featuring a variety of tools supporting different instances and needs of the interaction (microworlds, tools for planning, discussing, reflecting, messaging, etc.);
- From learning to argue, or learning a subject, to learning to learn together (L2L2);
- Addressing not just a question but a full, more complex assignment – "the challenge";
- Students plan the full activity and assume responsibility for the work and its results;
- The tools support students and teacher, mediating several facets of the interaction, and also inform the system so that it can produce feedback to foster learning and L2L2;
- Integrating conceptual constructs (e.g., microworld constructions) in plans and discussions for further elaboration, reference and shared understanding ("referable objects");
- Active role in regulating collaborative work (L2L2) with the messaging tool;
- Supporting reflective activity and the design of reflection lessons (reflection tool).

Project context and objectives

With a system of the above characteristics in mind, and conscious of the need to develop a suitable pedagogy to support that system toward the achievement of its ambitious goals regarding math and science learning and L2L2, the Metafora project set the following as its general objectives:

- To further our understanding of Learning to Learn Together (L2L2) or meta-learning within collaborative communities engaged in science, math and environmental learning;
- To design a visual language to support students' reflection on their individual and collaborative learning;
- To implement a platform integrating state-of-the-art discussion tools with exploratory environments;
- To develop an analytic system that, anchored on L2L2 central concepts and tuned to identify and monitor behaviors that are indicative in this context, will utilize AI techniques to support students and teachers during the collaboration and learning process;
- To carry out a design-based research supporting the Metafora pedagogy; and
- To design new forms of learning assessment, exploiting the analysis system and other tools to be developed.

By the end of the project these objectives had been fully achieved, although their relative importance and the amount of attention and work devoted to each of them by the consortium naturally varied from year to year. Below we succinctly describe this process, which clearly shows the way in which the project work evolved as a reflection of the correspondingly evolving project context – both technology-wise (the development – and, especially, the usability – status of the prototype) and pedagogy-wise (e.g., the need to know more about L2L2 and the characteristics required from a CSCL tool to promote it).

Year 1: Consistent with the ambitious and innovative character of the project – "*Metafora is intended to bring about a deep change in the way young students learn – and "learn to learn, together" in schools all over Europe*" (DoW, B3.1) – the work in the first year was marked by several challenges. In fact, despite the reliance of the Metafora idea on relevant experience of the partners in previous CSCL endeavors, the development of the new tool and of the supporting pedagogy had to be started virtually on no direct antecedent. The need to provide an acceptably solid basis to the R&D process brought the consortium to make an exceptionally extensive use of alternative means – especially, of "design workshops" – to fill some of the functions that otherwise would have been taken up by state-of-the-art surveys, readily applicable knowledge and more direct experience. These design workshops, always involving end-users (teachers and/or students, in this case), were a fundamental component of the partners' work in that year, joining the efforts of pedagogical and technological partners alike and producing much of the missing knowledge needed by both groups. Some 19 such workshops were carried out then, by four of the partners in four countries. The workshops performed a dual function, informing the technical development and pedagogical design work, on the one hand, and creating, on the other hand, the first layer of teachers, students and other school staff to be exposed to the Metafora concept and approach and have the opportunity to try and experiment with the incipient tools (or with their rough preliminary versions or substitutes). This was also one of the many initial steps of our project in the dissemination arena.

Year 2: This year Metafora has made significant advances toward its objectives. Building on previous year's advance in the R&D agenda of the project – based on the "design workshops" carried out and the knowledge obtained from them for the development of Metafora's technology and pedagogy, via the definition of the requirements, the visual language and, ultimately, the generation of a basic but usable prototype of the tools to enable real classroom activities – during the second year the consortium concentrated on the implementation of Metafora in schools. Five pilot studies (of a few hours duration each) followed by 11 longer studies (10-20 hours each) were carried out in five different locations by all the pedagogical partners in the project. In these studies,

the Metafora tools and pedagogical approach served as the basis for an intensive design-based research, the outcomes of which had, since then, been analyzed. This thorough work supported the process of conceptualization and the creation of a common ground for discussing pedagogical and technological issues within the consortium. These studies certainly contributed to the design and re-design of the Metafora tools and made possible the development and implementation of new features embedding our pedagogical approach. Special mention in this regard deserve the development of the feedback and monitoring tools that support students' group work, the help request device and the capability to discuss specific issues in the microworlds through referable objects in LASAD (the discussion tool featured in the Metafora system) and "resource cards" in the planning tool.

In a parallel fashion to this design-based research activity, in the second year we continued with the analysis and development of L2L2 theory with the aim of concretizing the definition of group learning behaviors that are valuable for our project. To this end, we created a special group – the "L2L2 Task Force" – composed of technical and pedagogical partners with the objective of "operationalizing" L2L2, i.e., identifying learning (and interacting, social) behaviors that can be observed when students use the Metafora tools during the experiments in schools. These concrete behaviors are connected on a high level to the concept and definition of L2L2, and on a lower level can be directly observed through indicators reported from the analysis components of the various tools comprised in the system. This process helped to strengthen our conceptual understanding and also provided a behavior model for monitoring and feedback tools developed under WP5 5 (the work package in charge of developing the analysis components of Metafora).

Year 3: The Metafora consortium completed the achievement of all its objectives during this year, in which the project's work concentrated mainly on:

- Finalizing the analysis of the main studies carried out in Year 2;
- Bridging the gap between the R&D and theory development work undertaken in the project and its actual implementation in the classroom through various means including written materials (eventually annexed to some of Year 3's deliverables) and specific dissemination activities with teachers;
- Assessing the value of the Metafora learning environment for L2L2 in practice;
- Defining and concretizing the awareness and feedback elements that should play a central role in the Metafora system and its use in order to achieve its goals;
- Related to above item: deepening and refining our understanding of the links between L2L2 theory and the identification of meaningful behaviors, made possible through a proper definition of landmarks and indicators that the system and its users would be able to work with;
- Completing the integration of the system and improving its user interface and usability;
- Finalizing the work on the microworlds and their integration (both system- and analysis-wise) in Metafora.
- Undertaking important dissemination activities, appropriate for the end of a project like ours, enabling, among other things, a better understanding of the way people see our tools and pedagogical approach and of the factors that would determine the wide acceptance of Metafora in the educational system; and
- Defining and creating the necessary infrastructure – in terms of free availability of the Metafora tools for future users and developers, by means of an open source licensing scheme – on which the future exploitation of Metafora could be built.

The main S&T results/foregrounds

As the project's results are a consequence of the work carried out during its whole active life, and in many cases those results cannot be readily linked to the work done in a specific year (in particular, to the last one, as previous periods' interim results can also be considered "S&T results" in their own right), this section has been prepared on the basis and as a summary of the content of Periodic Reports No. 2 and 3 describing the "S&T WPs" – WP2, 3, 4, 5 and 6. The description is, accordingly, presented on a work package basis, reporting for each WP, consecutively, results of Years 2 and 3.

WP2 - Supporting theory and the development of visual languages

Main results of the second year:

- Testing the impact of the use of visual language for collaborative learning with the Metafora system – The outcome of this task will be an important input in the design of metaphors and models to be featured in Metafora system. In the first year, we had tested whether and how a visual language in the Metafora system can be accommodated in the school contexts through iterations of design based research. In the second year, we aimed to build a stronger link between implementation of the visual language and the theoretical framework for L2L2. All the pedagogical partners (HUJI, ETL, LKL and UnExe) have conducted design based research studies to refine the visual language according to the key aspects of L2L2.
- Design based research to develop a theoretical understanding of Metafora-supported collaborative learning in science and mathematics – In the first half of the second year we conducted design based research on the design of the visual language. From this iteration, we have improved our pedagogy design for the uses of the visual language. In the second half of the second year, we (HUJI, ETL, LKL and UnExe) conducted another iteration of design based research. This iteration not only focused on the design of visual language, but also focused on the pedagogical affordances of the Metafora system (including the visual language) for L2L2.

Two deliverables – D2.2 (Interim report on the role of technology supporting dialogue using a visual language) and D2.3 (Interim report on the design based research into group meta-learning) – present the work and main results of WP2 so far.

In the third and final year:

- The experiments in using the visual language were implemented (project milestone 22). In order to achieve this, all the pedagogical teams have discussed our findings from previous studies and agreed on a shared research framework for data collection and data analysis. In accordance with the research studies conducted in Work Package 3, we have focused on how the dialogue and L2L2 should be supported by the Metafora tool and associated pedagogy.
- Conduct short studies to evaluate new features of the Metafora tools (e.g. the feedback and messaging tool). In accordance with the research studies conducted in Work Package 5, we have focused on the role of the monitoring tool and feedback tool in supporting dialogues and L2L2.

Significant results:

- Teachers' guidance for L2L2. In order to identify the optimal use of Metafora for L2L2, we proposed as a series of lesson plans to advise the teachers we worked at school on how they could appropriate the Metafora tools in their classroom for teaching L2L2.
- Assessment of L2L2 as a process and a competence. We have proposed a theoretical framework to unpack what are the learning changes, when students are learning how to

learn together. This includes pre- and post-test analysis and the group level mechanism for L2L2.
- Forms of assessment supported by the Metafora tools. We have proposed three forms of assessment could be supported by the monitoring tool and the messaging tool in a Metafora learning scenario.

Deliverable D2.4 – Final report on the roles of technology in supporting dialogues and L2L2 – presents all the WP2 outputs for the 3rd Reporting Period.

WP3 - Activity design, classroom implementation and the assessment of learning outcomes

Significant results of the second year:
- A set of best practices focusing on patterns of use of the Metafora System
- An addendum to Deliverable D3.2 with the title "Reflections on Scenario Design for Learning to Learn Together mathematics, sciences and environmental education with the Metafora System". This addendum focused on revisiting the scenarios developed in Year 1 in light of the findings of the pilot studies focusing on the characteristics of a scenario that serves learning to learn together in the context of specific scientific fields.
- A set of indicators – based on networking theories – aiming at the integration of research results

All the WP3 outputs for the 2nd Reporting Period are described in D3.2 – Report of the pilot studies and refinement of the research design.

Significant Results of Year 3:
- A framework for validating the Metafora System based on the synthesis of research results derived from studies in different contexts,
- Data grounded evidence across contexts on the role of tools and domains in shaping collaboration,
- Data grounded design guidelines for crafting pedagogical scenarios with the use Metafora System.

All the WP3 outcomes for the 3rd Reporting Period are described in D3.3 – Report of the analysis from the experiments.

WP4 - Framework System, Domain Tools, and Integration

In Year 2:
Designing a visual language, by means of which the students participating in a sequence of Metafora-hosted activities would be able to plan their future actions and reflect on them as well as on their learning process, is a central objective of our project. To enable a natural, friendly, non-expert use of the visual language for the students (as well as for their teachers and external players, like researchers that could be involved), the Planning Tool was devised, and its development became a central constituent of WP4's work. As described in deliverable D4.1 – Technical report on the framework system (Prototype 1) - the Planning Tool is a web application with which students can create plans by using the visual language. Those plans will be created by dragging and dropping elements of the visual language onto the map area of the Planning Tool. The elements of the visual languages were designed as cards, consisting of an image with a label and textbox to write comments or explanations into it. Those elements are split (according to the current view of the pedagogical partners involved) in six categories and integrated as a palette into the Planning Tool: "connectors", "activity stages", "activity processes", "roles", "attitudes", "resources", "gates" and "other". From this palette the visual elements are accessible and draggable when designing own learning activities and through the "connectors" category, two of those elements can be connected by creating an arrow between them. A sample screenshot of the Planning Tool in its current status

can be seen in the following picture. The “plan” depicted is based on the present version of the visual language.

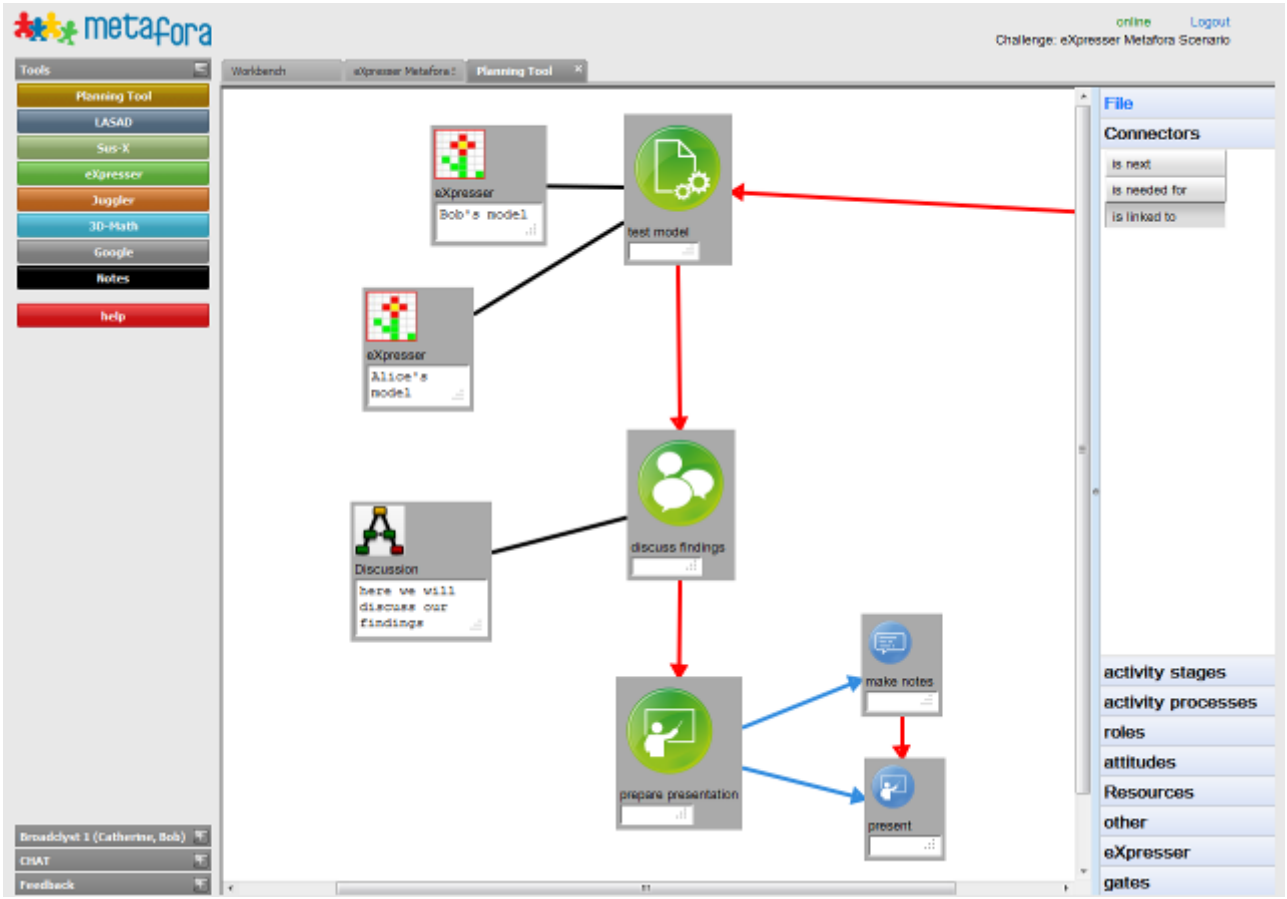


Figure 1: A sample screenshot of Metafora with the Planning Tool, at the time of this writing.

To support the collaborative learning, we developed the Planning Tool as a web application with a desktop-like interface. Through the drag and drop mechanism and further technologies like AJAX or GWT Comet, students are able to work together on one map at the same time in almost real-time interaction, but in different computers. The students are able to work collaboratively without time delays, a feature that was envisaged for a later time of the project, but has been developed early now based on discussion with the pedagogical partners and their needs for early insights into students’ planning activities. In cooperation with our pedagogical partners, we further developed our approaches by creating additional functionalities like setting the state of a card for process reflection and awareness, resource cards as placeholder for a specific workspace in a Metafora tool, a social concurrency conflict resolution (SoCCR, Harrer, Irgang, Sattes, Pfahler, 2012) when writing text into a card or saving the current version of a Planning Tool map.

When saving the current version of a Planning Tool map, a duplicate of this map will be generated, stored into a database and listed in the Workbench within the “Versions Management” section for later use. The Workbench was generated as a standalone application which is embedded into the Metafora system. Next to the Versions Management, the Workbench also provides up- and downloading of documents and a monitoring feature which lists latest actions about learning processes and outcomes to both students and teachers.

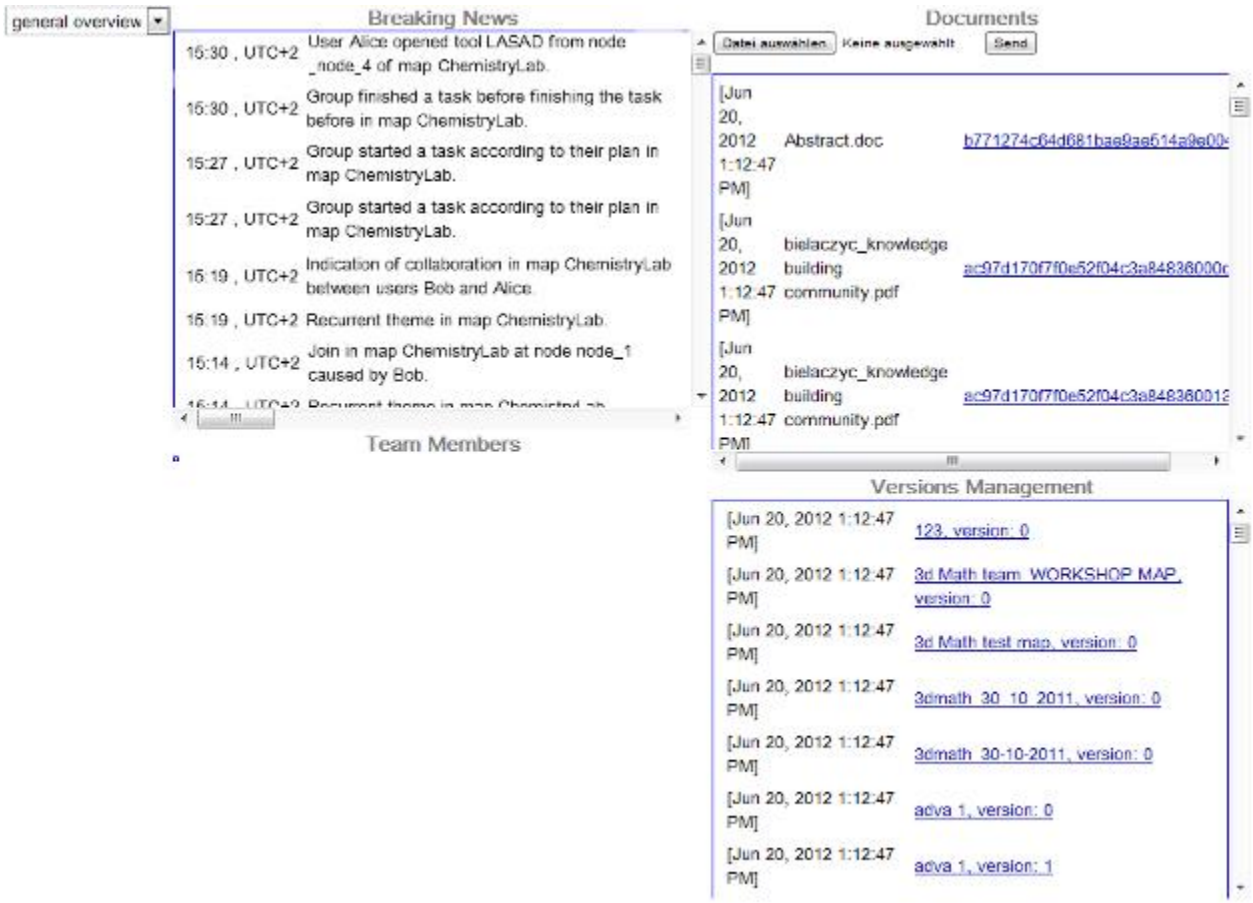


Figure 2: A sample screenshot of the Workbench, at the time of this writing.

Consistent with the objectives of the project, we have been developing, and will continue to develop, a platform which integrates all tools that the Metafora system put at the disposal of its users. In deliverable D4.1 we described the architecture of the Metafora system which we further enlarged through a tight communication during the second year. Next to its new login procedure the platform now also supports creating new user accounts in LASAD, automated login to LASAD, a chat with awareness of incoming messages and referable object support, help dialog and feedback mechanisms for various degrees of interruption. We also built a module with which the embedded microworlds can upload documents into a database of the Metafora system, to give users the ability to store states of a microworld. The upload module for microworlds was developed within the context of resource cards in the Planning Tool, which - as mentioned above - are used as placeholder for a specific workspace in a Metafora tool.

[Figure follows in next page]

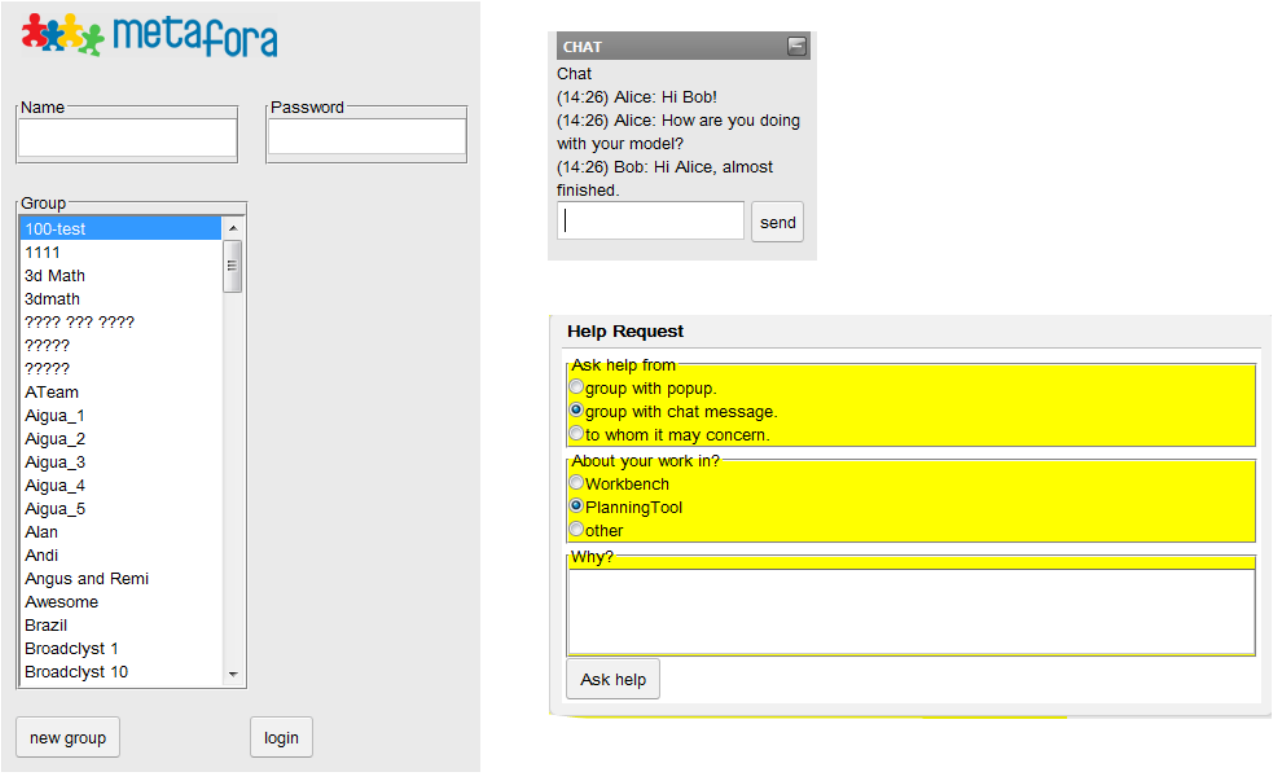


Figure 3: Example pictures of the login, chat and help request dialog in the Metafora platform (as developed by the end of Year 2).

The Metafora communication architecture got extended and improvements on its stability were undertaken. It can support an adaptive analytic system. Because of update issues and to avoid usability problems we now operate on two servers. One server runs the main Metafora system, with which experiments can be conducted. On this server only stable and tested software will be dispatched. The second server is used as test server on which software updates will be tested. After the extensive test of software updates, the main server gets updated with the new software in order to guarantee as much stability as possible.

During the second year of the Project, refinement, revision and development of 5 microworlds (domain tools) also took place. This involved: a) the Web eXpresser microworld developed by LKL, b) the Twisted Rectangle microworld (3d Math Authoring Tool), c) the 3d Juggler microworld (Physt Authoring Tool), d) the SusCity microworld (the latter three developed by NKUA) and e) the Pirates of the Kinematics Island, developed by Testaluna. The technical design analysis for the NKUA and LKL microworlds started early on the project, since these four microworlds partially came from previous developments, and were further adjusted within the context of Metafora during Year 2. To serve as reference for the entire duration of this task, the partners prepared for each microworld - and included in D1.1, then updated in D1.2 - detailed descriptions of the Technical Requirements. The microworlds were tested in real settings as the pedagogical partners used them for their WP2 and WP3 design workshops and other classroom activities involving teachers and students. The feedback coming from the users' experience as well as the Technical Requirements coming from the design of both the Framework System (WP4) and the Diagnostic Components (WP5) was used to further refine the design and development of the microworlds.

Specifically regarding microworld No. 5, "The Pirates of the Kinematics Island" – a microworld entirely developed in Metafora – it has been developed by Testaluna (TL) as a Serious Game microworld for its integration in the Metafora platform. The development of "PiKi" – as it is called in short – has started from activities of analysis and design performed mainly in Year 1 and continued in Year 2, leading to the first playable prototype in month 22 (MS4.6). During the second year TL has worked on different aspects of the game, mainly the creation of graphical assets (both 3D and

2D), creation of animations, development of game infrastructure, implementation of requirements (as outlined in D1.2 and in other, internal documents circulated for this purpose), integration and improvement of physics engine, creation of sounds, packaging and testing. PiKi is a web based microworld developed with Unity3D technology. Its main concept is to have students handling physics concepts like velocity, space, trajectories, restitution coefficients and the associated rules in a highly motivating environment where they can study, try, modify, and learn when dealing with challenges prepared by teachers. At the time of this writing, Ped partners are testing the PiKi prototype and providing suggestions and requests for modifications to TL in order to improve the tool and bring it towards final release expected for M28 (MS47). Two sample screenshots of PiKi follow, in Figure 4 below.

Figure 4: Two sample snapshots taken from PiKi

In Year 3:
In WP4 we continued with developing the framework system using current web-based technologies, GWT for graphical interactive web applications and cross-tool communication by exchanging messages via XMPP, mediated by the system. To enable qualitative experimentation with the system and grant as much stability as possible, but at the same time not constricting the development process, we set up a full replication of the Metafora servers to have two independent systems. One system was used to conduct experimentations with stable software releases and the other system served for testing purposes. Both systems were configured to be used via HTTPS and specifically SSL for up- and downloading documents or sending Messages via XMPP to enable high data security. Through the flexible architecture of the system and the standardized communication formats, new tools were easily tied to the platform and fully integrated, as can be seen for the CAVilLag or the Reflection Tool.

The visual language, by means of which students plan, enact and reflect on their Metafora-hosted learning activities, is a central objective of our project. To enable a natural, friendly, non-expert use of the visual language for the students, the Planning Tool was devised, and its development became a central constituent of WP4's work. In D4.2 – Technical report and user manual (Final System) – we describe the Planning Tool in which the visual language is embedded as a palette, where the elements are represented by cards with an image, label and textbox to write comments or explanations into it. From this palette the visual elements are accessible and draggable when designing own learning activities. A sample screenshot of the Planning Tool in its final state, embedded in the framework system of Metafora can be seen in Figure 1. To support the collaborative learning, we developed the Planning Tool as a web application with a desktop-like interface. Through the drag and drop mechanism and further technologies like AJAX or the GWTEventService, students are able to work together on one map at the same time in real-time interaction, but in different computers. In cooperation with our pedagogical partners, we further advanced our approaches by creating additional functionalities like the resource cards as

placeholder for a specific workspace in a Metafora tool, ownership of plans and awareness features of currently present users on a plan.

During the third period of the project the need arose to adapt the elements of the visual language according to the complex learning scenarios in the Metafora system. Since the visual language is set up to cover all domain specific use cases, it is not necessary to have all elements available all the time. Therefore we developed the CAVilLag (Challenge Authoring tool for the VIsuaL LAnGuage) to individually and flexibly set the elements of the visual language to cover the specific needs of a learning scenario. CAVilLag is a web-based tool, fully integrated in the framework system which offers the whole visual language of the Metafora system. Via a drag and drop mechanism a selection of elements can be saved for a learning scenario. Once this design is saved, the selection will be loaded in the Planning Tool of the system when logging in to the Metafora platform and selecting the specified scenario. Thus students can create plans with a set of visual language elements, specifically designed for their learning scenario.

Figure 5: A challenge design example in the CAVilLag.

To evolve the framework system according to users' needs, it got refined and revised in the third year of the project. We adapted the login process which grants access to the platform, during which awareness features indicate the previously entered login information and most recent selected choices. Once logged in to the system supporting features enable live communication for self- and group regulation of current learning activities, as well as historical support on the whole learning process, thus maintaining different modes of awareness, in detail content (things of interest), social (presence of remote users and their activities) and process awareness (what has happened during the whole learning process).

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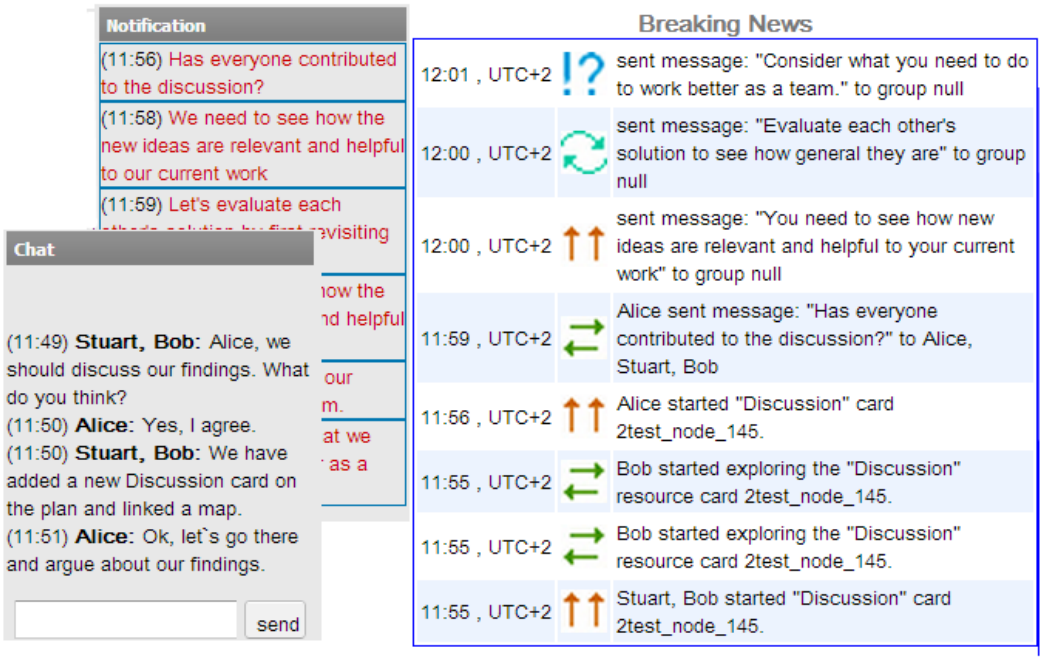


Figure 6: The Metafora chat, Notification area and Breaking News as samples of the modes of awareness.

As can be seen on the right side of the example screenshot in Figure 6, we designed icons for the different L2L2 categories. Those icons are used to strengthen the visualization of analytical results, produced by the artificial intelligence of the system in relation to L2L2.

Furthermore in the referenced period the need arose for additional support of self- and group reflection during the learning activities of students. Thus we designed the Reflection Tool to guide students in the complex learning situations beyond different learning tools and give them orientation about their whole learning process. In the Reflection Tool the students are made aware about actions of interest and relevance which are classified according to the L2L2 categories and produced by the artificial intelligence components of Metafora. Following our design principle of direct linking between the learning tools and a graphical intuitive representation, the Reflection Tool got visually embedded into the Planning Tool as an add-on, visualized as a time line and bars for the actual duration of planned activities, to support the process awareness of students' activities. Figure 7 shows the Reflection Tool linked to the actual occurred activities, in this example the Planning Tool to support process awareness.

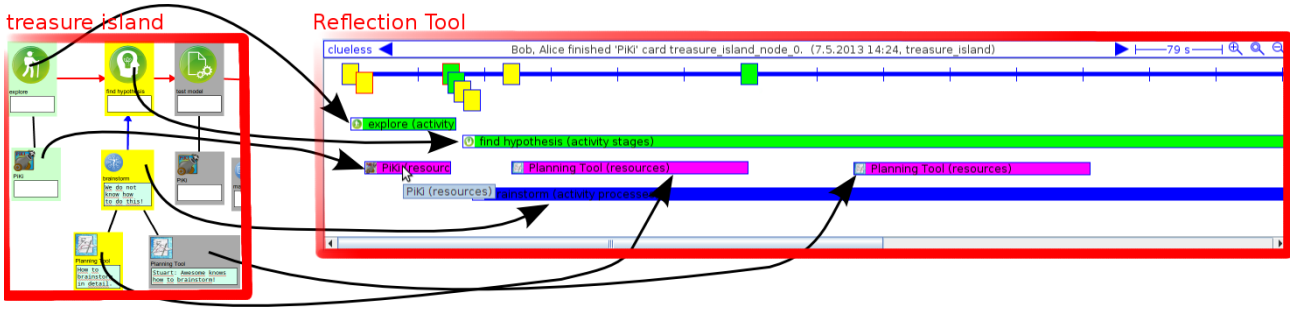


Figure 7: A sample screenshot of the Reflection Tool and Planning Tool with painted linking.

With the extension of two month of the project WP4 was able to finalize its development process by acquiring qualitative sustainability of the system to enable dissemination and exploitation beyond

the projects ending. Thus a concept was crated and aligned in cooperation with WP7 for persistent hosting of the system, including public access, sustainable legacy, licensing, good quality open source code and an easy-to-use full Metafora distribution. For further information please take a look at WP7 and D4.2.

Refinement, revision and development of domain tools – Development of PiKI by TL (Task 4.2):
In the third year of the project, development of Pirates of Kinematics Island (PiKI), one of the domain tools integrated in Metafora platform, has continued from the first playable prototype released in M22 (MS4.6).
PiKI is a web based serious game microworld developed with Unity3D technology. Main concept is to have students handling physics concepts like velocity, space, trajectories, restitution coefficients and the associated rules, in a highly motivating environment where they can study, try, modify, and learn.
Implementing the design developed in Year 1, but also incorporating feedback collected by partners who have tested the game in schools, and also comments received during the second review meeting, a series of new features have been introduced in the game. The most relevant are summarized below:

- the game can be played in Defence and Launch mode:
    - when playing in Defence mode, players can setup a scene by putting obstacles in order to defend their treasures against other team's attacks. Once a scene is completed it can be published on the Metafora platform for other players to deal with it.
    - in order to play in Launch mode, players can load Scenes submitted by other teams. The goal is to hit all treasures with cannon balls taking also advantage of Trampolines and Blocks.
- players can save, load and publish Scenes on the Metafora platform. The first two actions are done while a scene editing is in progress, while the latter is done for sharing the scene among other teams and allow "attackers" to use it.
- Blocks and Trampolines are objects that can be placed on the ground by players playing in Launch mode. Cannon balls bounce on them in order to jump over obstacles and hit treasures. Bouncing characteristics of Blocks and Trampolines can be changed manipulating Rules.
- when using Blocks and Trampolines, players can modify their bouncing characteristics by changing Rules. Both horizontal and vertical components of the bounce are available to be modified.
- a list of available scene is retrieved from the Metafora server, as well as a rank of best scenes, as voted by players (from 1 to 5 gold coins)
- based on above:
    - players can collaborate among the same group while creating a defence scene or shooting at treasures
    - players can compete among groups trying to create the most difficult defence scene or attempting to hit all treasure of other groups' scenes
- Indicators, referable objects and landmarks have been implemented in the game, in order to have it fully integrated with different components of the Metafora platform

[Figure follows in next page]

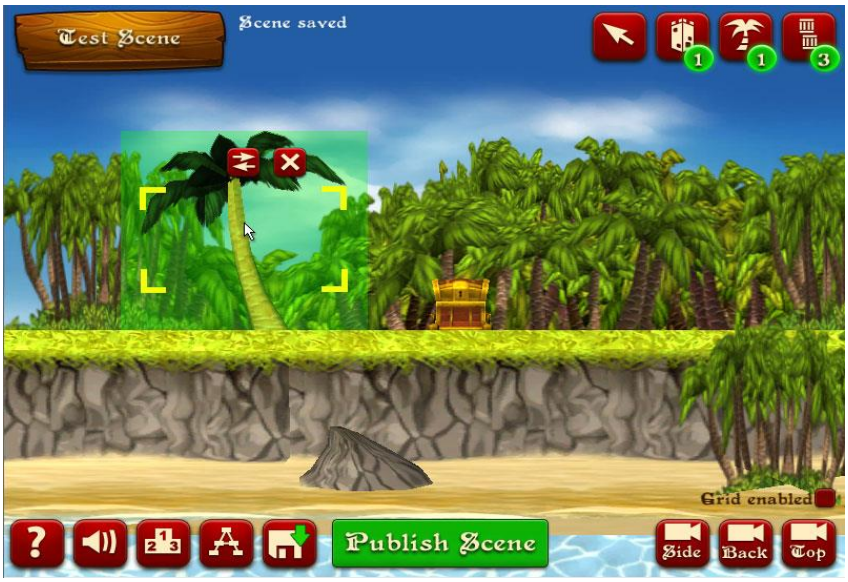


Figure 8: Above: a snapshot taken from Defence mode in PiKI

WP5 - Diagnostic Components

Work proceeded in Year 2 along several lines of effort. We have defined and populated a model of L2L2 behaviors. We have also improved individual analysis components for the different tools to allow either the system or a human observer to recognize these behaviors. Supporting all involved tasks, we chose to employ a methodological device referred to as Wizard-of-Oz (WOZ) studies that takes into account the difficulty of eliciting precise, concise and operationalized knowledge from teachers or educators, especially when this requires an understanding of novel interaction with systems and contexts for which they may lack expertise. WOZ studies employ a human (also known as wizard from which the studies take their name) to provide intelligent feedback through system functionality, based on the actions taken by students. By engaging in WOZ experimentation we gathered necessary information and experience to inform and refine the work. To support the WOZ studies (but also directly contributing to future work in relation to WP6) we have developed the Monitoring and Feedback Tool that gives users (e.g. teachers or other session facilitators) the ability to directly observe analysis and give feedback to students.

L2L2

Within the first reporting period, we developed a framework for analysis and offered some key examples, termed scenario sketches, to exemplify how analysis might be utilized in the Metafora framework (see D5.1). From this context, and taking into consideration the feedback from the first year review, we established a separate task-force with members from across the ped-tech boundaries in the consortium to further explicate and operationalize “Learning To Learn Together”. The group had bi-weekly remote meetings and also a face-to-face workshop in London (30 Nov – 1 Dec). The work produced attempts to merge two approaches: a top-down approach from the broader literature review and definitions of L2L2 as given in D2.1 and D2.2, and a bottom-up approach from the scenario sketches given in D5.1. From these sources, we attempt to develop a generic “model of L2L2” that can be applied, and expanded upon as the project progresses. This work brought many challenges, as L2L2 is not easily categorized or dissected, due to the interleaving and overlapping aspects of the pedagogy and modeled behavior. Therefore, we settled on a fitting model to be a set of “L2L2 behaviors”. Some specific criteria for these behaviors are:

- *Potentially recognizable* – the behavior can be defined in terms of system actions in such as way there is potential for automated recognition.
- *Related to theory / experience* – some documented rationale that this type of behavior is useful to understand, whether indicative of successful approach or problematic approach.

This documentation may be from educational theory or research, or from our own experience in Metafora studies.

- *Actionable* – the behavior is useful to understand because it should prompt some type of awareness or intervention.

This work is directly related to Tasks 2, 3, 4, and 5 in the DoW as we consider behaviors across discussion (Task 2), microworlds (Task 3), and their inter-relation (Task 4). Finally, we offer specific, pertinent awareness and feedback that the behavior might prompt (Task 5).

Analysis Components

During the second reporting period, we have also developed, enhanced, and / or integrated analytic components of the various tools in order to use the framework developed in the first reporting period. We have relied on the behaviors defined by the L2L2 task force to guide the efforts and dictate the type of indicators that are useful from the tools. Specifically, we consider what indicators are necessary to allow us to recognize the given important behaviors within each tool. These indicators can be simple activity indicators in certain instances, and in others need be more complex.

Considering specific tools, PlaTO (Planning Tool Observer[2]) is a component developed to offer analysis of Planning Tool activity. The component – described in more detail in a dedicated sub-section at the end of this WP5 heading – utilizes a rule-based java library (JESS) to recognize patterns in planning tool activity that represent key L2L2 behaviors, including information on both planning activities as well as enactment (as the Planning Tool is used as the "gateway" to other tools through resource cards). The LASAD tool has an independent Analysis and Feedback Engine[3], which has now been modified to report indicators to the Metafora Analysis framework as well. Similar to PlaTO, this analysis component uses the JESS library to recognize patterns within students' discussion maps and reports these as indicators to the Metafora analysis channel. Expresser also reports analysis indicators employing a set of previously designed and constructed analysis components[4] for its non-web version. These were adapted for the web version of eXpresser and integrated with the Metafora analysis system by converting the analysis information into indicators and posting to the analysis channel. Finally, the other microworlds (Juggler, 3D Math, PiKi, and Sus-City) have analysis components in development and are currently able to offer low-level activity-based indicators of student action including information necessary to recognize higher-level behaviors. While the work on LASAD analysis directly addresses Task 2 from the DoW, and work on the microworld analysis components addresses Task 3, we see our efforts towards analysis across all tools in a more unified way currently, and consider the Planning Tool analysis equally important to this effort. This represents a more developed, simplified approach to analysis that considers all tools in a relatively equal manner, allowing for future extensibility.

Metafora Monitoring and Feedback Tool

A key goal of analysis work on Metafora is to make a practical and usable system, not only something that is theoretically interesting. Towards these ends, and also to allow Wizard of Oz experimentation per Task 3, the team required some type of interface that would allow human

[2] Harrer, A. and Herbst, V (2012) PlaTO - the Planning Tool Observer in the multi-tool ELE Metafora In the Proceedings of the Workshop on Intelligent Support for Exploratory Environments 2012: Exploring, Collaborating and Learning Together at the 11th International Conference on Intelligent Tutoring Systems (ITS 2012).

[3] Scheuer, O., McLaren, B.M., Loll, F., & Pinkwart, N. (2009). An Analysis and Feedback Infrastructure for Argumentation Learning Systems. In V. Dimitrova, R. Mizoguchi, B. du Boulay, & A. Graesser (Eds.), Proceedings of the 14th International Conference on Artificial Intelligence in Education (AIED-09), Artificial Intelligence in Education: Building Learning Systems that Care: From Knowledge Representation to Affective Modelling. (pp. 629-631). IOS Press.

[4] Gutierrez-Santos, S. and Mavrikis, M. and Magoulas, G (2010). Layered Development and Evaluation for Intelligent Support in Exploratory Environments: The Case of Microworlds. In: Aleven, V and Kay, J. and Mostow, J. (eds.), Proceedings of the Tenth International Conference on Intelligent Tutoring Systems: Bridges to Learning. Volume 6094 of Lecture Notes in Computer Science. Berlin, Heidelberg, pp. 105--114. Published by Springer Berlin / Heidelberg.

access to the analysis information being offered by the different tools and also being recognized across tools. For this purpose, we have developed a monitoring tool. This tool allows users direct access to the analysis information carted by all Metafora tools, and allows filtering and visualization of this information at different levels of granularity. Collecting and visualizing this information is useful in terms of recognizing the behaviors described above, but to have an effect on student behavior, we also need means of intervention, to give students feedback. In this regard, we have developed a feedback tool that allows a user to create feedback, choose recipients and the level of interruption. The team then enhanced the Metafora platform to allow delivery of this feedback to individual students currently working on the system (this is described in D1.2 in detail). Combining the monitoring and feedback tools we describe above, WP5 has produced the Metafora Monitoring and Feedback Tool, a web-based, stand-alone tool built on GWT that allows facilitators to monitor and give feedback to students

This effort has been used most directly to address Task 3, giving the ability to run WOZ experiments, but also contributes heavily to task 4, helping identify patterns and useful techniques of recognizing L2L2 behaviors from indicators, and finally contributes to task 5, allowing experimentation and understanding of the effects of feedback that will inform choices about when automated feedback can be used and when awareness and human intervention might be more successful tactics.

Wizard-of-Oz studies

We have used this Monitoring and Feedback Tool to run Wizard-of-Oz (WOZ) style studies where we combine these lines of effort to recognize important L2L2 behaviors by monitoring indicators from the system, and offer feedback specific to the L2L2 process as specified by our L2L2 model. As discussed in more detail elsewhere[5], these studies aim to offer insight into: 1) the usefulness of current indicators (analysis information offered different tools) in recognizing the L2L2 behaviors from our model and 2) the effect of corresponding feedback specified by the model. However, the WOZ setup also allows for exploration around the timing and presentation of the feedback, which require consideration of the different contexts and challenges and therefore were not as clearly defined in the generic L2L2 model.

Three different partners (Exeter, LKL, HUJI) thus far have conducted WOZ studies in four locations with 6th, 8th and 9th grade students. At the time of this writing, we are in the process of analyzing the results of these studies and designing subsequent studies with the rest of the partners. These will be presented in detail on D5.2. In brief, our preliminary analysis suggests that students take the feedback into account and the various messages help modify their behavior (thus achieving our primary objective). However our findings also raise some technical and conceptual issues.

From a conceptual point of view, the studies unearthed issues that relate to the context of each scenario and pragmatic decisions necessary when the platform is in use. For example, we have discovered the importance of taking different time segments into account, as we have observed that different behaviors are expected or observed in relation to the overall time that the student has used the system, and also to the total time of the learning session. In relation to how students interpret the provided feedback, it is worth highlighting, that (as expected) we noticed that providing relevant, timely and accurate personalized messages was a challenge even for trained, expert wizards (let alone an automated system). Some of the students' behavior with respect to the feedback, who tried to answer directly or discuss with their peers about the feedback they received, also seems to suggest that for some of the feedback messages we may want to consider adopting ideas from the Open-Learner Modeling subfield. In this way, students could acknowledge, dismiss or respond to

[5] Mavrikis, M., Dragon, T., & McLaren, B.M. (2012). The design of wizard-of-oz studies to support students' learning to learn together. In the Proceedings of the Workshop on Intelligent Support for Exploratory Environments 2012: Exploring, Collaborating and Learning Together at the 11th International Conference on Intelligent Tutoring Systems (ITS 2012).

feedback thus indicating both that they are reflecting but also providing information to the system to aid its reasoning.

Finally, from a technical point of view, the studies allowed us to test and identify required improvements in our underlying architecture, particularly with respect to the real-time analysis provided by the different tools and displayed in the monitoring tool. Apart from better understanding the granularity and timing of the provided analysis that will concern us in detail in Y3, we also identified the need for analysis information on demand that raises related technical requirements.

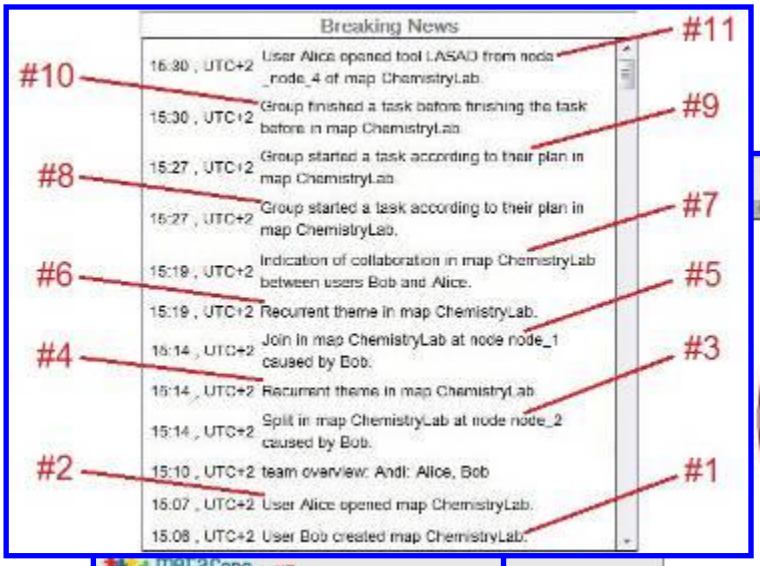
The PlaTO analysis component

Here we provide one example of the work done on analysis components for the different tools in greater detail to give a more in-depth understanding of the analysis approach. For a complete picture of all the analysis components, please see the "*WP5 Y2 extended periodic report: towards D5.2 report on analysis components*" document, submitted together with this Report. Developed in the second year, the PlaTO component is built as a rule-based approach for intelligent analysis of users' actions inside the Planning Tool and cross-tool interactions involving the Planning Tool. Among the detected behaviors are:

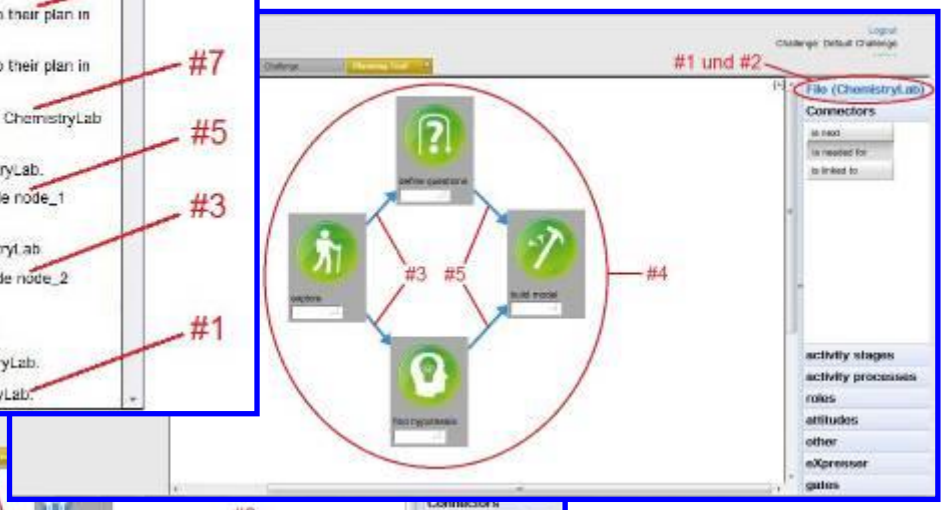
- creation / deletion of plans as possible indicators for milestones and cleanup
- opening of plans and changing of planning maps as possible indicators for changing the work context and choosing an appropriate space for planning
- working on the same map and connecting to others' objects as indicators for collaboration and take-up
- checks for connectivity of activity stages as indicators for the students' capabilities of creating coherent and connected plans
- checks for splits and joins in a planning process as indicators for divergent and confluent planning activities
- students' proactive change of activity states as indicators for starting, working and finalizing specific work phases and student's awareness of these phases
- cross-tool interactions initiated in the planning tool (such as open a learning tool, share a mathematical model, discuss this in LASAD or chat) as indicators for seamless transition between planning and domain actions

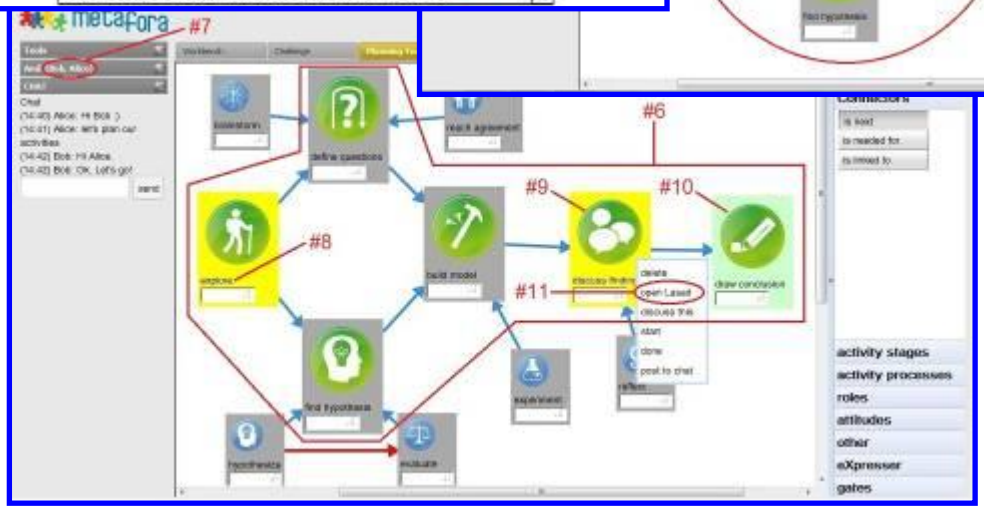
The detected behaviors that have been defined based on the principles of L2L2 are shared within the Metafora system as indicators sent to the analysis channel. Both the Breaking News section in the workbench and the indicator awareness tool are able to visualize this information to the users. Preliminary insights and a usage example of PlaTO have been published (see footnote 3 above) and are shown in the following figures.

[Figure follows in next page]



◄ **Figure 9:** PlaTO indicators displayed in the workbench





▲ **Figure 10**: Planning map after user actions producing indicators #1 to #5

◄ **Figure 11**: Planning map after user actions producing indicators #6 to #11

Year 3:

For this final period, WP5, led by partner UdS and with significant input from LKL, dedicated effort mainly towards the completion of the design and implementation of the analysis components by employing the generalized analysis framework designed and implemented in the first period (see D5.1) paying particular attention on how to scaffold L2L2, which was mainly defined and operationalized in the second period.

Referring specifically to the tasks given in the DoW for WP5, **Task 5.1 and Task 5.2** were basically completed in the first two reporting periods. WP5 completed progress on all other tasks during this period. At a conceptual level we have defined and populated a model of L2L2 behaviors, which underlies the components developed under tasks 5.2, 5.3, 5.4. We have improved individual analysis components for the different tools to allow either the system or a human observer to recognize these behaviors, supporting particularly tasks 5.2 and 5.3. Analyzing the data from the Wizard-of-Oz (WOZ) studies in combination with the analysis of WP3 main studies provided useful information for tasks 5.2-5.5.

The key results from this work are reported in D5.2. Here we summarize two key findings:

From a technical point of view, the studies allowed us to test and identify required improvements

both in user interface aspects (e.g. how the messages look visually) and our underlying architecture, particularly with respect to the real-time analysis provided by the different tools and displayed in the monitoring tool (c.f. D4.2 for further reflections on this using a different methodology and relying on eye-tracking).

From a conceptual point of view, the studies unearthed issues that relate to the context of each scenario and pragmatic decisions necessary when a challenge is being undertaken. This observation influenced our decision to involve the teacher more closely in the analysis of a situation in a classroom. This proved to be necessary as their role as facilitators leaves them mostly in control and more aware on what is happening (or what they would like to be happening) at any given time.

In relation to how students interpret the provided feedback, it was evident (even if expected from our previous work and collective experience) that although students generally recognize and respond to feedback, the feedback messages had to be relevant, timely and accurately personalized. These two realisations had a particular influence on the design of the WP5 components and guided us to filter and limit the indicators and landmarks that appear in the Metafora awareness tools, as well as to shift partial focus to scaffolding for peer-messages.

To continue and finalize the work under **Task 5.3** (*Design and develop diagnosis modules for microworlds*), we have relied on the behaviours defined by the L2L2 taskforce to guide the efforts and help us define the indicators and landmarks that are useful and necessary from the tools. Taking this information into account, we consider which indicators and landmarks are, on the one hand, needed to allow us to recognize the given important behaviours within each tool and, on the other hand, particularly useful for students' reflection. A challenge we had to face was generality. Each tool reports indicators and landmarks that are meaningful to the use of those tools specifically, but not necessarily to the use of system as a whole. Therefore, we also implemented landmarks that can be understood in a generic sense across all tools, landmarks about which the cross-tool analysis component can reason. With this in mind, we have defined four broad labels for landmarks coming from the different microworlds that allow for some recognition and decision-making on a generic level:

- *Perceived Solution*: an evaluation of an artifact produced within a tool that the students may consider a solution (but is not necessarily a solution).
- *Potential Solution*: a positive evaluation of the student's work that (based on some heuristics or criteria) is considered an acceptable solution to the given task.
- *Struggle*: some negative observation of a production process, outcome or interaction that indicates intervention is necessary.
- *Inactivity:* a microworld-specific landmark for recognition of inactivity.

This allowed for both generality and extensibility since subsequent microworlds that could be potentially be integrated in Metafora will be able to take advantage of the overall analysis system with little modification.

The integration of PiKI – Metafora's tailor-made microworld – with the analysis components of the Metafora platform was completed in the framework of a close collaboration of TL with other partners (mainly UdS) in WP5. Focus has been placed on the definition and technical implementation of landmarks, indicators and referable objects to be exchanged between PiKI and analysis components.

Task 5.4 (*Design and develop abstracted, integrative diagnosis modules and student interaction model*) and **Task 5.5** (Design and develop pedagogical modules) were also completed. Technically this offered a prototype system for experimentation and conceptually allowed us to make valid research contributions (as demonstrated by the related WP5 research papers) and opened up interesting research avenues. These two tasks were running in parallel. On one side, we used the

data analysis from the WOZ and main studies completed in Years 2 and 3 to help us define both the strategy and content of the feedback messages for use by students, teachers and automated system (Task 5.5). On the other side, the technical work on the cross-tool analysis component (Task 5.4) was finalized and presented in detail in D5.2. It monitors indicators and landmarks and applies a series of rules to recognize the behaviours developed from the L2L2 task force. Once behaviours are recognized, there are three different intervention mechanisms that the analysis system employs.

1. The first and least intrusive method is offering awareness information to users providing new landmarks to the analysis channel. These landmarks are presented in the Metafora system in several ways, namely the Breaking News and Reflection Tool.
2. The second type of intervention is "Suggested Messages". This intervention employs the Messaging Tool as a means of providing feedback, highlighting pertinent messages for students to consider.
3. The last and most intrusive form of feedback is direct feedback messages, given through Pop-up Messages and notifications area in the user interface.

Overall, this work forced us to rethink the role that the AI system could play. Aligned with current research in the field, it became evident that beyond its traditional function (i.e., direct presentation of feedback messages) a system can scaffold the students in sending messages to each other (indirect presentation). This opens up the definition of what an AI intervention (in the general sense) can mean: a system where fundamentally equivalent, theoretically grounded messages can be utilized by different stakeholders (human or AI agent) according to the needs, abilities, and circumstances of the given scenario. Apart from making these message templates available for students to consider and exchange, the same basic messages can either be catered to be sent directly to students (with appropriate justification) or be recommended to students or teachers as potentially pertinent to the situation.

The WP5 outcomes for the 3rd Reporting Period are described in more detail in D5.2 – Report on analysis components. In addition, while members of the WP5 team contributed to several of the Metafora publications, the main achievements with respect to WP5 work in particular was one paper accepted in the IEEE Journal of Learning Technologies (Dragon et al., 2013) and a paper for the workshop on Intelligent Support in Groups in the Artificial Intelligence in Education conference (Mavrikis et al., 2013). In addition, early prototypes were demoed during the EC-TEL 2013 and Constructionism 2012 conference as well the "*What the Research Says about Computer Supported Collaborative Learning*" event in Nottingham, UK.

The PlaTO analysis component

During the third year of the project, work on the PlaTO analysis component continued. PlaTO, as a rule-based approach for intelligent analysis of users' actions inside the Planning Tool and cross-tool interactions involving the Planning Tool, got revised and improved. The indicators and landmarks PlaTO detects were adapted to the L2L2 categories and integrated to the analyzed output. Next to the detected behaviors which were reported in the periodic report of the second year, indicators were assembled to detect the lack of attitudes or roles in a Planning Tool plan. Furthermore PlaTO got redefined and split up into two engines. One for the analysis of action-based indicators like the interaction between two students and the other engine for the structural analysis as for example the examination of structures in a plan.

WP6 - Design and development of representations and visualization tools

Year 2:

The work under WP6 has continued from Year 1 by completing the visual adaptation of existing

Domain tools/Microworlds and of the Planning tool, by delivering D6.1 – Renewed/extended domain tools (in M16), by harmonizing the visual appearance and usability of the Metafora platform (container), and by creating and improving cards and other elements of the visual language. All three tasks that compose this WP were active in this second year of the project, as shown below.

T6.1 – Design of a visual language for process models, learning plans, metaphors - Activities have progressed in Year 2 by creating and improving graphical elements of the visual language. A new category has been added, “resources”, which contains cards used to open tools of the platform (LASAD and Microworlds) with a defined status.

T6.2 – Implementation of a monitoring tool for the process models / metaphors - A first prototype of a monitoring tool was developed in the context of the Wizard-of-Oz studies (described under WP5 heading, above), which can be seen as an effort linking tasks T5.3, T5.4, T6.2 and T4.1, in close coordination between the respective partners. The monitoring, visualization and feedback provision were all priorities for WP5 after the development of the L2L2 operationalization, and therefore the 'wizard' side of the prototype and the basic implementation of the monitoring and feedback tool took place in WP5 (see above) in order to conduct the Wizard-of-Oz studies. In addition, data collection, the provision and arrangement of the data to be monitored through visualizations for the wizard and the receiving side of wizard feedback required the definition of technical interfaces and visual designs between all these tasks. This first prototype will need to be revised and scaled up to complete T6.2, which will require the cooperation of UDS, LKL, KUEI and TL in Year 3.

T6.3 – Visual redesign of existing domain and argumentation tools - Starting from the analysis of tools performed in Year 1, it has become clear that a visual redesign was needed not only for selected domain tools, but also for the Metafora container, Workbench and Planning tool. Albeit not initially planned, the consortium deemed this important for giving users the feeling of interacting with a coherent platform and not only with a mere collection of tools. In deliverable D6.1 – Renewed/extended domain tools – we provided a complete description of how this process had taken shape, both from a design and technical points of view. In essence, a first analysis has been performed to categorize tools based on the technology they have been created with. Taking the results of such analysis into consideration, a design of usability and visual appearance of the system and its components has been carried out. Subsequently, TL and the partners responsible for the various tools have worked together for implementing such design into Metafora platform’s components. This is an ongoing process that will continue also during the third year of the project, especially on Metafora container, Planning tool, Workbench and PiKi.

Year 3:

T6.1 – design of a visual language for process models, learning plans, metaphors
Activities have progressed in Year 3 by creating and improving graphical elements of the visual language. In particular "Hat cards" have been changed to "Coloured glasses cards" and icons for gates have been created.

T6.2 – implementation of a monitoring tool for the process models / metaphors
The prototypes of a monitoring tool for process models and an analytic monitoring tool to display indicators and landmarks have been consolidated in the third period. The monitoring tool for process models has been refined as a combination of the Planning Tool and the newly developed Reflection Tool (see D4.2) to allow users of the Metafora system to reflect about learning processes in context of their designed plans. The prototype of an analytic tool to support WOZ studies and researchers in analysing traces of indicators and landmarks produced by the AI components has evolved and been used practically in experimentation (see D5.2). All these activities have been conducted in close cooperation between WPs 1, 4, 5, and 6.

T6.3 – visual redesign of existing domain and argumentation tools
Activities on the visual redesign for Metafora container and Planning tool have continued in Year 3.

Albeit not initially planned, the consortium deemed such activities important for giving users the feeling of interacting with a coherent platform and not only with a mere collection of tool.
Various parts of the GUI of the container have been modified/re-designed:

- Login flow and related screens: completely re-designed taking into consideration feedback from studies in schools
- Awareness feature of selected choices: users are now always informed about their login information (name and group)
- Previous selected choices when logging in: previously selected groups, challenges and planning tool maps are now suggested as first choices during the login process
- Coherent logout button: a logout button is now always available
- Left side panels: several changes on left side panels taking into consideration feedback from studies in schools
- Chat: chat panel is now opened as default choice (it was Tools panel), and also it's layout has changed
- Group info: completely re-designed taking into consideration feedback from studies in schools
- Right bar of planning tool: completely re-designed taking into consideration feedback from studies in schools
- Connectors tab: major modifications based on feedback from studies in schools

Potential impact

The extraordinary success of Web 2.0 social networking technology offers a tantalizing glimpse of how easily people can organize themselves to work and learn together in online communities. However, in reality social networking sites are almost totally focused on social exchanges without educational content. Similarly the success with young people of immersive 3D gaming environments illustrates how operating in complex new domains can be fun and engaging, occurring almost naturally as a byproduct of acting in a simulated environment. Currently, however, this powerful technology mostly supports learning in contexts without any real-world relevance. Frequently the learning of skills in games is enhanced not only by the immersive representational media itself but also by individuals collaborating to meet the ends set within the game through developing communication, strategic thinking and problem solving skills. These kinds of skills are precisely those which, in a different context, could help young people understand scientific and mathematical ideas.

With these aims in mind, in Metafora we have developed tools and pedagogies that bring together the work of two, until now largely separate strands of educational technology research: (a) computer-supported collaborative learning (CSCL) and (b) learning through engagement in domain-specific learning environments. The original contribution (specifically to science teaching and learning, as this was the focus of our project, but certainly not limited by them) has come not only from the combination of these two research traditions but also from the recognition that **learning how to learn** is widely considered as the most important skill for young people to learn, vital for equipping workers and citizens with the ability to adapt and thrive in the fast-changing world.

To address these needs, we intended to help learners reflect on learning mathematics and science as a social process and discover the best ways to structure and engage in learning. The Metafora system is very innovative, linking the most advanced supports for collaborative learning with constructionist and exploratory microworlds. Pedagogically, we have developed an understanding of the affordances of new technology in supporting learning in mathematics and science through

dialogue on the construction and exploration of meanings. The distinctive elements that characterize Metafora, namely,

- Extending and enriching the interaction – from a single, one-time activity (e.g., a discussion) to a series of activities to be carried out over a relatively long period;
- Featuring a variety of tools supporting different instances and needs of the interaction (microworlds, tools for planning, discussing, reflecting, messaging, etc.);
- From learning to argue, or learning a subject, to learning to learn together (L2L2);
- Addressing not just a question but a full, more complex assignment – "the challenge";
- Students plan the full activity and assume responsibility for the work and its results;
- The tools support students and teacher, mediating several facets of the interaction, and also inform the system so that it can produce feedback to foster learning and L2L2;
- Integrating conceptual constructs (e.g., microworld constructions) in plans and discussions for further elaboration, reference and shared understanding (using referable objects generated in the interaction);
- Active role in regulating collaborative work (L2L2) with the messaging tool; and
- Supporting reflective activity and the design of reflection lessons (reflection tool),

carry with them the seed for the expected impact of the project, the achievement of which has been put by the consortium at the center of its attention – especially in the second half of the project – when devising its exploitation plan and strategy (as condensed in deliverable D7.3).

Several aspects have been considered in order to assess – and to confirm our initial expectations regarding – the need for our tools and approach, including the factors that we should take into account to improve the accessibility and the responsiveness of the target community, to know who this community is or could be, and to be aware of existing players that, with a proper attitude and actions from our side, could promote the introduction of Metafora as a standard tool to learning environments. We found three topics worth addressing in this regard: (1) Reactions to Metafora, (2) Lessons from the SCY and other projects, and (3) Inquiry-Based Learning as a valuable antecedent, to which we refer here very briefly (additional information in deliverable D7.3).

Reactions to Metafora - Nobody remains indifferent when hearing about Metafora; indeed, the partners have witnessed this phenomenon as a generalized experience since the very beginning of the project. Clear “welcome indicators” have reached the partners in virtually any dissemination event, in presentations to large and small audiences, and in joint experiences of many kinds and character (including hands-on workshops), involving teachers, school or school network management staff and other educational practitioners, and stakeholders of varied type and rank. In all cases Metafora raised enthusiastic reactions. These persons and institutions unequivocally showed that they wanted to bring it to their schools without delay; to take part in the development / trial work that took place at that time in the project and to be in "a good position in the line" when the system is ready and starts to be reliably implemented. With the end of the project as an R&D endeavor, we believe that this time has come, calling the partners to start the implementation phase foreseen in their exploitation plans.

Lessons from other projects and initiatives addressing R&D and field activities related to Metafora's – We learned from them about the increased students' motivation behind designing artifacts and the importance of their visibility and reuse. As well, and reinforcing our previous knowledge and experience, it has become clear to us that for larger impact it is teachers who should consider that the project is relevant to their situation. Based on the interaction that all the pedagogical partners have had with teachers during the project, it appears that the most interesting and prominent feature of the platform is the fact that it can be used for homework outside the classroom, with the added value of monitoring and supporting the activities of the students. This aspect is embedded in the pedagogical approach supporting the system (e.g., taking as typical durations of activities relatively long time spans, it is to be expected that much of the activity will be carried out remotely and asynchronously). Other distinctive characteristics of the tools, however, have proven to be equally appealing in this regard, including, for example, the provision of an ideal arena for mutual

awareness, collaboration and reflection, the real-time monitoring of the activities and feedback conveyance, and the way in which the system keeps for ulterior use a referable record of the extended, multiparty interaction, encompassing both the process and the outcomes.

IBL as a reference – The possibility of drawing conclusions useful for Metafora from the experience (and, in particular, the difficulties) in introducing other comparable or otherwise related educational approaches – e.g., Inquiry-Based Learning (IBL) – has been addressed by the consortium. Different sources consulted on this subject proved to be instructive in this regard, shading light on what we can expect, for Metafora, regarding its acceptance in school practice and the will to introduce it as a core curricular component or approach in the educational system. Indeed, IBL and Metafora share much in common – not only in their conceptual content but mainly in factors that have to do with the attitude (and aptitudes) of potential adopters and the role played by institutional factors in their acceptance or rejection/ignorance. Therefore, even if the two approaches have differences, their remaining similitude unquestionably invites us to build on the educational community's prior experience with IBL. The difficulties in introducing IBL to the curricula and to the school practice, as reported in those sources, are certainly valid indicators for our purposes. Moreover, planning Metafora's introduction as a widespread tool and approach may build directly on IBL's problematic implementation experience, at least with specific regard to the partial set of factors singled out in the literature. These would include, for example,

- Creating and maintaining a community of teachers (and researchers) to support them professionally in the use of Metafora;
- Creating a bank of challenges (Metafora assignments) and auxiliary material for the teachers to facilitate the insertion of Metafora-based activities in the class curriculum;
- Emphasizing proper teacher training, addressing not only the curricular content but also the maximization of Metafora's L2L2 potential (via awareness, reflection, help seeking and provision, feedback, etc.) and all operational aspects related to its utilization in class (technical and use matters, groups constitution, selection and formulation of challenges, Planning Tool affordances, microworlds, etc.);
- More in general, fostering a positive attitude toward the thoughtful introduction of technology to the classroom and the schooling system in general, and clearly explaining the role that Metafora could fulfill in this sense;
- Deciding with high level educational authorities as well as with school directors and teachers the extent and optimal path/speed for the introduction of Metafora to normal classroom practice. For example, the presence of nation-wide examinations in the last high-school years calls for preferring the introduction of Metafora in earlier years; etc.
- Engaging in an active campaign for a more conspicuous consideration of the skills, competences and attitudes promoted by Metafora in the course examinations, such as critical thinking, collaboration, teamwork, responsibility, curiosity, awareness to others' needs, written and oral expression, etc. To a varying degree, this process is underway or under discussion by educational authorities in various countries.

All these aspects underlie the exploitation plans adopted by the consortium and its individual members. In fact, these aspects – or rather, “recommendations” from others’ experience – together with the availability of stable tools and mature pedagogies, pave the way on which we could start moving toward a full realization of Metafora’s impact, as conceived from the very initial ideas that gave birth to this project. This view is consistent with that of the Expert Reviewers, who in their Final Report wrote (as *their* recommendation No. 3):

> *The project has a high potential for contributing to the understanding of the role and impact on learning through social interactions at the theoretical level. Now that the platform is operational and a number of pilot studies have been carried out, the consortium is encouraged to develop this contribution which is of interest for the CSCL community as well as for the ILS community.*

The main exploitable results of Metafora, as identified by the partners, are currently classified in two groups: (1) Learning-related services and (2) Tools for supporting group learning. The former, to be promoted in the main by the pedagogical partner, comprises mainly the design and delivery of courses and learning units; the selection, formulation and scheduling of "challenges" and supporting material for the teacher in the school curricula; training of teachers and moderators; tailor-making the tools and methods to special settings (e.g., subject matters other than science or math) and environments (e.g., VLEs); enriching the MW (and possibly other tools) set supported by the system, etc.; further development (or adaptation for special purposes) of the visual language used by the system for planning, reflecting and accessing the enactment of the students activities; etc. The latter, which will involve the technological/industrial partners as key players, relate to the tools without which the aforementioned services could not be provided and other technological spin-offs for the direct exploitation by the involved institutions. In principle, and in their basic embodiment, the Metafora system will be offered for free (at least for educational and not-for-profit organizations) in the framework of an open-source licensing scheme. The further development/adaptation of tools raises additional possibilities of exploitation associated with the standardization of 'analysis and system response' at a generic level, whereby we provide clear instructions for any educational software (for dialogue or domain - expression) to be connected in the future. In fact, much expertise is being created in Metafora in the incorporation of tools to the platform so that they cannot only be used by the students participating in the activities but also recognized and assimilated by the system's analysis components, enabling important feedback for the teachers and the students. In the development work carried out during the project's lifespan, only a few tools (e.g., Lasad, the Planning tool, five microworlds, etc.) are served by the system but, expectedly, other tools will be featured in the future, widening the scope of the Metafora system's application. The most obvious case is microworlds and other auxiliary (e.g., simulation) tools of diverse origin and character, which would readily be incorporated to the Metafora's platform responding to existing needs.

Considering the above and the knowledge gathered in much "exploitation-oriented dissemination" activity during the project, the consortium an exploitation strategy that builds on the following fundamental pillars:

- Teachers' appeal for the Metafora approach and tools is a necessary condition for a bottom-up, successful introduction of Metafora to schools and classrooms. Nurturing the links with teachers, maintaining a teachers' professional community around Metafora and proper training – during and after the project – are actions of utmost importance.
- Maintain and keep updated the Metafora website, which should enable also the access to the Metafora system for use.
- Ensure the sustainable accessibility, usability and up-datedness of Metafora tools and user manuals at all time after the project is concluded.
- Review, identify and assess, on a current basis, the need for Metafora tools and related services, searching for new possibilities and eventually devising new or rethinking pre-existing tools (e.g., adaptations) or services (e.g., specially focused training cycles).
- Keep track of the implementation / enforcement of any IP protection policy adopted (see further below), or periodically reconsider such an adoption – e.g., the possibility of filing for a trade-mark for Metafora's name and/or logo, discussed in the project – if not previously implemented.
- The integration with leading VLEs may be an important factor to facilitate the diffusion of Metafora's tools and approach. Arrange for materializing this integration the soonest and to the extent possible.
- Three guiding principles – Autonomy, Mutual support and Continuation – appear to best reflect the way the partners would want to approach the future exploitation of Metafora's results. Accordingly, exploitation would be conducted, in the main, at the partner- (or specific sub-group of partners-) level and by its (their) initiative, independently but within a positive

collaborative environment, as needed for the work to do, and benefiting from all necessary communication, networking and dissemination infrastructure.

- The consortium will get (for the moment, informally) instituted, after the project is over, to ensure that matters of common interest are addressed in a coordinated fashion, including further development/adaptation work, marketing / dissemination, licensing, new needs identification, and, in general, everything intended to ensure continuation and exploitation, while maintaining Metafora's spirit alive.

Following is an outline of last years' work in dissemination and exploitation-planning in Metafora:

Further to the preparatory actions carried out in the first and second years – especially the definition of a dissemination approach and action plan, the launch and maintenance of Metafora's website, the design and selection of the project's logo and the preparation and distribution of printed brochures, and the utilization for dissemination purposes of otherwise "pure R&D" activities, like workshops and pilots involving external people – the third year was devoted more intensively to further the depth and span of the dissemination activities and to advance in the planning and preparation of the future exploitation activity. The activities featured the whole range of possibilities foreseen in our Dissemination and Use Plan (D7.2), including the participation of representatives of the Metafora teams in conferences, workshops and other events (giving plenary and smaller group lectures, presenting papers, posters, etc.), scientific publications (much contributing to the already remarkable extent achieved in the previous two years), press releases, specific activities with policy makers and other influential people, etc. Also, in the third year we carried out, at two of the partners' premises, three FUG (Focus User Group) meetings, presenting the mature system that became available at the end of the project, and the theoretical and practical knowledge accumulated on the pedagogical side, to qualified audiences and receiving from them valuable feedback for a more effective planning of the future exploitation of our tools and pedagogies. The project's website was technically maintained and fed/updated by all the partners with new information including also the uploading of all the public deliverables and putting them at the disposal of external readers in the open "Publications" section.

Exploitation-related decisions have been taken by the consortium, and actions started to be implemented in order to make the Metafora system accessible by external users (supported, also, by a User Manual produced as part of deliverable D4.2 – Technical report and user manual - Final System) and creating the basis for an open developers' community by developing and publishing a proper and well documented source code. The technical development process got finalized by devising a concept for persistent hosting of the system, including public access, sustainable legacy, licensing, good quality open source code and an easy-to-use full Metafora distribution to enable dissemination and exploitation of the system. D4.2 gives an account on the final system of Metafora and its design decisions, technological characterization, architecture, components, dissemination and exploitation concept etc. In Deliverable D4.3 – Metafora Microworlds – information about the integrated microworlds is given with a short description, features and functionalities, integration etc.

Address of the project public website and contact details.

Project website: http://www.metafora-project.org/

Partners in the Metafora consortium:

THE HEBREW UNIVERSITY OF JERUSALEM
THE UNIVERSITY OF EXETER
NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS
KATHOLISCHE UNIVERSITAT EICHSTATT-INGOLSTADT
UNIVERSITAT DES SAARLANDES
INSTITUTE OF EDUCATION, UNIVERSITY OF LONDON
TESTALUNA SRL

Contact details of the Project Coordinator (additional contacts are available via project's website):

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Metafora logos (vertical and horizontal layouts):

2. Use and dissemination of foreground

A plan for use and dissemination of foreground (including socio-economic impact and target groups for the results of the research) shall be established at the end of the project. It should, where appropriate, be an update of the initial plan in Annex I for use and dissemination of foreground and be consistent with the report on societal implications on the use and dissemination of foreground (section 4.3 – H).

The plan should consist of:

- **Section A**

  This section should describe the dissemination measures, including any scientific publications relating to foreground. **Its content will be made available in the public domain** thus demonstrating the added-value and positive impact of the project on the European Union.

- **Section B**

  This section should specify the exploitable foreground and provide the plans for exploitation. All these data can be public or confidential; the report must clearly mark non-publishable (confidential) parts that will be treated as such by the Commission. Information under Section B that is not marked as confidential **will be made available in the public domain** thus demonstrating the added-value and positive impact of the project on the European Union.

Section A (public)

This section includes two templates

- Template A1: List of all scientific (peer reviewed) publications relating to the foreground of the project.
- Template A2: List of all dissemination activities (publications, conferences, workshops, web sites/applications, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters).

These tables are cumulative, which means that they should always show all publications and activities from the beginning until after the end of the project. Updates are possible at any time.

TEMPLATE A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES

NO.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Relevant pages	Permanent identifiers[6] (if available)	Is/Will open access[7] provided to this publication ?
1	Planning for life – educate students to plan	Harrer A.	Proceedings of the 13th IEEE International Conference on Advanced Learning Technologies	July 2013	ICALT	China	2013			yes
2	SoCCR – optimistic	Harrer A.	Proceedings of	Septembe	CRIWG	Germany	2012			yes

[6] A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).

[7] Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

	concurrency control for the web-based collaborative framework Metafora		the 18th International Conference on Collaboration and Technology	r 2012						
3	Metafora: A Web-based Platform for Learning to Learn Together in Science and Mathematics.	Dragon, T., Mavrikis, M. McLaren, B.M., Harrer, A., Kynigos, C., Wegerif, R., & Yang, Y.	IEEE Transactions on Learning Technologies	July-Sept. 2013 (vol. 6 no. 3)	IEEE Computer Society Digital Library		2013	pp. 197-207	http://doi.ieeecomputersociety.org/10.1109/TLT.2013.4	Yes, after one year
4	Applying a Constructionist Frame to Learning about Sustainability,	Daskolia, M., & Kynigos, C.	Creative Education	2012. Vol.3, Special Issue,			2012	pp. 818-823	DOI:10.4236/ce.2012.326122.	http://www.SciRP.org/journal/ce
5	Boundary Objects in Educational Design Research: designing an intervention for learning how to learn in collectives with technologies that support collaboration and exploratory learning	Yiannoutsou, N., & Kynigos, C.	Educational Design Research: Introduction and Illustrative Cases	2013	SLO, Netherlands Institute for Curriculum Development, Enschede, The Netherlands		2013	pp 357 – 379,	ISBN:978 90 329 2335 8,	http://international.slo.nl/bestanden/Ch01-51_total.pdf/
6	Scaffolding Collaborative Learning Opportunities: Integrating Microworld Use and	Dragon, T., McLaren, B.M., Mavrikis, M., & Geraniou,	Advances in User Modeling: Selected papers from UMAP 2011 Workshops		Springer-Verlag	Girona, Spain	2012	pp. 18-30		

	Argumentation	E.								
7	Niches for Constructionism: forging connections for practice and theory.	Kynigos, C.	Proceedings of the Constructionism 2012 Conference - Theory, Practice and Impact	2012	National and Kapodistrian University of Athens.	Athens, Greece	2012	pp. 40-51	ISBN: 978-960-88298-4-8	no
8	Scaffolding Inquiry-Based Science Learning with a digital learning platform and playing in the school yard.	Smyrnaiou, Z., Moustaki, F., Kynigos, C.	Alpine Rendez-Vous: Scaffolding Inquiry-Based Science Learning (IBSL) with computer environments	2013		Villard-de-Lans, Vercors, French Alps	2013			http://arv-ibsl.imag.fr/index.php/Main_Page
9	On- line discussions about emerging mathematical ideas.	Kynigos, C. & Moustaki, F.	Proceedings of the Eighth Congress of the European Society for Research in Mathematics Education	2013	CERME 8	Antalya, Turkey	2013			no
10	Designing tools to support group work skills for constructionist mathematical meaning generation	Kynigos, C., & Moustaki, F.	Proceedings of the IDC 2013 Conference	2013	Interaction Design and Children,	New York, USA	2013			no
11	Bringing learning science and user interface design into one loop of joint research interests – the SoCCR case in Metafora	Lingnau A.	Learning Science and Human Computer Interaction Workshop	15th June 2013	10th Interna-tional Conf. on Computer Supported Collaborative Learning	USA	2013			yes
12	Peer scaffold in math problem solving.	Abdu, R.	Computer Supported			U.S.A.	2013			

			Collaborative Learning conference, Madison, Wisconsin, U.S.A.							
13	Computational Methods and Tools for Social Network Analysis of Networked Learning Communities	Harrer A.	Tutorial at the third Conference on Learning Analytics and Knowledge	2013	LAK	Belgium	2013			yes
14	Mathematical ideas on constructing 3d digital figures shared on-line within a group.	Kynigos, C. & Moustaki, F.	Proceedings of the 37th Conference of the International Group for the Psychology of Mathematics Education	2013	PME	Kiel, Germany	2013			no
15	Reflektionsunterstützung im Metafora System durch eingebettete Learning Analytics Werkzeuge	Irgang T.	Workshop on Learning Analytics	8th of September 2013	DeLFI Mensch & Computer	Germany	2013			yes
16	Analytics of collaborative planning in Metafora – architecture, data, and analytics methods	Harrer A.	Proceedings of the third Conference on Learning Analytics and Knowledge	2013	LAK	Belgium	2013			yes
17	The Metafora design principles for a collaborative, interoperable	Harrer A.		2013	CRIWG 2013	New Zealand	2013			no

	learning framework									
18	Research on collaborative planning and reflection – methods on tools in the Metafora Project	Harrer A.	Proceedings of the 8th European Conference on Technology Enhanced Learning	September 2013	EC-TEL	Cyprus	2013			yes
19	Learning how to learn together (L2L2): Developing tools to support an essential complex competence for the Internet Age.	Yang, Y. Wegerif, R., Dragon, T., Mavrikis, M., & McLaren, B.	CSCL 2013 conference			Wisconsin, Madison, USA	2013			
20	The Metafora tool: supporting learning to learn together	De-Groot, R. Dragon, T. Mavrikis, M. Harrer, A., Pfahler, K. McLaren, B. Wegerif, R. Kynigos, C. Schwarz, B.	In: Rummel, N. Kapur, M. Nathan, M. Puntambekarto S. (Eds.) To see the world at a grain of sand: Learning across levels of space, time and scale				2013	Vol. II P. 392-396.		
21	Blockmodelling and role analysis in multi-relational networks.	Harrer A.	Social Networking Analysis and Mining journal, Journal no. 13278	2013		Wien	2013			yes
22	Unpacking the idea that dialogue itself should be a goal of collaborative learning.	Wegerif, R.	EARLI			Munich, Germany	2013			

23	Patterns of Collaboration: Towards Learning Mathematics in the Era of the Semantic Web.	Jones, K., Geraniou, E. & Tiropanis, T.	In D. Martinovic et aL (eds.). Visual Mathematics and Cyberleaming. Mathematics Education in the Digital Era.		Springer Science & Business Media	Dordrecht, Nether-lands	2013		L DOl 10.1007/978-94-007-2321-4_1	
24	Ermittlung von Kollaboration und take-up in Lernszenarien durch autonome Agenten	Harrer A.	Workshop on Learning Analytics	8th of September 2013	DeLFI Mensch & Computer	Germany	2013			yes
25	Kollaboratives Planen und Lernen mit der web-basierten Lernplattform Metafora	Harrer A.		September 2013	DeLFI Mensch & Computer	Germany	2013			yes
26	Fostering creativity in learning about sustainability through engagement in constructionist activities.	Daskolia, M., Kynigos, C.	Proceedings of the 7th World Environmental Education Congress (7WEEC)	2013	Turin: Istituto per l' Ambiente e l' Educazione Scholè Futuro	Marrakesh - Morocco	2013		ISBN: 9788885313361	no
27	Towards Supporting 'Learning To Learn Together' in the Metafora platform.	Mavrikis, M., Dragon, T., Yiannoutsou, N. & McLaren, B. M.	In the Proceedings of the Intelligent Support for Learning in Groups Workshop held at the 16th International Conference on Artificial Intelligence in				2013			

			Education (AIED 2013)							
28	Some dialogic mechanisms at work when children learn to think.	Wegerif, R., Yang, Y., & Kazak, S.	EARLI			Munich, Germany	2013			
29	METAFORA System: learning to learn together during explorations with microworlds.	Yiannoutsou, N., Mavrikis, M., Moustaki, F., Abdu, R., Xenos, M.	Proceedings of the Constructionism 2012 Conference - Theory, Practice and Impact	2012	National and Kapodistrian University of Athens.	Athens, Greece	2012	pp. 687	ISBN: 978-960-88298-4-8	no
30	Constructionist Discussions With and Around Microworld Referable Objects	Mavrikis, M., Kahn, K. and Dragon, T.	In C. Kynigos, J. E. Clayson & N. Yiannoutsou (Eds), Proceedings of the Constructionism 2012 Conference - Theory, Practice and Impact		National and Kapodistrian University of Athens	Athens, Greece	2012	380-384		
31	Developing technological and pedagogical affordances to support collaborative inquiry science processes	Pifarré, M. Wegerif, R. Guiral, A. & Del Barrio, M.	in D. Sampson; M. Spector & D. Ifenthaler (Eds) (2012). Proceedings of the IADIS International Conf. Cognition and Exploratory Learning in Digital Age (CELDA 2012)		IADIS Press		2012			

32	Artificial intelligence supporting collaborative constructionist activities in environmental education.	Xenos, M.	Proceedings of the Constructionism 2012 Conference - Theory, Practice and Impact	2012	National and Kapodistrian University of Athens.	Athens, Greece	2012	pp. 669	ISBN: 978-960-88298-4-8	no
33	Dialogic: Education for the Internet Age	Wegerif, R			Routledge		2012		ISBN-10: 0415536782 ISBN-13: 978-0415536783	
34	The Metafora Project and the Promotion of Creativity – Theory-based Expectations and Preliminary Findings	Drachman, R., Abdu, R., Daskolia, M., De-groot, R. Dragon., T., Harrer, A., Kynigos, C., Wegerif, R.	eChallenges e-2012 Conference Proceedings	2012	IIMC International Information Management Corporation		2012		ISBN: 978-1-905824-35-9	no
35	Creating motion models by manipulating parameters that correspond to scientific conventions	Smyrnaiou, Z., & Moustaki, F.	Proceedings of the Constructionism 2012 Conference - Theory, Practice and Impact	2012	National and Kapodistrian University of Athens.	Athens, Greece	2012	pp. 625-629	ISBN: 978-960-88298-4-8	no
36	Teachers learning about sustainability while co-constructing digital games.	Daskolia, M., Kynigos, C., Yiannoutsou, N.	Proceedings of The International Conference on Higher Education (ICHE 2012).	66, 2012	World Academy of Science, Engineering and Technology	Paris, France	2012	pp. 521-526		No
37	METAFORA and the	Abdu, R.,	In C. Kynigos, J.		National and	Athens,	2012	468-479		

	fostering of collaborative mathematical problem solving.	Schwarz, B.	E. Clayson & N. Yiannoutsou (Eds), Proceedings of the Constructionism 2012 Conference - Theory, Practice and Impact		Kapodistrian University of Athens	Greece				
38	Exploring Learning-to-learn-together Processes within the Context of an Environmental Education Activity.	Daskolia, M., Yiannoutsou, N., Xenos, M., Kynigos, C.	In the Proceedings of the Ireland International Conference on Education	2012	IICE-2012.	Dublin, Ireland.	2012		ISBN 978-1-908320-06-3	no
39	Developing a Planning and Reflection tool to Support Learning to Learn Together (L2L2).	Wegerif, R., Yang, Y., De Laat, M., Pifarre, M., Yiannoutsou, N., Moustaki, F. Smyrnaiou, Z., Daskolia, M., Mavrikis, M., Geraniou, E. and Abdu, R.	IST-Africa 2012 Conference Proceedings	2012	IIMC International Information Management Corporation	Tanzania, Africa	2012		ISBN: 978-1-905824-34-	no
40	Interweaving meaning generation in science with learning to learn	Smyrnaiou, Z., Moustaki,	Themes in Science & Technology	5(1/2), 2012			2012	pp. 27-42		http://earthlab.uoi.gr/theste/index.

	together processes using Web 2.0 tools.	F., Yiannoutsou, N., & Kynigos, C.	Education,							php/theste/article/view/105
41	L'émancipation intellectuelle passe d'abord par le virtuel ?	Smyrnaiou, Z.	Colloque international CREAD « formes d'éducation et processus d'émancipation ».	2012		Université Rennes 2, Campus Villejean, France	2012	pp. 42-52		no
42	Students' constructionist game modelling activities as part of inquiry learning processes. Electronic Journal of e-Learning.	Smyrnaiou, Z., Moustaki, F., Kynigos, C.	Special issue on Games-Based Learning, Volume 10,	Issue 2, 2012,			2012	pp.235 - 248		http://ejel.org/issue/download.html?idArticle=196.
43	The Metafora platform tools and Learning to Learn Science Together.	Smyrnaiou, Z. & Evripidou, R.	Proceedings of 4th International Conference on Computer Supported Education	2012	CSEDU	Porto, Portugal.	2012	pp. 200-205		no
44	Dialogical Interactions Concerning the Scientific Content Through Face to Face and Distance Communication Using Web 2 Tools.	Smyrnaiou, Z., Varypati, E. & Tsouma, E.	Proceedings of 10th International Conference on Computer Based Learning in Science (CBLIS), Learning science in the society of computers	2012		Barcelona, Catalonia/Spain	2012	pp. 117-125		No
45	Meanings for 3d mathematics shaped by on-line group discussion	Moustaki, F., & Kynigos, C.	Proceedings of the Constructionism 2012 Conference	2012	National and Kapodistrian University of Athens.	Athens, Greece	2012	pp. 174-183	ISBN: 978-960-88298-4-8	no

			- Theory, Practice and Impact							
46	Learning how to learn with microworlds: evaluation and help seeking	Yiannoutsou, N., & Mavrikis, M.	Proceedings of the Constructionism 2012 Conference - Theory, Practice and Impact	2012	National and Kapodistrian University of Athens.	Athens, Greece	2012	pp. 490-499	ISBN: 978-960-88298-4-8	no
47	The design of wizard-of-oz studies to support students' learning to learn together.	Mavrikis, M., Dragon, T., & McLaren, B.M.	Proceedings of the Workshop on Intelligent Support for Exploratory Environments 2012: Exploring, Collaborating and Learning Together at the 11th International Conf. on Intelligent Tutoring Systems (ITS 2012)				2012			
48	PlaTO – the planning tool observer in the multi-tool ELE Metafora	Harrer A.		2012	ITS Workshop Proceedings on Intelligent Support for Exploratory Environments : Exploring, Collaborating and Learning Together		2012			Yes
49	Metafora: Defining and Supporting "Learning to Learn Together"	Dragon, T., Mavrikis, & Yang, Y	IEEE Learning Technology Newsletter	14(1)	EEE Computer Society Digital		2012	pp. 4-7		

					Library					
50	Learning to Learn Science Together with the Metafora tools.	Smyrnaiou, Z. & Evripidou, R.	Proceedings of 10th International Conference on Computer Based Learning in Science in Science (CBLIS), Learning science in the society of computers	2012		Barcelona, Catalonia/Spain	2012	pp. 132-139		No
51	Constructionism: theory of learning or theory of design? Regular Lecture.	Kynigos, C.	Proceedings of the 12th International Congress on Mathematical Education	2012	ICMI	Seoul, S. Korea.	2012			no
52	Constructing digital games about sustainable lifestyles: creativity in learning to learn together.	Daskolia, M., Kynigos, C.	Proceedings of the EDULEARN12 Conference,	2012	International Association of Technology, Education and Development (IATED).		2012			No
53	Collaborative modeling processed using the Juggler half-baked microworld. (in Greek).	Smyrnaiou, Z., Moustaki, F., Yiannoutsou, N., Kynigos, C., Daskolia, M.	Proceedings of the 8th Panhellenic Conference “Information and Communication Technologies in Education”	2012		Volos, Greece	2012	pp. 416-423		
54	Learning to Learn Together through Planning, Discussion	Mavrikis, M., Dragon, T.,	Accepted for Demonstration presentation			Saarbrücken, Germany	2012			

	and Reflection on Microworld-based Challenges.	Abdu, R., Harrer, A., De-Groot, R., and McLaren, B . M.	at EC-TEL 2012: Seventh European Conference on Technology Enhanced Learning.							
55	Tinkering creatively with sustainability.	Daskolia, M., Kynigos, C.	Proceedings of the Constructionism 2012 Conference - Theory, Practice and Impact	2012	National and Kapodistrian University of Athens.	Athens, Greece	2012	pp. 194-203	ISBN: 978-960-88298-4-8	no
56		Wegerif, R., Postlethwaite, K., Skinner, N., Mansour, N., Morgan, A., Hetherington, L.	Dialogic science education for diversity. In Mansour, N and Wegerif, R (Eds) (In press for 2012) Science Education for Diversity.		Springer	New Jersey	2012		ISBN-10: 9400745621 ISBN-13: 978-9400745629	
57	L'usage d'un micro-monde pour apprendre le langage de programmation LOGO.	Xenos M. & Smyrnaiou Z.	Proceedings of the Sciences et technologies de l'information et de la communication en milieu éducatif : Analyse des pratiques et enjeux didactiques, Quatrième Colloque	2011	Université de Patras, Athènes : New Technologies Editions.	Patras, Greece	2011	pp. 79-80		No

			International DidaPro 4 – Dida&STIC							
58	La experiencia y los proyectos educativos del Grupo Kishurim y su relevancia para el fomento de la creatividad.	Drachman, R.	Presented in 3er Congresso Internacional de Creatividad y Pedagogia			Cartagena de Indias, Colombia	2011			
59	Collaborative design and construction of digital games to learn about sustainable lifestyles.	Kynigos, C., Daskolia, M.	International Technology, Education, Development Conference Proceedings	2011	Office for Official Publications of the European Communities	Valencia, Spain	2011			Yes http://library.iated.org/view/KYNIGOS2011COL
60	Technology and Dialogic Space: Lessons from History and from the 'Argunaut' and 'Metafora' Projects.	Wegerif, R. B., Yang, Y.	Presented at CSCL 2011, Hong Kong.			Hong Kong	2011			
61	Creating meanings in science with collaborative kinaesthetic games.	Kynigos, C., Smyrnaiou, Z. & Roussou, M.	Proceedings of the 7th Greek National Conference on Science Education and ICT in Education «Interactions between Research and Practice in Science Education»,	2011			2011	pp. 487-495		Yes/ http://www.7sefepet.gr
62	Engineering Students'	Moustaki, F., &	Proceedings of the 35th Conference	2011	PME	Ankara, Turkey	2011	Vol. IV, pp. 366		no

	Visualization And Reasoning Processes While Interacting With A 3d Digital Environment. I	Kynigos, C.	of the International Group for the Psychology of Mathematics Education.							
63	Digital learning environments fostering exploration and bricolage.	Kynigos, C., Daskolia, M., Smyrnaiou, Z., Psycharis, G., Yiannoutsou, N., Moustaki, F. & Xenos, M.	Proceedings of the 6th Pan Hellenic Teachers' Conference for Information and Communication Technologies "Using ICTs in the Didactical Practice".	2011		Syros, Greece	2011			no
64	Introducing planning in socio-constructionist activities in Environmental Education, Maths and Physics.	Yiannoutsou, N., Smyrnaiou, Z., Daskolia, M., Moustaki, F., Kynigos, C.	EARLI CONFERENCE 2011, 14th Biennial EARLI Conference for Research on Learning and Instruction, "Education for a Global Networked Society".	2011		Exeter, United Kingdom	2011			no
65	METAFORA Learning Approach Processes Contributing To Students' Meaning Generation In Science Learning.	Smyrnaiou, R., Moustaki, F., & Kynigos, C.	Proceedings of 5th European Conference on Games Based Learning, (ECGBL)	2011	Academic Publishing Limited.	Athens, Greece	2011	pp. 657-664		No

67	Analysing and Supporting Students' Interactions in Synthesized Learning Environments: A Case Study with a Microworld and a Discussion Tool.	Dragon, T., Gutierrez-Santos, S., Mavrikis, M. & McLaren, B.M..	Conference proceedings from Technology-Enhanced Learning for Mathematics and Science (TELMAS): Landmark Research and New Contributions. Held in conjunction with EC-TEL 2011			Palermo, Italy	2011			
68	Developing spatial and visualization abilities using a specially designed computational medium	Moustaki, F., & Kynigos, C.	Proceedings of the 34th Conference of the International Group for the Psychology of Mathematics Education.	2010	PME	Belo Horizonte, Brazil	2010	Vol. IV, pp. 366		No
69	Supporting Students Learning to Learn Together in Constructionist Situations: The vision and technical approach in the Metafora project.	Mavrikis, M., McLaren B., Harrer, A. and Kynigos, C.	In the Fourth International Workshop on Intelligent Support for Exploratory Environments. In conjunction with EC-TEL 2010			Barcelona, Spain	2010			
70	Visualization processes in a 3d tool designed for engineering activities.	Moustaki, F., & Kynigos, C.	Proceeding of the Constructionism 2010 Conference-Constructionist	2010	American University of Paris.	Paris, France	2010			No

			approaches to creative learning, thinking and education: Lessons for the 21st century.							

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
1	Conference	ETL/NKUA	PME 34 – Conference of the International Group for the Psychology of Mathematics Education.	18–23/7/10	Belo Horizonte, Brazil.	Scientific community		Worldwide
2	Conference	ETL/NKUA	Constructionism 2010 - Constructionist approaches to creative learning, thinking and education: Lessons for the 21st century.	16–20/8/10	Paris, France.	Scientific community		Europe and other countries
3	Workshop	UNEXE	Design workshop on the visual language	13/9/2010	Baring Court, Exeter, UK	Scientific Community	4 University academics from Science Education group and 1 secondary Science teacher.	UK
4	Conference	ETL/NKUA	7th Pan-Hellenic Conference with International Participation "ICT in Education" – HCICTE 2010	23–26/9/10	Korinthos, Greece.	Scientific Community, Policy makers		
5	Symposium	ETL/NKUA	Symposium DIDAPRO (in French) – HCICTE 2010	23–26/9/10	Korinthos, Greece.	Scientific Community		

[8] A drop down list allows choosing the dissemination activity: publications, conferences, workshops, web, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters, Other.

[9] A drop down list allows choosing the type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias, Other ('multiple choices' is possible).

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
6	Workshop, publications	LKL/IoE (workshop organizer) LKL, UdS, KUEI and ETL (paper authors)	Workshop - Fourth International Workshop on Intelligent Support for Exploratory Environments (ISEE'10)	28/9/10	Barcelona, Spain	Scientific Community	20 participants	Mainly Europe
7	Conference	UNEXE	International conference	29/09/10	Athens, Greece	Scientific Community	40 delegates attending	
8	Workshops	HUJI, UdS, IoE/LKL and NKUA/ETL	Seminars / Design workshops Assessing use and acceptance, and collecting feedback on several current development strands in Metafora: Visual language, planning, discussion tools, microworlds (eXpresser).	September 2010 – January 2011	Jerusalem and Beer-Sheba, Israel	Teachers, school principals.	2 schools, 6 teachers and school directors, and approx. 50 students.	Israel
9	Workshop / Seminar	ETL/NKUA	Seminar on the visual language of Metafora.	6/10/2010	Athens, Greece	Scientific Community; teachers	11 Secondary school teachers and researchers.	Greece
10	Conference	UNEXE	mLearn 2010 International conference	22/10/10	Malta	Scientific community; academics interested in mobile learning in Science.		

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NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
11	Seminar	UNEXE	Research seminar for scientists from the Learning Science Research Institute and academics from the School of Education, University of Nottingham.	23/11/10	Nottingham, UK	Scientific community	20 learning scientists and academics.	
12	Presentation, Other	Testaluna	F2F Meeting with GaLA Coordinator	01/12/10	Genoa, Italy	Scientific Community		All Europe
13	Workshop / seminar	ETL/NKUA	Seminar on Integrating and study planning process in Sus-City activity (3 face to face meetings and asynchronous communication via e-class platform)	20/12/2010 , 14/1/2011 and 2/2/2011	Athens, Greece	Students	8 students	Greece
14	Talk, presentation	HUJI	Presentation of Metafora and its pedagogical basis to faculty members of the Haifa University	28/01/11	Haifa, Israel	Scientific Community	2 professors	Israel
15	Conference	Testaluna	Casual Connect Europe	8/02/2011	Hamburg, Germany	Industriy (important actors from the Casual Games and Social Games sectors).		
16	Seminar	LKL/IoE	Seminar about the MiGen system (part of Metafora's suite of microworlds)	8/2/2011	London, UK	Students	50 PGCE students	UK

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17	Workshop / seminar	ETL/NKUA	Seminar on Integrating and study planning process using the 3D Juggler tool (face to face meetings and asynchronous communication via e-class platform)	15/2/2011	Athens, Greece	Students	6 high school students	Greece
18	Symposium	UNEXE	Participation in symposium	24/02/11	Mexico City	Scientific community	40 Mexican education-alists	Mexico
19	Seminar	LKL/IoE	"Learning to Learn Together: Planning and Argumentation in constructionist activities for mathematics and science"	28/02/11	Southampton, UK	Scientific community		UK
20	Conference	ETL/NKUA	INTED 2011 (International Technology, Education, Development Conference)	7–9/3/11	Valencia, Spain.	Scientific community, Industry		Europe and other countries
21	Workshop	UnEXE and LKL/IOE	Design workshop on the visual language	14/3/2011	London, UK	Students, teachers	1 secondary science teacher and 5 Year 7 students	UK
22	Workshop / Seminar	LKL	'Mathematics teaching in change' event at the Institute of Education	22/03/11	London, UK	Mathematics teachers; Scientific community.		UK

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NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
23	Workshop / Seminar	LKL	Lecture at the Instituto de Matemáticas, Universidad Nacional Autónoma de México: "Supporting and Understanding Mathematics Learning with Technology"	12/04/11	Mexico City, Mexico	Undergraduate and postgraduate students interested in the use of technology in math and researchers from the Institute and from the newly established "Laboratorio de Innovación Tecnológica para la Educación".	20-30 participants	Mexico and other countries
24	Conference	ETL/NKUA	7th Pan-Hellenic Conference on Science Education & ICT in Education.	15-17/4/11	Alexandrou-polis, Greece	Scientific community, teachers		Greece
25	Conference	ETL/NKUA	6th Pan Hellenic Teachers' Conference for Information and Comm. Tech. "Using ICTs in the Didactical Practice".	6-7/5/11	Syros, Greece.	Teachers, Scientific community		Greece
26	Seminar	UNEXE	Research Seminar	10/05/11	Beijing Normal University, China	Scientific community	40 Chinese academics and Postgraduate research students.	China
27	EU event	Testaluna	ICT Proposers' Day 2011	19-20/5/11	Budapest, Hungary	Scientific community, Industry (esp. European SMEs)		Europe

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28	Lecture in a course	HUJI	Lecture in a learning and instruction course	25/05/11	HUJI, The School of Education, Jerusalem, Israel	Teachers and postgraduate education students.	12 participants	Israel
29	Conference; personal meetings	Testaluna	INTETAIN 2011 - 4th International ICST Conference on Interactive Entertainment	25–27/5/11	Genoa, Italy.	Scientific community, Industry		Europe and other countries
30	Academic event	HUJI	Lecture at the 10th anniversary of the Program of Cognitive Sciences, HUJI	27/05/11	HUJI, Maiersdorf faculty club, Jerusalem, Israel.	Academic staff of the program of cognitive sciences, students and alumni. In addition, participated in the conference two HUJI Deans and President.	150 participants.	Israel
31	Workshop	ETL/NKUA	“Learning about sustainability through the construction of digital games. The SusCity case.” Work-shop within the Postgraduate Programme on "Educational Studies with Applications in ICT" offered by the Dept. of Primary Educ. at the University of the Aegean.	2/6/11	Rhodes, Greece	Postgraduate students who attend the Postgraduate Programme on “New Technologies in Education”.	25 participants.	Greece
32	Workshop	UnEXE	Design workshop on the visual language	20 and 22/6/2011	Exeter, UK	Teachers and students	2 secondary science teacher and 5 Year 7 students	UK

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NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
33	Presentations, Other	Testaluna	Meetings with an important customer of TL. Combined dissemination – exploitation-planning meeting	20–21/6/11	Amsterdam, The Netherlands	Industry		Europe, and possibly worldwide
34	Conference	UDS	AIED 2011 - The 15th International Conference on Artificial Intelligence in Education	28/6–7/7/11	Auckland, New Zealand.	Scientific community	Several hundreds	Worldwide
35	Workshop, interactive event; publication	KUEI, HUJI, UNEXE	CSCL 2011 - Connecting computer-supported collaborative learning to policy and practice.	4–8 /7/11	Hong-Kong University, Hong-Kong, China	CSCL pedagogical researchers and practitioners; computer scientists.		Worldwide
36	Conferences	HUJI	4 conferences in two main events: in Ubaté (Escuela Nacional Superior) and in Cartagena (Fundacion Universitaria del Area Andina)	4-14/7/11	Bogotá, Ubaté and Cartagena, Colombia	Teachers, other educational practitioners, local and regional educational authorities and university lecturers and researchers in education and related fields.	Hundreds	Colombia
37	Conference	UDS	EDM 2011 - The 4th International Conference on Educational Data Mining	6-8/7/11	Eindhoven, The Netherlands	Scientific community		Worldwide
38	Conference	ETL/NKUA	PME 35 – Conference of the International Group of Psychology of Mathematics Education.	10–15/711	Ankara, Turkey.	Scientific community, researchers of the mathematics community	Hundreds	Europe and other countries

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39	Conference	UDS	UMAP 2011 - International Conference on User Modeling, Adaptation, and Personalization	11–15/7/11	Girona, Spain.	Scientific community		Europe
40	Workshop	UDS	Workshop Talk at ASTC - The International Workshop on Adaptive Support for Team Collaboration held in conjunction with UMAP 2011	15/7/11	Girona, Spain.	Scientific community		Europe
41	Interview	KUEI	Interview given by Prof. Andreas Harrer, leader of KUEI team in Metafora, to the catholic radio station K1 in Eichstätt.	26/7/11	Eichstaett, Germany	Industry, Civil Society, Policy makers, media, other		Germany
42	Presentations	HUJI	Talks with Vice Mayor of the city of Beer Sheva, in charge of education.	May and August 2011	Beer Sheva, Israel	Policy makers	5 people	Israel
43	Conference	ETL/NKUA, UNEXE	EARLI CONFERENCE 2011, 14th Biennial EARLI Conference for Research on Learning and Instruction, "Education for a Global Networked Society".	30/8-3/9/11	Exeter, United Kingdom	Scientific community, teachers, educational stakeholders, Policy makers, other	Hundreds	Worldwide
44	Conference	ETL/NKUA	The European Conference on Educational Research – ECER 2011	13-16/9/11	Freie Universität – Berlin, Germany	Scientific community, teachers		Europe

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
45	Conference, seminar	UDS, LKL	Seminar on Technology-Enhanced Learning for Mathematics and Science (TELMAS): Landmark Research and New Contributions. held in conjunction with EC-TEL 2011	21/9/11	Palermo, Italy	Scientific community		Worldwide
46	Conference	UDS	EC-TEL 2011 Sixth European Conference on Technology Enhanced Learning Towards Ubiquitous Learning	20-23/9/11	Palermo, Italy	Scientific community, industry, policy makers		Worldwide
47	Other	Testaluna	Release of Metafora Logo	24/9/10	Italy, then distributed to all partners for their use	Industry, Civil Society, Policy makers, Media, Other	Very large	All Europe and Israel
48	Web	Testaluna (contents coordinated by HUJI)	Launching Metafora Website (http://www.metafora-project.org/)	27/09/10	Italy and Internet	Industry, Civil Society, Policy makers, Media, Other	Very large	Worldwide
49	Workshop	UDS	Workshop Talk at Joint Research Workshop 2011 – Shanghai Jiao Tong University – Centre for e-Learning Technology	29-30/09/11	Saarbrücken, Germany	Educational scientists		China
50	Presentations, flyers	KUEI	Teacher Day at KU Eichstätt	30/09/11	Eichstätt, Germany	Teachers		

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NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
51	Conference	ETL/NKUA	5th European Conference on Games Based Learning – ECGBL 2011	20-21/10/11	Athens, Greece.	Industry, teachers, educational scientists	Hundreds	Greece and other European countries
52	International colloquium	ETL/NKUA	DidaPro 4 – Dida&STIC (Sciences et technologies de l'information et de la communication en milieu éducatif)	24-26/10/11	Patras, Greece	Teachers, educational scientists		Eurupe and elsewhere
53	Media briefings, other	UDS	Talk for Cornelsen Verlag Publishing House Representatives	27/10/2011	Saarbrücken, Germany	Industry, media, other	Small group	Germany, China
54	Workshops	ETL/NKUA	Pilot studies for microworlds integrated in Metafora.	November 2011	Greece	Other	25 students and their teachers	Greece
55	Flyers	Testaluna (design); HUJI (contents compilation and printing); UdS (English language editing)	Release of Metafora‘s brochure	29/11/10	Italy (design) and Israel (printing); then put at all partners' disposal)	Industry, Civil Society, Policy makers, Media, Other	3000 (+ indirect access, also via electronic version in project's website)	Europe and Israel
56	Conference	ETL/NKUA	ENEDIM 2011 – 4th Conference of the Greek Association for Research in Mathematics Education (GARME).	1–4/12/11	Ioannina, Greece	Scientific community, math teachers		Greece

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57	Conferences	HUJI	Conference: Technology at the Service of the Citizen, organized by CISCO and the Calcalist economic newspaper.	7/12/11	Tel-Aviv, Israel	Policy makers, civil society, Scientific Community (higher education, Research), Media, Industry	Several hundreds	Israel
58	Colloquium	KUEI	Invited Talk Informatics Colloquium Clausthal	14/02/12	Clausthal, Germany	Scientific community	Tens	Germany
59	Conference	HUJI	Chais 2012 Conference	15-16/2/12	Raanana, Israel	Scientific community, teachers, school principals, industry	Hundreds	Israel
60	Presentation	HUJI	Presentation of Metafora to High Tech High in Kaye Teachers College	22/2/12	Beer Sheva, Israel	Teachers, Industry, Media, Other	Approx. 100	Israel
61	Workshops	HUJI	Workshops - Assessing use and acceptance of the evolving Metafora system and approach	February 2012	Beer-Sheba, Israel	Teachers, students, Scientific Community		Israel
62	Conference	TL	Games for Change	06/03/12	San Francisco, USA.	Industry (serious, non-leisure games), Media, Other	Thousands	Worldwide
63	Presentations, Exhibitions, Interviews, Flyers	HUJI	Meetings with principals and teachers of the Mevoot ha'Negev School	March 2012	Kibbutz Shoval, Negev desert, Israel	Teachers, school principals, authorities	Approx. 100	Israel

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64	Presentations, workshops	HUJI	Talks and mutual updating with high officers of "Amal", a large network of schools in Israel	15/3/12, 18/3/12, and in several other opportu-nities, on a current basis	Tel Aviv and other cities in Israel	Policy makers, Other	Some 10 people (officers, teachers), potentially accessing a community of hundreds of teachers and thousands of pupils and students	Israel
65	Workshops	ETL/NKUA	Main Studies with microworlds integrated in Metafora	March-June 2012	Athens, Greece	Students, teachers	42 7th-9th grade students and their teachers, in 3 workshops	Greece
66	Talk, Other	UNEXE	Invited talk on dialogic and technology referencing Metafora project	11/04/12	Universidad Oberta de Calalunya. Barcelona, Spain	Scientific community	40 delegates attending.	Spain and other European countries
67	Conference	ETL/NKUA	Ireland International Conference on Education (IICE-2012)	16–18/4/12	Dublin, Ireland	Scientific community, teachers and other educational players	Hundreds	Europe
68	Conference	ETL/NKUA	4th International Conference on Computer Supported Education (CSEDU)	16–18/412	Porto, Portugal	Scientific community, teachers	Hundreds	Worldwide
69	Invited talk in conference	UNEXE	IST-Africa 2012	10/5/12	Dar-es-Salaam, Tanzania	Scientific community, industries, policy makers, educational stakeholders	30 delegates.	Africa

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70	Colloquium	ETL/NKUA	Colloque international «formes d'éducation et processus d'émancipation». Proposition de deux symposiums animés par le groupe CoSciEns (Coopération-Scientifiques-Enseignants)	22-24/5/12	Université Rennes 2, Campus Villejean, France	Policy makers, Scientific Community		
71	Colloquium	ETL/NKUA	La didactique des mathématiques: approches et enjeux: Colloque hommage à Michèle Artigue	31 May – 2 June 2012	Paris, France	Policy makers, Scientific Community		
72	Workshop	KUEI	Special Force Program of DFG on Adaptivity	11/06/12	Darmstadt, Germany	Scientific community		Germany
73	Workshop in conference	UDS, LKL	Workshop on Intelligent Support for Exploratory Environments 2012: Exploring, Collaborating and Learning Together held in conjunction with ITS 2012.	14/6/2012	Chania, Greece	Scientific community	20 participants	Europe and other countries
74	Conference	UDS, LKL	ITS 2012 – The 11th International Conference on Intelligent Tutoring Systems	14-18/6/12	Chania, Greece	Scientific community	Hundreds	Europe and other countries
75	Conference	ETL/NKUA	International Conference on Computer Based Learning in Science (CBLIS)	26–29/6/12	Barcelona, Catalonia / Spain	Scientific community	Hundreds	Europe and other countries

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76	Conference	ETL/NKUA	International Conference on Higher Education - ICHE 2012	27–29/612	Paris, France	Scientific community, teachers, policy makers	Hundreds	Europe and other countries
77	Conference	ETL/NKUA	8th Global Conference: Creative Engagements: Thinking with Children	29/6-1/712	Oxford, UK	Scientific community, industry, teachers, policy makers	Hundreds	Europe and other countries
78	conference	ETL/NKUA	ICME 2012 – The 12th International Congress on Mathematical Education.	8-15/7/12	Seoul, Korea	Scientific community, teachers	Hundreds	Europe and other countries
79	Academic talk	UNEXE	Invited talk on dialogic and technology referencing Metafora project.	18/7/12	Tecnológico de Monterrey, Mexico	Scientific community	550 synchronous online video-linked participants.	Mexico and other countries
80	Conference and workshops	NKUA/ETL, HUJI, IoE/LKL	Constructionism 2012 – Theory, Practice and Impact, organized by partner ETL/NKUA	21–25/8/12	Educational Technology Lab / Univ. of Athens, Athens, Greece	Scientific community, teachers, educational stakeholders	Hundreds	Worldwide
81	Video	HUJI	Production of a video recording for dissemination purposes	September 2012	Jerusalem, Israel	Industry, Civil Society, Policy makers, media, Other		Israel and Europe
82	Conference	KUEI	CRIWG 2012 – The 18th Conference on Collaboration and Technology	16–19/9/12	Raesfeld Castle, Germany	Scientific community, industry		Germany and other countries
83	Conference and workshops	UDS, LKL, HUJI	EC-TEL 2012	18-21/9/12	Saarbrucken, DE	Scientific community, teachers, educational stakeholders, policy makers	Thousands	Europe and other

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NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
84	Presentation	TL	Medi@tic project Workshop, showing best practices in Serious Games design and development	24/9/12	Kristiansand, Norway	Scientific community, industry		Europe
85	Conference	NKUA/ETL	8th Panhellenic Conference with International participation "Information and Communication Technologies in Education"	28-30/9/12	University of Thessaly, Volos, Greece	Scientific community, industry		Greece
86	Conference and Exhibition	NKUA/ETL, HUJI, UdS, KUEI, EXETER	eChallenges 2012 Conference & Exhibition	17-19/10/12	Lisbon, Portugal	Scientific community, industry	Hundreds	Europe
87	Press release	HUJI	Written and graphic material on the Metafora project supplied to the Scientix portal - a web-based community of science teachers, science communicators and researchers – for publication in several European languages.	26/10/12	Jerusalem	Science teachers, science communicators and researchers	The community, launched in 2010, now has over 1500 members and some 4000 visitors each month	All Europe

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88	Interview	HUJI	Phone interview with Joe Howes from The Research Media Magazine, a leading portal for scientific dissemination (www.researchmedia.eu)	31/10/12	Jerusalem	Scientific community, industry, policy makers	30,000 ICT readers at the govern-ment, policy, academic, ICT research and private sector/SME levels	Potentially, all Europe and INCO countries
89	Talk	LKL	What the Research Says about Collaborative Learning with Technology	30/11/12	Nottingham, UK	Researchers, industry	40 participants	UK
90	Talk	UDS	Lab talk: Developing and Implementing a model of how students "Learn to Learn Together" in Metafora.	12/12/12	Saarbrucken, DE	Scientific community		Germany
91	Colloquium	NKUA/ETL	Alpine Rendez-vous 2013	28/1-1/2/13	Villard - de- Lans, Vercors, French Alps	Scientific community		Europe and other
92	Congress	NKUA/ETL	CERME 8- Eighth Congress of the European Society for Research in Mathematics Education	6-10/213	Manavgat-Side, Antalya, Turkey	Scientific community		Europe
93	Talk	UDS	Invited Talk, Ithaca College [THE INVITED TALK WAS NOT FUNDED BY THE METAFORA PROJECT.]	15/2/13	Ithaca, NY, USA	Scientific community		USA

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NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
94	Talk	UDS	Invited Talk, Connecticut College [THE INVITED TALK WAS NOT FUNDED BY THE METAFORA PROJECT.]	19/2/13	New London, CT, USA	Scientific community		USA
95	Talk	UDS	Invited Talk, Hampshire College [THE INVITED TALK WAS NOT FUNDED BY THE METAFORA PROJECT.]	21/2/13	Amherst, MA, USA	Scientific community		USA
96	Conference	LKL	NCETM Digital Technologies Conference - 27 February 2013	27/2/13	London, Institute of Education	Scientific community, math education stakeholders	Hundreds	UK and other countries
97	Colloquium	KUEI	Eichstätt Colloquium about education mathematics	28/2/13	Eichstätt, Germany	Teachers		Germany
98	Conference, workshops	TL	Serigamex 2013	21/3/13	Rome, Italy	Scientific community, Industry. Experts and researchers in the field of serious games and simulations.	Thousands	Worldwide
99	Small group talks in conference	TL	Games for Change	25-29/3/13	San Francisco, USA.	Industry (serious games)		Worldwide
100	Conference	KUEI	LAK 2013 – The third Conference on Learning Analytics and Knowledge	8–12/4/13	Leuven, Belgium	Scientific community		Europe

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
101	Interview	UdS	Phone interview with Nature Magazine editor / writer Mitch Waldrop for upcoming article. Discussed higher-level learning skills, and the specific Metafora approach of viewing these skills through the lens of L2L2. Also discussed implementation details of how a system can recognize and automatically respond to these behaviors, as is done in Metafora	29/4/13	Saarbruecken, Germany	Stakeholders of all kinds in the fields of cognition, teaching and learning, ICT, AI, CSCL, and related sciences and technologies.	Thousands	Worldwide
102	Conference	UDS	The 5th International Conference on Computer Supported Education (CSEDU 2013)	6-8/5/13	Aachen, Germany	Scientific community, teachers	Hundreds	Worldwide
103	Workhops, conferences, presentations, other	UNEXE	Talk given at the Metafora Focused User Group (FUG) Seminar in the London Knowledge Lab.	10/5/13	London, UK	Scientific Community	17 researchers in the education sciences	Austria, Finland, Germany, Israel, Italy, Luxembourg, the Netherlands, Norway, Poland, UK
104	Workshop, presentation	HUJI	1st Focus User Group (FUG) meeting in Israel	28/5/13	Jerusalem, Israel	Students	4 advanced students in Education	Israel

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
105	Workshop, presentation	HUJI	2nd Focus User Group (FUG) meeting in Israel	3/6/13	Jerusalem, Israel	Teachers, other educational practitioners, policy makers	10 participants	Israel
106	Congress	NKUA/ETL	7th World Environmental Education Congress (WEEC 2013)	9-14/6/13	Marrakech, Morocco	Teachers, other educational practitioners, policy makers		Morocco, etc.
107	Press release	KUEI	Press release about the PMB Metafora researcher meeting at the Catholic University Eichstätt-Ingolstadt	17/6/13	Eichstaett, Germany	Homepage of the Catholic University Eichstätt-Ingolstadt, Germany		Germany
108	Conference, workshops, demo	KUEI, UNEXE, HUJI	CSCL 2013 – The 10th International Conference on Computer Supported Collaborative Learning	15–19/613	University of Wisconsin, Madison, USA	Scientific community, policy makers, educational stakeholdes	Thousands	Worldwide
109	Conference, workshop	NKUA/ETL	IDC 2013 – Interaction Design and Children	24-27/6/13	New York, USA	Presentation at the "Interactive technologies that enhance children's creativity - from design to fabrication" workshop by Chronis Kynigos. Participation approved by PO.		Worldwide
110	Talk, presentation	UNEXE	Open talk presenting Metafora - "Talk, Technology and Mathematics".	1/7/13	Shinsu University, Japan	Scientific community		Japan, UK

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
111	Conference	LKL, UDS	The 16th International Conference on Artificial Intelligence in Education (AIED 2013).	9-13/7/13	Memphis, Tennessee, USA	Scientific community		Worldwide
112	Workshop at conference	UDS, LKL	Workshop talk at AIED 2013	9-13/7/13	Memphis, Tennessee, USA	Scientific community		Worldwide
113	Conference	KUEI	ICALT 2013 – The 13th IEEE International Conference on Advanced Learning Technologies	15–18/7/13	Beijing, China	Scientific community, industry		Worldwide
114	Presentations	HUJI	Meeting with officers of the Ministry of Education	4/8/13	Tel Aviv, Israel	Policy makers	6	Israel
115	Presentations	HUJI	Meeting with a key player in the Amit school network	August 2013	Beer Sheba, Israel	Policy makers, teachers	2	Israel
116	Presentations, workshops	HUJI	Talks and mutual updating with high officers of “Amal”, a large network of schools in Israel	2011, 2012 and 2013, on a current basis	Tel Aviv and other cities in Israel	Policy makers, teachers	6	Israel
117	Conference	HUJI, UNEXE	15th Biennial EARLI conference (EARLI 2013)	27-31/8/13	Munich, Germany	Scientific community, teachers, policy makers		Worldwide
118	Conference	KUEI	DeLFI 2013 – Mench & Computer	8–11/913	Bremen, Germany	Scientific community		Europe
119	Conference, poster, demo	KUEI	EC-TEL 2013 – Eighth European Conference on Technology Enhanced Learning	17–21/9/13	Paphos, Cyprus	Scientific community, industry, policy makers		Europe an other

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
NO.	Type of activities[8]	Main leader	Title	Date/Period	Place	Type of audience[9]	Size of audience	Countries addressed
120	Conference	KUEI	CRIWG 2013 – The 19th Conference on Collaboration and Technology	30/10-1/11/13	Wellington, New Zealand	Scientific community, industry, policy makers		Worldwide

Section B (Confidential[10] or public: confidential information to be marked clearly)
Part B1

The applications for patents, trademarks, registered designs, etc. shall be listed according to the template B1 provided hereafter.

The list should, specify at least one unique identifier e.g. European Patent application reference. For patent applications, only if applicable, contributions to standards should be specified. This table is cumulative, which means that it should always show all applications from the beginning until after the end of the project.

➔ ***NO patents, trademarks, registered designs, etc., to declare***

TEMPLATE B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.					
Type of IP Rights[11]:	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Application reference(s) (e.g. EP123456)	Subject or title of application	Applicant (s) (as on the application)

[10] Note to be confused with the "EU CONFIDENTIAL" classification for some security research projects.

[11] A drop down list allows choosing the type of IP rights: Patents, Trademarks, Registered designs, Utility models, Others.

Part B2

Please complete the table hereafter:

Type of Exploitable Foreground[12]	Description of exploitable foreground	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application[13]	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
COMMERCIAL EXPLOITATION	SERIOUS GAME BASED ON PROTOTYPE "PIRATES OF THE KINEMATICS ISLAND"	NO	N/A	SERIOUS GAME - MICROWORLD	1 TECHNOLOGY ENHANCED LEARNING	2015 - 2016 (ESTIMATED)	NO PATENTS	TL (OWNER) HUJI (CONTRIBUTOR)
GENERAL ADVANCEMENT OF KNOWLEDGE	MONITORING TOOL /FEEDBACK TOOL	NO	N/A	MONITORING AND FEEDBACK TOOL	1 TECHNOLOGY ENHANCED LEARNING		NO PATENTS	UDS AND LKL (OWNERS)
GENERAL ADVANCEMENT OF KNOWLEDGE	AUTOMATED ANALYSIS COMPONENT	NO	N/A	AUTOMATED ANALYSIS COMPONENT	1 TECHNOLOGY ENHANCED LEARNING		NO PATENTS	UDS (OWNER) LKL (CONTRIBUTOR)
EXPLOITATION OF RESULTS THROUGH SOCIAL INNOVATION	METAFORA FRAMEWORK SYSTEM	NO	N/A	FRAMEWORKS SYSTEM, PLANNING TOOL, REFLECTION TOOL	1 TECHNOLOGY ENHANCED LEARNING		NO PATENTS	HARRER (OWNER, FORMERLY WITH KUEI, NOW TU CLAUSTHAL). CONTRIBUTORS: HUJI UNEXE NKUA/ETL UDS IOE/LKL TL
GENERAL ADVANCEMENT OF KNOWLEDGE	METAFORA PEDAGOGICAL APPROACH	NO	N/A	DEVELOPMENT OF NEW "CHALLENGES" (LEARNING	1 TECHNOLOGY ENHANCED LEARNING	STARTING IN 2014	NO PATENTS	OWNERS: HUJI UNEXE NKUA/ETL

[19] A drop down list allows choosing the type of foreground: General advancement of knowledge, Commercial exploitation of R&D results, Exploitation of R&D results via standards, exploitation of results through EU policies, exploitation of results through (social) innovation.

[13] A drop down list allows choosing the type sector (NACE nomenclature) : http://ec.europa.eu/competition/mergers/cases/index/nace_all.html

Type of Exploitable Foreground[12]	Description of exploitable foreground	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application[13]	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
	FOR THE PROMOTION OF L2L2 (LEARNING TO LEARN TOGETHER) IN SCHOOLS AND OTHER LEARNING ENVIRONMENTS			UNITS FOR METAFORA-SUPPORTED ACTIVITIES), METAFORA-BASED COURSES, CONDUCTION OF METAFORA-BASED ACTIVITIES, TEACHER TRAINING IN THE USE OF METAFORA IN LEARNING ENVIRONMENTS, ETC.				UDS IOE/LKL CONTRIBUTORS (TECHNOLOGICAL ENABLERS): KUEI TL

In addition to the table, please provide a text to explain the exploitable foreground, in particular:

- Its purpose
- How the foreground might be exploited, when and by whom
- IPR exploitable measures taken or intended
- Further research necessary, if any
- Potential/expected impact (quantify where possible)

TL foresees interesting opportunities for the exploitation of one or more serious games based on the prototype of Pirates of the Kinematics Island (PiKI), developed within Metafora. PiKI is a web based serious game microworld developed with Unity3D technology. Main concept is to have students handling physics concepts like velocity, space, trajectories, restitution coefficients and the associated rules, in a highly motivating multiplayer environment where they can study, try, modify, learn.

This can be exploited both as web product or tablet app (iOS and Android), thanks to the multiplatform technology it has been built with. Market addressed is clearly the afternoon one, where serious games are getting a relevant interest, thanks also to increasing number of downloads the tablet apps are getting in the last years.
Product definition will be refined with learning experts (such as HUJI did during the project lifetime), in parallel with the preparation of a business plan to better identify the monetisation strategy, the need to address multiple markets (and languages), multiple curricula etc.
Potential impact is very interesting, being serious games a growing market, with parents more and more used and favourable towards paid downloads. Different platforms can be addressed, with a potential user base of various millions of people (e.g. global tablet shipments reached 51.7 million units in the second quarter of 2013, with a positive outlook).

The Monitoring and Feedback Tool provides generic functionality that allows researchers, facilitators, and potentially students to monitor activities and offer directed feedback to users of the Metafora system, and to any other external systems that are integrated with the communication protocols established during the Metafora project. In addition, the Automated Analysis Component utilizes the same communication protocols in order to monitor and offer automated feedback and awareness information.
These tools provide a framework for offering directed feedback and support for students using the Metafora system, any individual components of the Metafora system, or even other tools potentially linked in the future. Various partners have interest in utilizing these components for further research. Researchers from the Metafora team are interested in studying more closely the impacts of the specific feedback defined within the Metafora project, as well as considering comparisons between the impact of human feedback given through the feedback system vs. automated feedback. This research is leading to a clear framework that allows optimal exploitation of monitoring capabilities, feedback systems, and automated analysis across multiple tools and exploratory environments.

The whole design, architecture, and implementation of the Metafora framework system (aka platform) has been oriented towards an open source approach, i.e. we explicitly chose to use and adapt freely available libraries and components that are compatible with an open source policy for offering the Metafora platform at the end of the project lifetime. It is planned to continue usage of the platform and encourage uptake and integration of further learning tools in the future to broaden the scope and uptake of the system in a broader audience, thus furthering social innovation of the learning places in academic institutions.

The Metafora Pedagogical Approach for the Promotion of L2L2 comprises all exploitable results that are based on the theoretical and practical pedagogical knowledge and experience accumulated in the Metafora project. Supported by the technological tools developed in the project, those results in general will be exploited as services of many kinds, which will be provided – commercially or otherwise – by pedagogical partners in Metafora, alone or in collaboration with all or part of the technological partners in the project and/or with third parties. Likely "customers" will be schools and school networks, ministries of education and other local or regional educational authorities (e.g., municipalities), teacher communities or professional organizations, etc.

3. Report on societal implications

Replies to the following questions will assist the Commission to obtain statistics and indicators on societal and socio-economic issues addressed by projects. The questions are arranged in a number of key themes. As well as producing certain statistics, the replies will also help identify those projects that have shown a real engagement with wider societal issues, and thereby identify interesting approaches to these issues and best practices. The replies for individual projects will not be made public.

A General Information *(completed automatically when **Grant Agreement number** is entered.*	
Grant Agreement Number:	257872
Title of Project:	Metafora — Learning to learn together: A visual language for social orchestration of educational activities
Name and Title of Coordinator:	Prof. Baruch Schwarz

B Ethics	
1. Did your project undergo an Ethics Review (and/or Screening)? • If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 *'Work Progress and Achievements'*	***NO***
2. Please indicate whether your project involved any of the following issues (tick box) :	***YES***
RESEARCH ON HUMANS	
• Did the project involve children?	YES
• Did the project involve patients?	NO
• Did the project involve persons not able to give consent?	NO
• Did the project involve adult healthy volunteers?	NO
• Did the project involve Human genetic material?	NO
• Did the project involve Human biological samples?	NO
• Did the project involve Human data collection?	NO
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	NO
• Did the project involve Human Foetal Tissue / Cells?	NO
• Did the project involve Human Embryonic Stem Cells (hESCs)?	NO
• Did the project on human Embryonic Stem Cells involve cells in culture?	NO
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	NO
PRIVACY	
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	NO
• Did the project involve tracking the location or observation of people?	NO
RESEARCH ON ANIMALS	
• Did the project involve research on animals?	NO
• Were those animals transgenic small laboratory animals?	NO

• Were those animals transgenic farm animals?	NO
• Were those animals cloned farm animals?	NO
• Were those animals non-human primates?	NO
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	**NO**
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	**YES**
DUAL USE	
• Research having direct military use	NO
• Research having the potential for terrorist abuse	NO

C Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator		2
Work package leaders	3	5
Experienced researchers (i.e. PhD holders)	6	2
PhD Students	2	1
Other		

4. How many additional researchers (in companies and universities) were recruited specifically for this project?	4
Of which, indicate the number of men:	3

D Gender Aspects

5.	**Did you carry out specific Gender Equality Actions under the project**?	○ x	Yes No

6. Which of the following actions did you carry out and how effective were they?

		Not at all effective				Very effective
❑	Design and implement an equal opportunity policy	x	○	○	○	○
❑	Set targets to achieve a gender balance in the workforce	x	○	○	○	○
❑	Organise conferences and workshops on gender	x	○	○	○	○
❑	Actions to improve work-life balance	x	○	○	○	○
○	Other:					

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

○ Yes- please specify

x No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

x Yes- please specify

Several workshops in schools, research was done in schools with pupils and teachers.

○ No

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

X Yes- please specify

Virtual booklet of 10 lessons of training for L2L2 , more than 20 different learning units (challenges) in science and mathematics.

○ No

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

X Main discipline[14]: 1.1, 1.2,

X Associated discipline[14]: 5.4 ○ Associated discipline[14]:

G Engaging with Civil society and policy makers

11a	**Did your project engage with societal actors beyond the research community?** *(if 'No', go to Question 14)*	X ○	Yes No

[14] Insert number from list below (Frascati Manual).

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

- ○ No
- ○ Yes- in determining what research should be performed
- ○ Yes - in implementing the research
- X Yes, in communicating /disseminating / using the results of the project

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	X Yes ○ No

12. Did you engage with government / public bodies or policy makers (including international organisations)

- ○ No
- ○ Yes- in framing the research agenda
- ○ Yes - in implementing the research agenda
- X Yes, in communicating /disseminating / using the results of the project

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

- X Yes – as a **primary** objective: Educational, training youth, Information society
- X Yes – as a **secondary** objective , research and innovation
- ○ No

13b If Yes, in which fields?

Agriculture		Energy		Human rights	
Audiovisual and Media		Enlargement		Information Society	
Budget		Enterprise		Institutional affairs	
Competition		Environment		Internal Market	
Consumers		External Relations		Justice, freedom and security	
Culture		External Trade		Public Health	
Customs		Fisheries and Maritime Affairs		Regional Policy	
Development Economic and Monetary Affairs		Food Safety		Research and Innovation	
		Foreign and Security Policy		Space	
Education, Training, Youth		Fraud		Taxation	
Employment and Social Affairs		Humanitarian aid		Transport	

13c If Yes, at which level?

- ○ Local / regional levels
- X National level
- X European level
- X International level

H Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?	**91**
To how many of these is open access[15] provided?	**All**
How many of these are published in open access journals?	**All**
How many of these are published in open repositories?	**All**
To how many of these is open access not provided?	**N/A**
Please check all applicable reasons for not providing open access:	
❑ publisher's licensing agreement would not permit publishing in a repository ❑ no suitable repository available ❑ no suitable open access journal available ❑ no funds available to publish in an open access journal ❑ lack of time and resources ❑ lack of information on open access ❑ other[16]: ……	

15. How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*		**None**
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	**None**
	Registered design	**None**
	Other	**None**
17. How many spin-off companies were created / are planned as a direct result of the project?		**At least one**
Indicate the approximate number of additional jobs in these companies:		**10** (very tentative)

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

X	Increase in employment, or	❑	In small & medium-sized enterprises
❑	Safeguard employment, or	❑	In large companies
❑	Decrease in employment,	X	None of the above / not relevant to the project
x	Difficult to estimate / not possible to quantify		

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs:	

[15] Open Access is defined as free of charge access for anyone via Internet.
[16] For instance: classification for security project.

Difficult to estimate / not possible to quantify	❑

I Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?

X Yes ○ No

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

○ Yes X No

22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

X	Press Release	❑	Coverage in specialist press
❑	Media briefing	❑	Coverage in general (non-specialist) press
❑	TV coverage / report	X	Coverage in national press
❑	Radio coverage / report	X	Coverage in international press
❑	Brochures /posters / flyers	❑	Website for the general public / internet
❑	DVD /Film /Multimedia	X	Event targeting general public (festival, conference, exhibition, science café)

23 In which languages are the information products for the general public produced?

❑	Language of the coordinator	X	English
❑	Other language(s)		

***Question F-10*:** Classification of Scientific Disciplines according to the Frascati Manual 2002 (Proposed Standard Practice for Surveys on Research and Experimental Development, OECD 2002):

FIELDS OF SCIENCE AND TECHNOLOGY

1. NATURAL SCIENCES

1.1 Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]

1.2 Physical sciences (astronomy and space sciences, physics and other allied subjects)

1.3 Chemical sciences (chemistry, other allied subjects)

1.4 Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, oceanography, vulcanology, palaeoecology, other allied sciences)

1.5 Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences)

2 ENGINEERING AND TECHNOLOGY

2.1 Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)

2.2 Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]

2.3. Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as

geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3. MEDICAL SCIENCES

3.1 Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immunohaematology, clinical chemistry, clinical microbiology, pathology)

3.2 Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)

3.3 Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4. AGRICULTURAL SCIENCES

4.1 Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)

4.2 Veterinary medicine

5. SOCIAL SCIENCES

5.1 Psychology

5.2 Economics

5.3 Educational sciences (education and training and other allied subjects)

5.4 Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary , methodological and historical S1T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6. HUMANITIES

6.1 History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)

6.2 Languages and literature (ancient and modern)

6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group]