A Virtual Environment for Distance Education and Training

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1. Introduction

The world-wide networks and the information superhighways allowing rapid transmission of digital multimedia information to any user in any time, offer a ground for a new educational reform that would prepare the citizens to live in the Information Society. This reform would break the monopoly of the *print and paper based educational system* and would rely on learning environments incorporating *asynchronous space and time, interactivity, and virtual reconstruction* (McClintock, 1992). The most important characteristics of the learning environment is the virtual reconstruction of the school space by building virtual places: auditoriums, workshop rooms, cafes, libraries, etc., where students from different locations can meet, interact, and work together, as if they were face-to-face.

The paper aims at developing a model for a *Virtual Environment for Distance Education and Training* (VEDET) that offers a comprehensive metaphor to be used both for human-computer interface and instructional design purposes. It also gives a paradigm for restructuring traditional education and training by complementing them with a virtual component. Thus the VEDET would not replace the traditional school, university or training department of a organisation but rather extend their facilities and tools and make their activities more flexible and technologically enriched.

The VEDET is being developed in the frames of the EU Copernicus Project *Flexible and Distance Learning through Telematics Networks: A Case of Teaching English and Communication and Information Technologies*. The VEDET also offers a paradigm for re-conceptualisation of distance research and co-operation between the Copernicus Project partners, exchange of educational resources and services, (virtual) mobility of teachers and students, multicultural distance education.

2.Virtual Communities

Looking back at the communication and information technology history we could clearly observe that the main attention of researchers and technologists has been gradually moved from hardware to software, next - to human-computer interface, and now - to social issues related to global communication and collaboration (Sendov, 1996). The telematics based distance education model has in its core the acceptance that learning is essentially a social process (rather than individual one) which best takes place in an environment where communication is easy, and that new communication technologies can be used to provide such an environment(Jennings, 1994). Communication is the most typical activity in a community - without communication neither organisation nor collaborative actions are possible. The Computer Mediated Communication (CMC) leads to establishment of virtual communities formed on the basis of common topics of interest, collaborative work, or other joint activities(Fernback & Thompson,1995). These communities are trans-national and trans-cultural and need re-conceptualisation of the social life, including education.

3. Models of Telematics Based Distance Education

Two models have been identified for the implementation of telematics based distance education (Davis & Jennings, 1991):

- evolutionary model - courses provided by existing educational establishments are offered at a distance too.

- revolutionary model - development of a virtual educational establishment where no physical campus exists.

The *virtual college* is a new paradigm for distance and open learning where teaching and learning is constrained by neither time nor distance, but where interactivity is a key component in the learning process (Jennings, 1994). The virtual college exists in three main forms now:

- on-line access to resources, programmes and services of a real university or college;
- integrated distance education on-line services realised in partnership of university, colleges, and business organisations;
- entirely virtual establishments with academic departments, curriculum, administration.

> As with organisational implementation of telematics based structures and practices, the realisation of these potentials is more than a simple matter of providing the technologies and putting students and tutors online. The primary issues which need to be addressed are not essentially technological ones, but issues of communication and co-ordination, pedagogy and management. Effective implementation involves thoughtful construction of the virtual learning environment, careful design of the learning materials, thorough training of tutors and the adaptation of organisational and management structure to accommodate a new paradigm (Jennings, 1994).

The main advantage of the telematics-based distance education is the provision of facility for all participants (students, teachers, administrators) to work interactively in a co-ordinated way as if they were located on campus.

By means of the information superhighway some futurists scenarios of education (Gooler & Stegman, 1995) from utopia get into reality. For instance the Globewide Network Academy (GNA, 1993), a virtual educational consortium, is a typical case of a revolutionary model for distance education. The GNA aims at establishing a fully accredited online university with target audience all individuals in the world who have access to Internet. They designed the virtual environment so as to have multiple levels of access, e.g. students who only have e-mail access, can receive a text based instructional

material and take part in asynchronous discussions. Those learners who have WWW could receive all advantages of networked multimedia systems. The GNA got the award of the *best campus wide information system* although its campus is entirely virtual.

Similar model of educational re-conceptualisation is the Virtual Educational Environment (VEE) created by Athena-Virtual Online University (VOU) and the GENII Project whose mission was to establish a Virtual Faculty of networked educators for K-12 teachers(Ducket, et al, 1995). Although the interpersonal interaction is textual, based on a Multi-user, Object-Oriented (MOO) environment, the VEE demonstrates the potential of Internet to foster collaboration and conceptual change between people who have never met face-to-face. It also shows a conceptual and virtual integration of higher and school education.

Organisations like GNA and VOU could be considered as prototypes of the educational establishments of the next century. Through pedagogical re-engineering (Collis, 1996) and virtual reconstruction the educational institutions will amalgam the advantages of the place-based and virtual educational establishments. However some global decisions should be taken beforehand, e.g. developing a global credit transfer system. In the competitive market of educational services most of the educational institutions will be forced to expand their programs with distance learning options of delivery. The competition will affect also teachers and students, as they would have access to the global educational services, audience, resources.

> Despite enormous growth of the Internet and its proliferation of tools, resources, and on-line virtual communities, the connection between local learning environments and virtual learning environments remains tenuous. (Ryder & Wilson, 1995).

Bridging the existing gap between local and virtual learning environment is a challenge for researchers, educators, and technologists. Most of the problems they face are new, do not have a single solution and need systematic analysis and further study.

4. Use of Metaphors in Designing Virtual Learning Environments

Instructional design can be seen as a reaction against the traditional classroom metaphor of instruction (Wilson, B, 1995). The product delivery metaphor conveys an image of instruction as a package to be exported from its production site to its delivery site. The product metaphor provides a focus and an object for our work. Systems definitions of instruction emphasise inputs and outputs, interlocking mechanisms, and self-correcting feedback and maintenance. Process definitions tend to emphasise the steps or stages of design, or steps or stages of instruction. The systems and process metaphors have led to a language for describing the dynamics of instruction and how one designs it. The performance-support metaphor relies on help systems, job aids, and other tools to accomplish what training largely is charged to do - effective performance on the job.

Different assumptions (metaphors) about knowledge and its acquisition influence the views (metaphors) about instruction. Viewing instruction as a learning environment will tend to have some connection to a meaning-construction view of knowledge. A learning environment is a place where people can draw upon resources to make sense out of things and solve problems. This metaphor can provide a needed complement to the established metaphors in the field (Wilson, B, 1995).

Like the classroom metaphor the learning environment metaphor gives emphasis to the *place* or *space* where learning occurs. The metaphor of constructivist learning environment emphasise on peer group of learners collaboration and it could be defined as:

> "...a place where learners may work together and support each other as they use a variety of tools and information resources in their pursuit of learning goals and problem-solving activities"(Wilson, 1995).

The components of a learning environment are classified by Perkins (1991) as follows:

- information banks - sources or repositories of information, e.g. teachers, textbooks, videotapes;

- symbol pads - allow construction and manipulation of symbols and language, e.g. notebook, word processor, data base;
- phenomenaria - areas for presenting, observing, and manipulating phenomena, e.g. aquariums, educational simulation, microworlds;
- construction kits - packed collections of components for assembly and manipulation, e.g. Lego, authoring tools, math-manipulation software;
- task managers - elements that set tasks, provide guidance, feedback, and changes in direction. The role of a task manager is typically attached to the teacher, but in constructivist learning environment this role is often taken by the students themselves. The teacher becomes a co-learner, a coach, an advisor, and a mentor to support the students activities.

Perkins identifies two types of learning environments:

- minimalists learning environments containing information banks, symbol pads, and task managers;
- rich learning environments that contain more construction kits and phenomenaria, and place more control of the environment in the hands of learners themselves.

In the virtual learning environments the learners interact with other members of the virtual community as well as with a great amount of widely spread resources and tools. They are more open than the popular computer based microworlds that are self-contained learning environments. The Internet can be considered the ultimate constructivist learning environment (McManus, 1995).

> Open, virtual learning environments have tremendous potential for learning, but they carry their own set of design challenges and concerns (Wilson, 1996).

Most of the virtual learning environments are based on the networked hypermedia concept. In the hypermedia virtual learning environment we can identify several levels of design that incorporate different metaphors behind. For instance the main metaphor incorporated into the instructional model designed according the *cognitive flexibility*

theory is the *criss-cross landscape* with its suggestions of a non linear and multidimensional traversal of complex subject matter, returning to the same place in the conceptual landscape on different occasions coming from different directions(Spiro, et al, 1991). The instructional theory that is derived from the cognitive flexibility theory and applied in flexible learning environments is called *random access instruction*. However it should be mentioned that there is a difference between the hypermedia design metaphor and the instructional and interface metaphor (McManus, 1996). The hypermedia design metaphor deals with how the designers organise the learning domain during the creation of the learning environment, while the interface metaphor deals with how the learner accesses knowledge within the environment. The interface design as well as the availability of navigational means such as concept maps and browsers, have to guide the students and let them make decision about the next step they will take in the hypermedia learning environment.

We will mostly focus our consideration on the design of the non content part of the VEDET rather than on the design of the learning domains, which is matter of further research and developments actions.

The design of an appropriate human-computer interface, based on a visual metaphor representing the components of the virtual learning environment, helps the distance educators to better adjust their educational strategies and to easier navigate in the virtual spaces. For instance the Berlitz Language Learning Centre metaphor represents different areas where different modes of communication are available(Jennings, 1994). The virtual environment consists of: an *administrative area*, a number of *study rooms* for small group work, a *workshop and gym area* for carrying out language exercises, a *resource area* and a *cafe* (for social interactions).

The VEE uses the metaphor of an *orbital space station* that has an *administrative office*, *public spaces*, and *virtual classrooms*(Ducket, et al, 1995).

5. An EU Copernicus Project on Distance Education through Telematics Networks

In January, 1995, the EU Copernicus Project COP1445: *Flexible and Distance Learning through Telematics Networks: A Case of Teaching English and Communication and Information Technologies* began. The partners were: Sofia University, Faculty of Mathematics and Informatics and Faculty of Economics and Business Administration, Sofia, BG; University of Twente, Faculty of Educational Sciences and Technologies, Enschede, NL; University of Exeter, Exeter, UK; The Technological University of Kaunas, Kaunas, Lithuania; and Glushkov Institute of Cybernetics, Kiev, Ukraina. The project aimed at:

- establishing Internet communication between the project participants;
- developing Project Data Base suitable for establishing a Telematic Research Network;
- developing pedagogical framework for teleteaching in individual and group mode and a conceptual model for flexible and distance learning system using Telematics networks.
- developing and delivering two sets of distance education courses: English (English for CIT, and Business English) and CIT (CIT for Teacher Training, CIT for Engineers, and Business CIT);
- developing software tools supporting course development and delivery.

The VEDET aims at offering a common software environment that allows co-operation and training for a multicultural and multilingual virtual learning society. It includes an integrated virtual extension of the existing educational institutions participating in the project and will serve as a virtual environment for distance education course development and delivery. The VEDET also provides a common virtual research environment for the remote collaborative partners.

The VEDET offers a conceptual model of a virtual environment for open and distance learning (ODL) that could be applied in other EU Programmes as well. For instance it is

appropriate for the projects in the ODL Action of the SOCRATES Programme that aims at (SOCRATRES, 1995):

- facilitating co-operation between organisations and institutions in the field of ODL;
- enhancing the skills of teachers, trainers, and managers in the use of ODL techniques;
- improving the quality and user-friendliness of ODL products;
- encouraging the recognition of qualifications obtained through ODL;
- improving the quality of the organisational environment in which ODL takes place;
- improving the availability and quality of the teaching media and resources for ODL;
- use ODL as a means for overcoming barriers to physical mobility;
- use CIT to improve the quality of traditional education.

6. The VEDET Metaphor

The VEDET (seen from a helicopter view) includes four types of learning organisations: a *virtual university* (VU), a *virtual school*(VS), a *virtual enterprise*(VE), and a *virtual language learning centre* (VLLS). It includes also a *virtual student house* as well as a number of *virtual services*, such as a *virtual library*, a *virtual exhibition and entertainment centre*, a *virtual electronic publishing house*, a *virtual help desk*, a *distance education brokerage service*, a *virtual student assessment centre*, a *virtual electronic document and software delivery service*, a *virtual course customisation service*, a *virtual transportation service*, a *virtual liaison office*, *a virtual public arena*, a *virtual post office*. The VEDET duplicates and extends some of the existing educational and training establishments and services and allows their better integration and enrichment. The kernel of the VEDET is the VU, which will be described in more details.

6.1 The Virtual University

The VU includes the following main virtual places:

- an *administration office* where students can register and discuss organisational matters with the VU staff;

- a *virtual lecture hall* (auditorium) where a lecturer could deliver a lecture for a certain virtual learning community;
- *virtual seminar rooms* where the virtual class can discuss matters related to learning topics.
- *virtual workshop rooms* where collaborative work/learning can take place;
- a *virtual reading* room that contains all locally prepared learning materials and other learning materials directly referred as student resource materials. It also has open gateways to the VS, VE, and VLLC reading rooms, to the VEDET virtual library, and to other virtual libraries in the cyberspace. In the VU reading room students and teachers can discuss in pairs or in small groups issues, related to the learning materials.

The VU learning environment includes *branches* of most of the VEDET services, such as: *library*, *exhibition and entertainment centre*, *electronic publishing house*, *help desk*, *distance education brokerage service*, *student assessment centre*, *electronic document and software delivery service*, *course customisation service*, etc.

6.2 The Virtual Services

The virtual library has an integrated catalogue of locally available electronic books, papers, learning materials, and other electronic resources, as well as a gateway to other virtual libraries, such as the GNA Library (GNA, 1993). It offers a local document search engine and an access to global search engines such as Lycos and Magelan.

The virtual electronic publishing house offers networked hypermedia document publishing services on demand of: electronic books, lecture notes, teacher guides, student guides, questionnaires, visuals, etc. It includes a *photo-studio*, *picture and icon galleries*, *graphical design section*, *pre-print section*, and other elements of the electronic publishing process. The publishing house will be directly connected with the VU reading room, the virtual electronic document and software delivery service, and other places.

The virtual electronic document and software delivery service is an important component of the VEDET. It allows supply of learning resources at any time and any place *locally* and *globally*, to other wired virtual learning environments. A user (lecturer or administrator) can plan the learning resources flow and the work-flow. For instance a lecturer can request certain learning resource materials needed for a distance education session to be delivered to all participants by the time the session starts. Such materials could be: a case study, a set of multimedia software envisaged to be used, the facilitator's transparencies (or the PowerPoint presentation), lecture notes, questionnaires.

The virtual electronic entertainment centre provides access to virtual museums, art galleries, aquariums, exhibitions, concerts, movies (on demand), group computer games, virtual tourism, etc.

The virtual help desk provides expert help, access to the teacher, school administration, support in specific activities, e.g. a software kit for flexible instructional modules design(Nikolova, 1996).

The virtual public arena is a place for informal talks, such as: *virtual cafes* (for longer talks), a *virtual corridor* (for short talks *while walking*). The virtual cafe has a number of different *sitting-rooms*, e.g. separate sitting-rooms for students, teachers, parents, employers, as well as places for cross-meetings such as a cross-meeting sitting-room for discussing carrier opportunities between students, parents, and employers.

The virtual course customisation service deals with distance education course customisation and adaptation to the needs of *the local learning community*, by taking into consideration the local educational and training traditions, tutors, language, culture, and even the individual needs of certain learner.

The virtual liaison office takes care about administration and co-ordination of the international co-operation projects, as well as the student and staff virtual mobility schemes, e.g. students from the VEDET at Sofia could study and take accreditation for a

DE course delivered by the Exeter's VEDET; a lecturer from the Kiev's VEDET virtually teaches at the Kaunas' VEDET, etc.

The distance education brokerage service plays the role of a market place for educational services and products where any educational institution can do global marketing research for its own products as well as receiving an opportunity of *buying* educational products to be included in its own educational programmes and initiatives.

The virtual transportation service provides fast *shuttle-bus* transportation service between the virtual places of the VEDET and a *space-shuttle line* between different VEDETs. For instance one could take a shuttle-bus to rapidly move from VU to VS, or a space-shuttle to *fly* from Sofia's VEDET to Kiev's VEDET.

The virtual post office provides electronic news services, multimedia e-mail and listserv services, electronic journal subscriptions and delivery, postcards construction and delivery (MIT, 1996), etc.

The VEDET provides the basic virtual spaces, resources, and services. The users could reconstruct the virtual space by adding new facilities, spaces, and services according to the learning process requirements. For instance for the purposes of a session of electronic commerce a new virtual workshop room could be created and *equipped* with educational resources, a *business Web pages development tool kit*, software and electronic conference tools appropriate for collaborative projects in marketing on the Internet, etc.

Every user could create his/her own *personal learning environment* (PLE) at the client side of the client/server software model.

7. The VEDET Software Environment - Behind the Metaphor

Behind most virtual places and services of the VEDET a software specialist can see a variety of software tools: from simple e-mail to specialised hypermedia systems, electronic conferences, including conferences supporting collaborative learning and collaborative work, shared data bases and electronic catalogues, advanced searching tools, specialised electronic performance support systems and other types of educational networked hypermedia system software. The educational technology strategy relies on asynchronous group communication systems which incorporates a variety of collaborative approaches applicable to education and training: topical discussions, working on joint projects, students' presentations of the educational outcomes in front of a *virtual audience*, debates, individual tutor/student discussions, group educational games playing, answering questions, explorations, etc. The openness of the WWW and the opportunity every user to become a milti-media document author give rise to a new generation computer-supported co-operative learning/work systems, such as: Virtual Classroom(Turoff, 1995), *ComMentor* (Roscheisen, Mogensen&Winograd,1995), the BSCW Shared Workspace System(GMD, 1996), *CoNote*(Davis & Hutchenlocher, 1995*), IRIS Phone on the Web* (IRIS, 1996), etc.

A functional specification of the VEDET software and a rapid-prototyping of some of its components, has already been made.

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