



OPEN CLASSROOMS

in the Digital Age

Cyberschools, e-learning
and the scope of (r-)evolution



open classroom
IV Conference



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Open Classrooms in the Digital Age

Cyberschools, e-learning and the scope of (r-)evolution

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AN OPEN DISTRIBUTED COMPUTER ENVIRONMENT FOR EDUCATIONAL TELEMATICS

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1. Introduction

The aim of this paper is to present the functions and tools of an open distributed computer environment for telematics-based learning; developed under the international project ARCHIMED "Advanced Multimedia-System Architectures and Applications for Educational Telematics"¹. The RTD activities in this project were oriented towards: establishing virtual environment affecting the effectiveness of the used learning methods and systems, the design, integration and testing of telematics-based services; development of new multimedia user interfaces; development of solutions appropriate for different user groups, including ways of visualisation, mobility, interactivity, hypermedia organisation

The analysis of the educational multimedia features and the current trends in educational telematics [1, 2, 5] leads to the following conclusions for the computer environment required functionality: the necessity of interactive use of the multimedia materials, allowing individualised feedback and discussion; extensive use of distributed multimedia resources available on WWW; the necessity of effective student navigation according to the student's needs and current state of knowledge; the necessity for versatility of composition for fast update and modernisation of educational content; the necessity of modular and open-system organization; the need for intelligent assistance in information handling.

The open educational environment under consideration is based on conceptual pedagogical model, specifying both the structure of multimedia courses and various ways of their use (teacher-centred or learner-centred organisation of the educational processes). It applies the constructivist pedagogy principles and use models, based on the following main ideas [3-5]:

- Learning should be context based, i.e. learning experiences should be contextualised in authentic activities; learning is acquired through making links with existing knowledge.
- Conceptual learning is through active involvement: a task is understood through participation in it.
- Learning is through collaboration with others: sharing knowledge resolves misunderstandings; understanding evolves from shared knowledge constructing;
- Learner should have personal autonomy and control over learning; teacher mediation depends on needs and skills of the learners.
- Specific content and learning outcome should not be prescribed; multiple perspectives of the learning task and different approaches to understanding are needed.

2. Archimed Knowledge Village and its virtual spaces

The metaphor of ARCHIMED Knowledge Village (AKV) was developed to serve as a conceptual framework for creation of distributed educational multimedia systems and is oriented towards development of sufficiently general and open environments which can receive and organise in a comprehensive way an open variety of courses in very different

¹ The work reported in this paper has been supported by the EC INCO-COPERNICUS Program, Grant No. PL961060 with partners from Greece, France, Austria, Hungary, Bulgaria, Portugal

knowledge fields AKV supports Distant Learning Centres providing distant learning courses, organising learning activities in a given knowledge field, located in partner sites or distributed among them. The functions and services /Fig.1/ of AKV are organised around several virtual spaces. The decomposition to virtual spaces permits to combine AKV functionally related modules in groups. This decomposition facilitates AKV design and implementation as it focuses the designers' attention on the common information flow and information structures, backed up by the AKV databases.

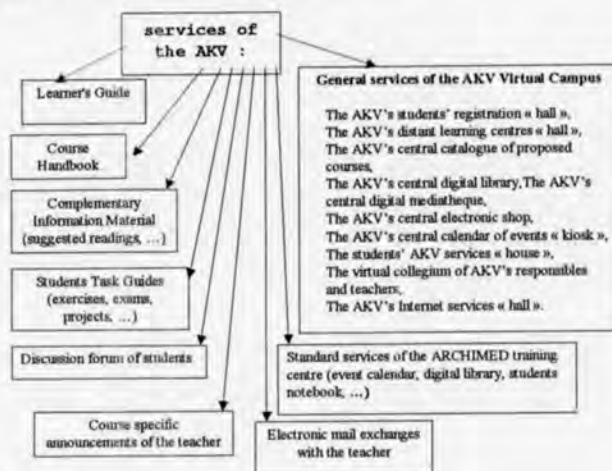


Figure 1

2.1 Learning space

This space enables the learners to do computer-assisted learning by access to appropriate services via a user-friendly interface:

- The learner uses interactively the produced courses and courseware modules in the learning environment of AKV. The courses are organised as applications kept in the distributed depository.
- The learner executes the tests and assessments, included in the courses as well as personal assessments, assigned by the teacher. S/he develops projects on the course materials (possibly using other materials from the virtual library).
- The learner exchanges information (questions/results) with the other students, executes evaluation assignments (e.g. peer review), participates in discussion forum and forms of collaborative learning.

The learning space integrates the educational activities of learners and teachers/instructors around the offered distant learning courses. A distant learning centre can have many members, including learners as well as instructors, grouped in a generalisation hierarchy. Learners follow courses and participate in examinations. Examination objects can be individual exercises, exams, projects, etc. Examination feedback is based on discussion messages, examination results, analysis and suggested readings. Feedback messages are exchanged between the learner and the instructor of the course. Examination results involve the evaluation marks. Learners also participate in groups for doing team work for a course. Learner groups take part in several educational activities in the same way as individual learners do.

2.2 Information space

This virtual space supports the AKV, providing various types of necessary information for the learners and trainers. Its main part is the «courseware repository» module, containing the pedagogical resources (courses, courseware modules and documents, used as courseware

building blocks) together with more detailed standardised descriptions of the documents and access parameters. The pedagogical resources are structured around the concept of a course, consisting of courseware elements. The major components of the repository include:

- User catalogue with descriptions of the available courseware and courseware elements. The descriptions are developed considering the approach and standards of educational metadata (IEEE LTSC Learning Object Metadata standard) and support distributed access and retrieval of the material, available in AKV repository.
- The courseware elements, stored centrally or in a distributed way in the courseware database. The database permits two ways of structuring the courses: a/ as electronic books, consisting of chapters, sections, subsections etc. associated with document in any format such as HTML, Word Document, PDF or any multimedia document format; b/ as sets of lectures, consisting of presentation slides and multimedia material. The data model also allows inclusion of examination material, consisting of exercises and projects. Simple and complex exercises are considered, the latter category comprising multiple-choice questions, answer matching exercises, interactive exercises and projects.

2.3 Teacher's and author's space

This virtual space supports all AKV activities of teachers and authors of multimedia educational materials.

- The teachers' activities in the ARCHIMED Knowledge Village is to give and organise courses and follow student progress.
- The teacher monitors the teaching process by offline/online connection with the learners of the group (e-mail, billboard) and has access to local section of the repository with materials for finished/on-going tests, assessments, projects. S/he has access to lists of students questions, memorised sessions of talks 'advisor-student', memorised sessions of peer reviewing. Learner progress follow-up includes the correction of examination material and provision of feedback on learner activities, answering to learner questions and overall evaluation of learners with respect to a specific course.
- The authors create and modify multimedia courseware, by means of the available in the environment authoring tools and using materials from the «courseware repository».

2.4 Administrative space

This virtual space organises two groups of administrative activities in the AKV:

- Management of the learning/teaching/authoring processes with registration of learners, teachers and authors with appropriate access rights;
- Management of the AKV information resources, including further development of the sites, realising the ARCHIMED Knowledge Village.

3. Classifications of A K V courseware

The implementations of AKV modules reflect the features and intended methods of use of different multimedia courseware, developed under the project ARCHIMED and kept in the AKV courseware repository. The courses are classified according to three organisational features, determining the specific features of the courseware content and its presentation.

3.1 Classification according to the learners target groups

1/ Introductory courses. These courses are oriented toward acquisition of initial knowledge for the discipline under study and serve as general introduction in the field for non-specialists. They are teacher-centred expositive² courses with less attention to interactivity and exercises.

² In an expositive course, the information flows mainly from the resource to the learner. The learners' input to the course is mostly in the form of navigation clicks. Expositive documents are typically used for learning-by-reading.

2/ Intermediate and advanced courses. These courses are aimed at deepening the knowledge in the problem area. They often have as a target also skill acquisition and mastering. In the current practice of technology-supported learning there is a strong tendency to develop such courses as active³ learner-oriented courses, possessing essential "learning-by-doing" features.

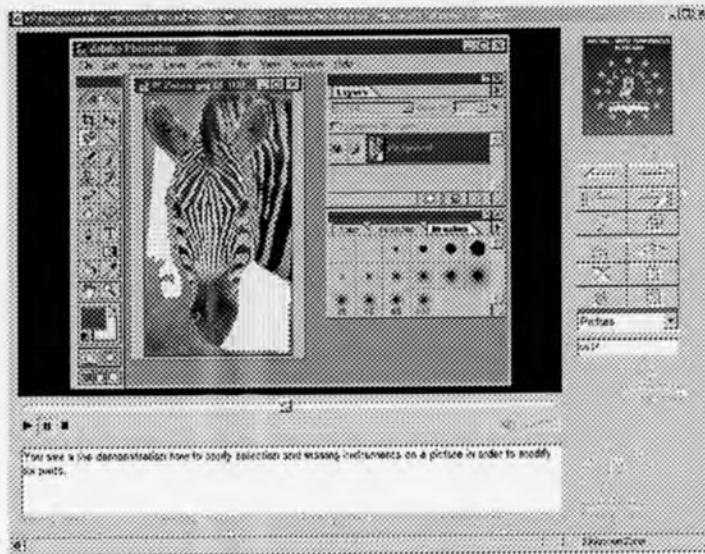


Figure 2

3.2 Classification according to the courseware organisation as computer application

1/ Courses, organised as stand-alone applications

These applications contain all the necessary multimedia information structures as well as the control sequences for their presentation.

2/ Courses with modular organisation.

This organisation uses more adequately the possibilities of database technology. It permits easy reconfiguration and generation of variants for different learner groups. In the AKV courseware repository the modular course organisation is achieved by set-of-lectures database elements.



Figure 3

³ In an active course, the information flows in both directions - from the resource to the learner, but also from the learner to this resource. Semantically meaningful input to the computer is expected in the courseware organisation. Active documents are typically used for learning-by-doing.

Both types of courseware are kept in the courseware database module, realising the courseware repository. In the case of stand-alone applications the users have access only to the whole course, while in the second case different levels of the courseware are accessible: variants of the whole course, different modules, their units ("lectures") and possibly their building blocks.

3.3 Classification according to the course content organisation

1/ Courses/modules, organised as electronic books/book chapters

This organisation is appropriate for expository courses. They are characterised with pre-defined sequential navigation through the lessons/exercises, possibly with additional hypertext links. This type of courseware is natural for domains when the verbal content is predominant not only in presentations but also in the learning goals (e.g. in language learning). In this case there is a strong trend to perform assessments in the form a small variety of tests (multiple-choice tests, fill-in tests etc), which may be checked automatically. The authoring systems for multimedia documents offer means, permitting relatively easy to create courseware in the form of electronic book.

2/ Project-oriented courses/modules

This organisation is appropriate for active courses. Their important characteristic is that the learning goals include not only acquisition of knowledge, but also acquisition and mastering of respective skills. Such courses require more on-line interaction with the learning environment in the AKV distant learning centre and are oriented towards learner-centred education. This specific of the course content fits more naturally to the modular courseware organisation.

The conceptual scheme of the AKV courseware database module makes possible an association of the book and lecture types of content organisation through their finer structural elements, as for a specific course entity chapters and lectures refer to the same material. In fact the two organisations represent different ways to view or present the learning material of a course. Therefore the same multimedia documents from the database may be integrated in an electronic book courseware or in a modular lecture-based organisation. Fig2. and Fig 3 show screen examples of the project-oriented active modular course "Authoring Computer Graphics" from AKV repository.

4. A K V implementation directions and decisions

The choice of appropriate hardware and software platforms for implementation of AKV modules is based on the analysis of the necessary functions and services of ARCHMED architecture /Fig.4, Fig.5/ and of the computer and communication infrastructure of the university partners. This analysis leads to the following design and implementation decisions for use of software system and instrumental tools:

- The main modules of the AKV virtual spaces are developed as applications working under the operation systems Microsoft NT Server / Microsoft NT Work Station.
- The multimedia courseware is developed by using different authoring tools like Microsoft PowerPoint, Macromedia Director etc. in accordance with the course content and authors' experience and preferences.
- The prototypes of the courseware repository and other databases are realised using Microsoft SQL Server.
- The organisation of the communications inside and between the learning, teaching and administrative AKV spaces is performed through execution of control sequences (scripts) by the applications - implementations of the main AKV modules. The scripts are written using appropriate scripting languages as Visual Basic Script.
- More complex communication services inside the local computer networks of the project partners, which constitute instances/subsets of AKV realisation, are to be covered by the product Microsoft Site Server.

- Totally distributed realisation of ARCHIMED Knowledge Village is designed to be implemented with the use of Microsoft Exchange Server on the top of the sketched hierarchy of computer and communication means.

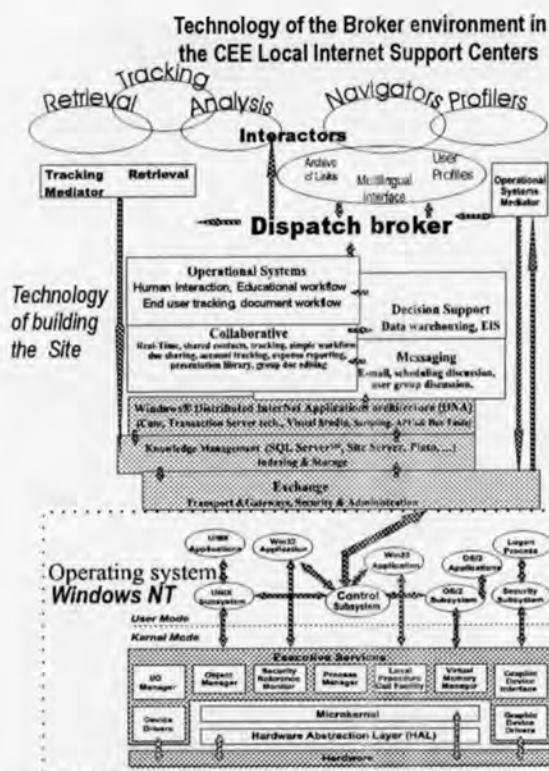


Figure 4

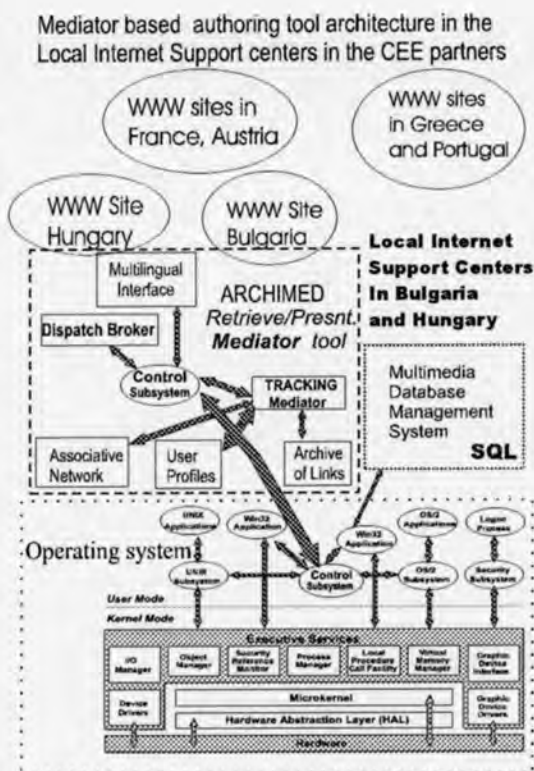


Figure 5

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