

COLDEX



Collaborative Learning and Distributed Experimentation

Information Society Technologies Programme

Project number: IST-2001-32327

System Report

Deliverable Number:	D7.3.1
Contractual Date of Delivery:	M30
Actual Date of Delivery:	M36
Version:	Final
Work-Package:	WP7
Lead Partner:	UDUI
Contributing Partner:	UNED, USB
Authors:	Hoppe, Ulrich; Oelinger, Maria; Barros, Beatriz; Diehl, Stephan
Primary Contact:	hoppe@collide.info

Table of Contents

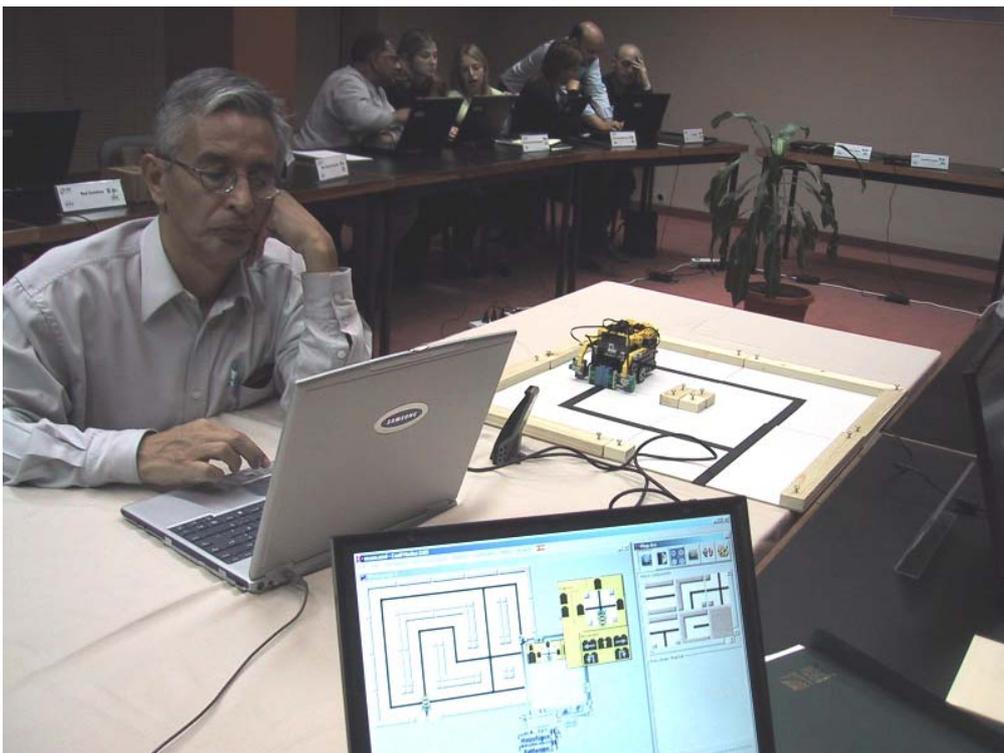
GENERAL	3
1 STANDARDISATION OF TOOLS.....	4
2 CONNECTIVITY TO THE LEARNING OBJECT REPOSITORY – LOR	4
2.1 COLDEX PORTAL AS LOR INTERFACE AND COOL MODES CONNECTION TO THE LOR.....	5
2.2 COOL MODES AS A SPECIFIC INTERFACE TO THE REPOSITORY.....	8
2.3 SUPPORT FOR LOR USAGE.....	9
3 PEDAGOGICAL INTEROPERABILITY OF SCENARIO PLUG-INS.....	9
3.1 MAZE, MOON AND MORE: SHORT EXAMPLE USAGE.....	9
4 FORMATION OF THE OUS – TECHNICAL NEEDS AND REQUIREMENTS	10
WORKSHOP No 1.....	11
WORKSHOP No 2.....	11
5 EVALUATION OF APPLICATIONS	12
6 REFERENCES	17

General

In COLDEX, local learning communities have shared their ideas, results and problems in an international network, established by the project's "Open User Scheme". Since the project partners are not only from different countries and continents, but also from different hemispheres, the trans-continental learning community in COLDEX aimed (and still aims) at cross-fertilisation of experience and scientific understanding in a multicultural and multi-experiential community.

This deliverable represents the system report for the Open User Scheme (OUS) within COLDEX. The purpose of this deliverable is to provide an overview of the underlying systems for potential OUS users.

Within the COLDEX portal www.coldex.info > *ous* > *downloads* the scenario components are published and available, i.e. software, learning material and OUS guides.



Beginning with the first Open User Scheme workshop in May 2004 in Buenos Aires, Argentina, several projects have been started. An interested group of educational institutions form the initial OUS community, located in Germany, Sweden, and Latin

America. The second OUS workshop will take place in March / April 2005 where some of the OUS partners will report of their projects.

With the Open User Scheme we have implemented a flexible method to open up the COLDEX community particularly towards more Latin-American participants, without giving up the quest for commitment and community spirit in Europe. Participation bases on mutual exchange. Since some of the participants are more familiar with Spanish rather than English, we deliver material and services also in Spanish.

1 Standardisation of tools

For the collaborative modelling system a number of scenario-based applications have been developed. For reasons of embedding the repository functionality within the applications, re-factoring of the Cool Modes system and Cool Modes plug-ins has become necessary in order to comply with the requirements of the COLDEX project, first of all the connectivity to and compatibility with the LOR. Besides the plug-ins which are located in the astronomy scenario and the maze scenario, other plug-ins have been added to enrich the scenarios. For example, the system dynamics plug-in has been served as a tool within both, the astronomy and the biodiversity scenario. Also the stochastics plug-in is now part of the OUS. Petri nets, handwriting and QOC (question, option, criterion) are also useful and can enhance the scenarios, too.

2 Connectivity to the Learning Object Repository – LOR

According to the central hypothesis

"It is possible to initiate and to maintain an exchange of learning results and social interaction through "thematic objects" in a virtual community made up of subgroups with face-to-face interaction based on learning challenges in the form of non-standard problems!"

the common ground for learners in COLDEX is the group memory soaking up the learning objects which are in fact knowledge artefacts for ideas born in the projects' scenarios.

The LOR – the repository representing the common group memory for the learning objects which are initiated, created, shared or re-used – is *the* platform for the learning communities. Therefore the connectivity to the LOR is essential especially for the Open User Scheme, since the LOR is the core system for exchanging ideas which are inherent in

resp. visualised via the learning objects (LOs). The flexible database connectivity between Cool Modes resp. the COLDEX portal and the LOR represents the infrastructure which builds the foundation of all OUS activities.

2.1 COLDEX portal as LOR interface and Cool Modes connection to the LOR

The LOR is a service to store LOs and manage their retrieval. Data stored in the LOR are learning objects. They are defined by a number of authors using different terminology, although essentially referring to encapsulated educational components. Their structure typically includes metadata, educational content or services. The LOR integrates data and objects created with heterogeneous resources. Objects created with tools like Cool Modes are included in the repository with the enriched metadata information generated by the tool. It is possible to get automation of metadata generation for specific sub-communities by defining different application contexts.

Once there is a set of object types, a user can add or delete his or her own objects, either through

- the web portal, which provides to the user a direct access to the LOs, organised in workspaces. [Verdejo 2003]
- Cool Modes which is able to generate the adequate metadata from the task context (see also section 2.2). [Pinkwart 2004]

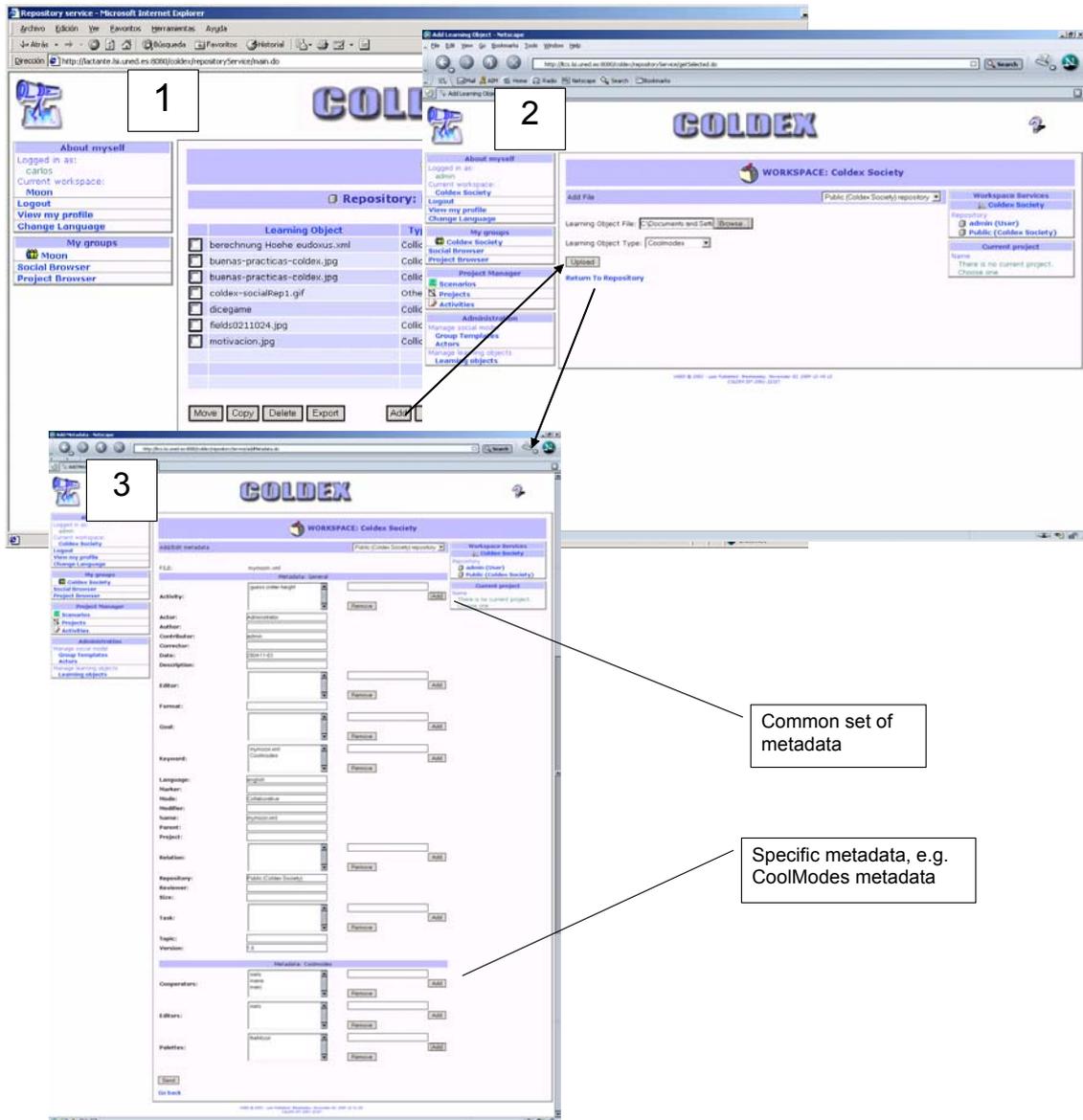


Figure 1 Adding a learning object (LO) to the LOR

Figure 1 shows a snapshot of a group workspace for a registered user (a view of the repository with the LOs as well as the operations which are available in it, label 1). Clicking the "Add" button opens a page, labelled 2 in the same figure, where the user can select the contents of a new LO (i.e. a file to upload) as well as the LO type that describes it best. Then – as it is shown in the page labelled 3 –, the new LO's metadata is displayed, some of these values are automatically filled in, other have to be manually filled. The user can edit all these values (modifying or deleting them). Finally, the new LO is added into the

LOR. This operation can be done also when working with Cool Modes, without entering into the portal.

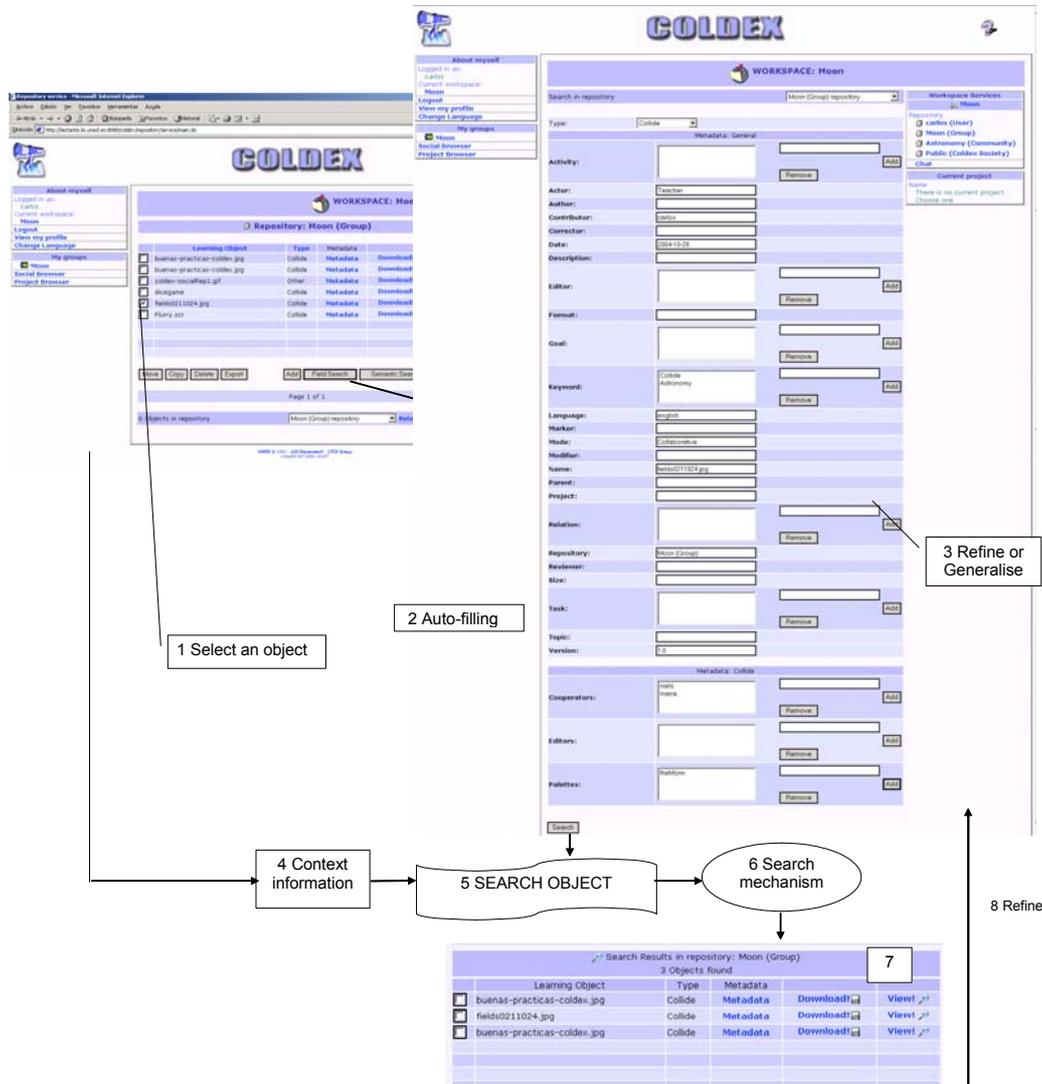


Figure 2 Searching the LOR

Further features like browsing contents, copying LOs from one workspace to another, deleting LOs or exporting a list of LOs for an external tool (chosen among a range of known ones) are available, too.

An important feature, of course, is searching. Users can work either through the portal or using Cool Modes. In the first case, the portal shows the metadata for a user-selected LO (label 1 in figure 2) as well as possible values, automatically filled regarding to the selected LO and the context (label 2). These values can be edited, i.e. adding constraints – or deleted, i.e. relaxing existing constraints (both operations are shown under label 3 in figure

2). Then, the LOR searching mechanism will be triggered (labels 5 and 6), and the results will be presented (label 7). If necessary, the user can iteratively refine this search (label 8 in figure 2).

2.2 Cool Modes as a specific interface to the repository

Working with Cool Modes, the user can connect to the LOR and store her learning objects in the repository. Like in the portal, some of the metadata categories are filled automatically, some have to be completed manually.

Furthermore, users can retrieve the LOR directly within the Cool Modes environment. Implemented retrieving features are

- Search archive (common query form)
- Take document as query (auto-filled query form which can be adjusted by the user)

The metadata structure for Cool Modes objects is tailored to the users' needs. First of all, many of them are generated automatically. Context-based information is also used – like in the COLDEX portal. Additionally, tool information is used to generate some more metadata values, e.g. the used plug-ins. For a user it is very easy to handle the uploading process. He connects to the repository via a menu item. Most of the metadata categories are already filled, the user adds only some of the semantic information like description and keywords. Then he can store his learning object.

Retrieving is very intuitive, too. The user wants to take her current document as query input – choosing this option will show a form with all metadata categories are already filled, but still editable. The user then adjusts them and sends this query to the repository. Or, if a more general search should be done, the user gets a common query form where she can specify the metadata information by giving the value (e.g. "Luis" as author), she can request metadata categories without giving a value (e.g. to get all LOs with the maze plug-in) or define categories as "not important" which are then ignored in the searching process (e.g. the date does not matter).

However the user retrieves the LOR, the result is a list of LOs which can again be used as query input which means the user can refine her search and follow the trace of promising results until the most appropriate one is found in the end.

2.3 Support for LOR usage

The COLDEX LOR web portal as the user interface to the repository is published at <http://galileo.coldex.info:8080/coldex>. To support users in communication about OUS activities and as regards contents, there are two mailinglists available: the first addresses the communication between all OUS participants (ous-com@coldex.info); the second one can be used for specific questions to COLDEX members (ous-support@coldex.info).

3 Pedagogical interoperability of scenario plug-ins

For several scenarios, the Cool Modes plug-ins can be combined in a flexible manner. Since all plug-ins are bound together in one modelling environment, the learning space can be chosen arbitrarily. To clarify this approach, an example is described in section 3.1. The ability to mix different plug-ins which represent different visual languages and thus different learning domains enriches the pedagogical context. Not only the combination of the different plug-ins is supported, but also the mixture of graph-based elements within one model, e.g. the calculation of a moon crater (using a calculation net), mixed with a model of physical processes (using the system dynamics plug-in).

In this manner students can be introduced to extracurricular topics and will be able to learn in a self-regulated way. The teacher is not forced to determine the way, but can act as guide and co-designer. This flexibility fosters the challenge-based learning approach which stresses the non-standard character of COLDEX activities.

3.1 Maze, moon and more: short example usage

A teacher wants to introduce the students to the space theme. Therefore he plans a didactic

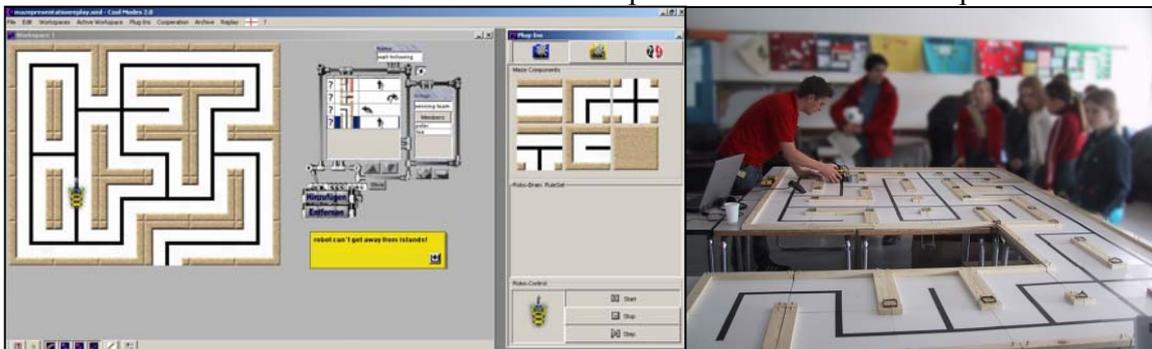


Figure 3 Maze scenario

sequence (lesson series) with the usage of COLDEX scenarios (see D7.2.1 *Learning Material and Guidelines*). He motivates the maze scenario as a first step to understand path finding missions like the mars missions; he chooses the lunar height calculation to make the students familiar with changing representations,

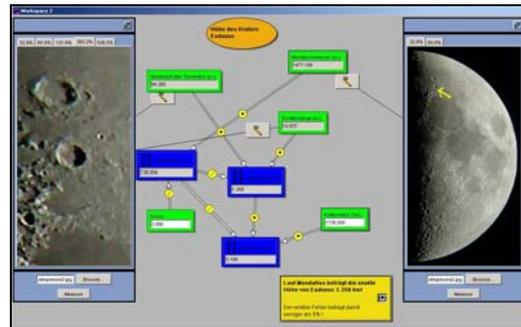
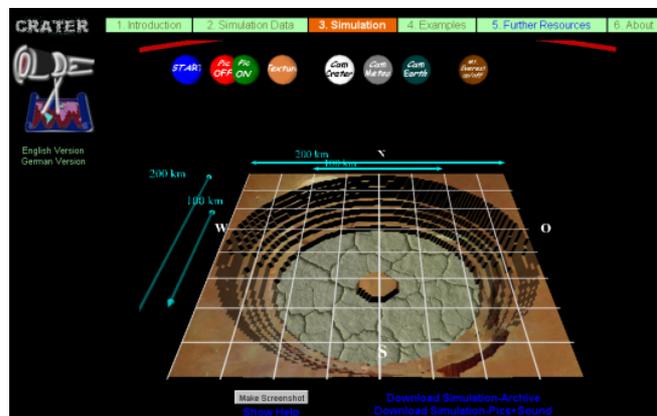


Figure 4 Moon scenario

especially in mathematical formulas (i.e. introduction to the calculation net).

Using the CRATER simulation – a web-based tool enriched with VRML functionality –



they have the possibility to set several parameters of the meteorite and the target ground, including the size, density and speed of the meteorite. Meteorite impacts can not only occur on earth. Consequently, the simulation also allows simulations for other cosmic bodies

and thus allows, for example, to see what happens if a meteorite collides with the moon and then to compare it with impacts on earth or planet Mars. The system dynamics plug-in of Cool Modes, finally, can be used to simulate the energy flow in a water rocket experiment. Via the LOR (Learning Object Repository) users can exchange different models (like maze or moon models), simulations (as compressed VRML archives) or pictures (screen dumps of simulations, moon pictures) to explore different kinds of the astronomy scenario, e.g. meteorite impacts.

4 Formation of the OUS – technical needs and requirements

To form the OUS two Open User Scheme workshops have been held. The first one focussed on the thematical demands of the COLDEX scenarios, whereas the second one stressed the activities done and the experiences from these. It turns out to be important to

ease the use of tools and to expand the range of scenarios in an additional mathematical direction.

Workshop No 1

The first Open User Scheme workshop was hold in Buenos Aires, addressing twenty-three participants from eight countries in Laint America. In two days the scenarios and principles of COLDEX have been explained which led to the following overview of interests:

COLDEX proposal	High interest	Low interest
Math education, e.g. stochastics	✓	
Moon: lunar heights	✓	
Maze scenario		✓
System Dynamics	✓	
LOR	✓	

Table 1. Interests of participants

The table lists the high or low interests of the participants in math education, moon cartography, the maze scenario and System Dynamics. The most interest could be observed for the math education and related topics like System Dynamics. The moon cartography tool initiated a discussion about using the measurement feature in other contexts.

Workshop No 2

The second OUS workshop was hold in Cercedilla (near Madrid), Spain. The focus group here were teachers and organisers of COLDEX activities, at the most outside of the consortium. The eighteen participants – including one via audio conference – discussed for two and a half day about COLDEX activities and sustainability of the support of the scenarios and related technology. The main workshop topic were reports on the activities and evaluation of these: On-going activities and practices, applications and tools used, experiences and impressions of the teachers who presented what they had done. Here, one of the important results of the discussions were a teachers' wish list (which will be available as part of the FR – Final Report). The functionality of the LOR and the Cool Modes

scenarios took centre stage. For example, a big demand was that the usage of the webinterface of the LOR should be easier.

5 Evaluation of applications

The OUS activities within COLDEX are evaluated, i.e. the data collection of the previous workshops and projects are now analysed. The evaluation instruments and methods have been adapted for the project, some of the instruments have been developed specifically for COLDEX. The evaluation of COLDEX scenarios took place in several countries using generic evaluation instruments to be able to provide the same evaluation possibilities for all scenarios. The instruments were adapted and tailored to the collaborative and technological nature of COLDEX scenarios. Different types of evaluation were conducted to assure appropriateness of the evaluation results.

The detailed description of the evaluation is reported in the deliverable D8.3.1 Evaluation Report. The following survey is also part of the project brochure which is the addenda for the Final Report of COLDEX.

Observation

An open observation was chosen to observe the students during the COLDEX activities. The students were informed beforehand that an observation would take place. Additionally the sample students that the observers selected for observation were asked if the observers could watch them closely when working on the activity. Every Observer was briefed about the COLDEX-specific observation material.

Since an observation of all students who are involved in an activity would have been too extensive, we decided to do a sampling. Three observers who are experienced evaluators chose one peer-peer group to observe them throughout one learning unit. The foci of observation were students' interactions and instructional styles. The rubric that was used by the observers to guide the observation process consisted of several criteria that defined the focus of observation: level and type of collaboration, level and type of argumentation and type of communicated content. The scales concerning instructional styles concentrated on the overall teaching method (learner-centred vs. teacher-centred) and level of teacher involvement in student activities.

Additionally to rating scales and annotations, student artefacts were used for convergent validation and pictures were taken throughout the instructional learning unit.

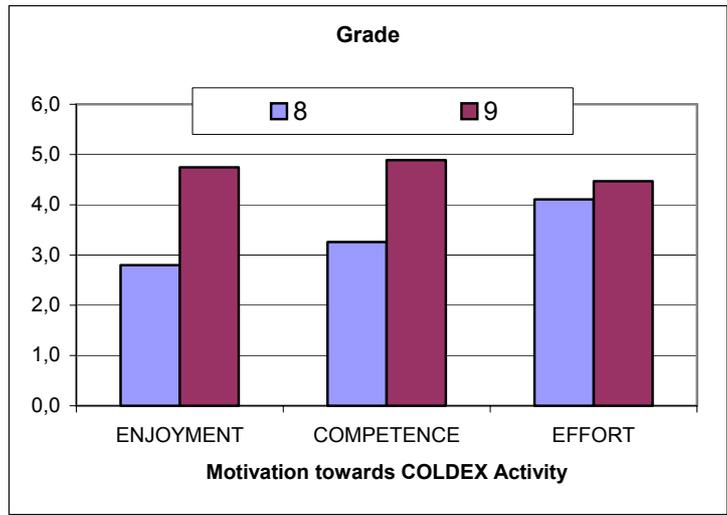
The following student behaviours and teaching methods were observed: We conducted observations in two different COLDEX scenarios to gain insight in what way the software Cool Modes was supporting interactive behaviour focusing on collaboration between students. It seemed that in both scenarios stochastics and the moon module of the astronomy scenario engaged students in collaborative behaviour to a certain extent.

During theory-based instructional phases and discussions in the beginning that happened without involving Cool Modes, students collaborated very little. This was expected due to the teacher-centred teaching method during the theory session. The Cool Modes session – a learner-centred phase – gave opportunities to interact with peers and to discuss challenges. When looking at the content of the discussions within the classes, it became apparent that in the beginning of working with Cool Modes the students focused on the functionality of the software rather than on the subject matter at the task itself. After getting accustomed to the software we observed a change of behaviour towards more task-related discussions. It seemed that the more the students became accustomed to the software, the more they were able to open up to other groups and to share ideas across the class community. Regarding the contents of their discussions, students spent then more time with rethinking hypotheses, for example.

Motivational Assessment

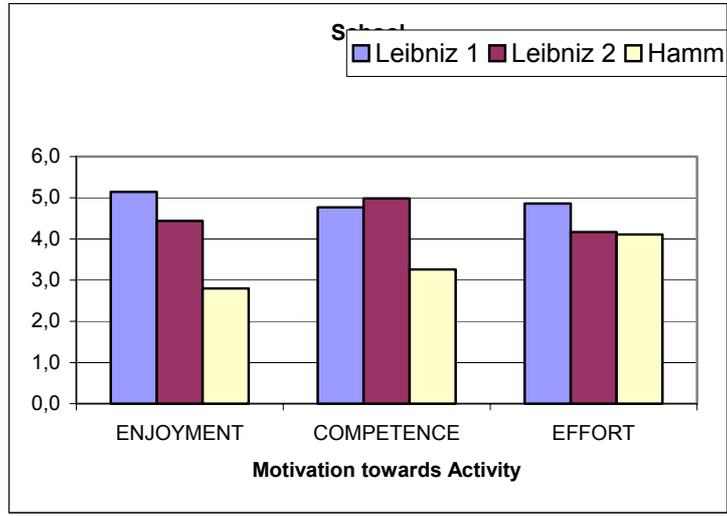
Besides levels of collaboration that took place during our COLDEX scenarios, we were also interested in students' attitudes. Therefore we assessed their attitudes towards science and computer in general, since we wanted to find out whether students were interested in COLDEX scenarios dependent on their interest in learning science and working with computers in general.

A grade related analysis showed that older students were significantly more motivated towards COLDEX activities than younger students.



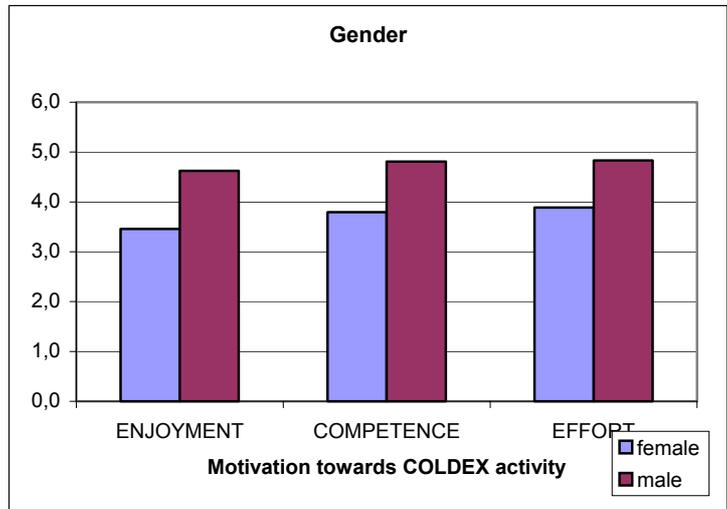
Graph. Motivation towards COLDEX activity: grade differences

We also determined motivational differences between different participating schools. Here a significant difference can be found between the Leibniz Gymnasium and the Hammer Gymnasium (both Germany). There was no significant difference in motivation between both classes from the Leibniz Gymnasium.



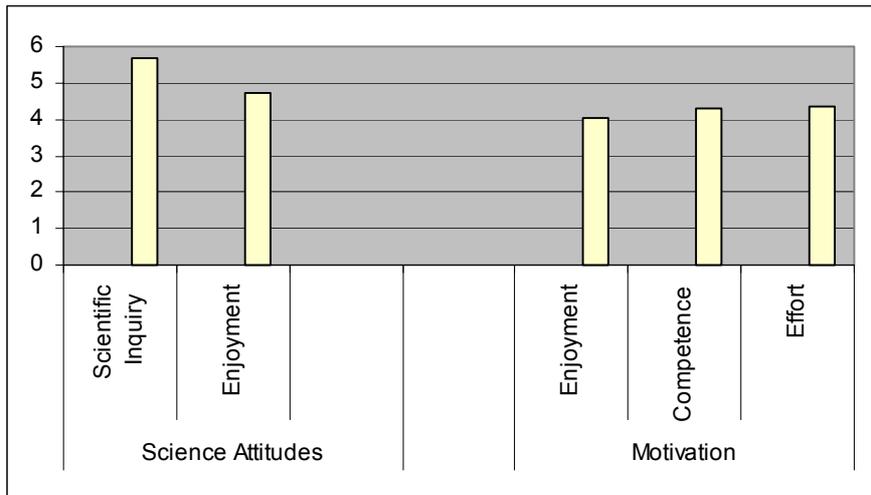
Graph. Motivation towards COLDEX activity: School differences

We found gender related differences regarding motivation for all three scales measuring different types of motivation: enjoyment, competence and effort. Male students seemed to enjoy the COLDEX scenarios more than female students. Also they found to feel more competent and to put more effort when engaging in the activities than female students.



Graph. Motivation towards COLDEX activity: Gender

We compared the students' attitudes regarding science in general with their motivation regarding COLDEX activities. There were no significant differences between interest in science generally and the students motivation towards COLDEX activities.



Graph. Relation between Attitudes Towards Science and Motivation regarding COLDEX activity

Set of COLDEX Evaluation Instruments for Teachers

Most of the instruments can be used as evaluation instruments to assess the COLDEX scenarios in a school context. Therefore are teachers encouraged to use COLDEX evaluation instruments for their own school lessons. The questionnaires, forms and observation rubrics can be found in detail in the annex of this brochure.

The following instruments are available for teachers:

Instrument Name	Focus	Language available
<i>Science Questionnaire</i>	Students' general attitude towards science	English, German
<i>Computer Attitude Questionnaire</i>	Students' general attitude towards computers	English, German
<i>Motivation Questionnaire</i>	Students' Motivation towards activity (scenario)	English, German, Swedish
<i>Observation Rubric</i>	Level of collaboration during COLDEX activity	English
<i>Software Environment Questionnaire</i>	Added Value of the software used	English
<i>Activity Questionnaire</i>	Added Value gained through activity	English
<i>Knowledge Quiz FoodinSpace</i>	Assessing knowledge about Plant Biology/ Scientific Inquiry	English
<i>Knowledge Quiz Stochastic</i>	Assessing knowledge about Stochastic	German
<i>Knowledge Quiz Maze</i>	Assessing knowledge about maze categories and escaping strategies	German

6 References

- [Pinkwart 2004] Pinkwart, N., Jansen, M., Oelinger, M., Korchounova, L., & Hoppe, H. U. (2004). Partial generation of contextualized metadata in a collaborative modeling environment. In L. Aroyo and C. Tasso (Eds.), *Workshop proceedings of the 3rd International Conference on Adaptive Hypermedia*. Eindhoven (NL): Technical University Eindhoven, 372-376.
- [Verdejo 2003] Verdejo, M. F., Barros, B., Mayorga, J. I., & Read, T. (2003). Including collaborative learning designs in a Learning Object Repository. In H.U. Hoppe, F. Verdejo & J. Kay (Eds.): *Proceedings of the 11th International Conference on Artificial Intelligence in Education*. Amsterdam, IOS Press, 509-511.