
THE SCHOOL OF TOMMOROW. INVESTIGATING THE E-LEARNING PARADIGM FOR NATIONAL DEVELOPMENT

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Introduction

The new educational paradigm has been a common challenge within the national educational systems of the European countries. The tremendous development of the ICT's and especially the development of many distance learning, web based training and e-learning integrated platforms set a new base ground for exploitation but in most of cases this effort was limited on typical installations. The e-learning initiative of the European Union as well as other initiatives such Leonardo Da Vinci, EUMEDIS and IST expand the opportunities to research new concepts and to develop systems that will justify the key role of ICT's in the new millennium. This paper discusses and provides a new proposition, which combines theoretical concepts and technological requirements. The overall objective is to reveal the importance of e-learning pedagogy that is not present in the majority of the e-learning platforms. Our model for further analysis is called e-School and will be presented in detail in the following sections.

Current Situation. Experiences from projects.

With no doubt in the past decade we had the opportunity to use and to evaluate a number of technological innovations that made possible the delivery of learning content on-line and off-line irrelevant of time or place limitation. Looking at the priorities of such systems the conclusion is that the establishment of learning highways on the Internet was the first consideration. But after a few years of employment it seems that the Information Society has to offer a lot more than realizing a chat room, a bulleting board and a publishing on line mechanism. The new demanding areas for research and development are learners profiling, dynamic learning content reconstruction, and value discovery on learning processes as well as customized learning spaces. From the National Educational system perspective the above stated challenges and opportunities formulate a context for important debates, evaluations and decision. Furthermore the e-learning dimension of the National Educational Systems is not a buzzword but it is a concept for further analysis.

The analysis of the e-learning market in Europe is not only difficult but it has to be based on issues closer to effectiveness than to population increase. In most of cases the virtual universities, the e-learning systems base their functionality on a simple browsing mechanism accompanied with a section of web links and a few on-line quizzes. In other words which is the value of such a system when in most of cases the employment of the ICT is limited on the print button of browsers. We could state that these systems secure the growth of the so-called distance-learning marketplace in Europe even though the learner satisfaction from such a system is very limited. A critical question is can we enhance the learner satisfaction on an e-learning system or his first impression will be negative.

On a recent survey conducted on the Context of Teletraining Centre of Athens University of Economics and Business (www.teleduc.aueb.gr) most of the users of the "e-learning" system found the system limited due to its static nature (The system was supported from the traditional functionalities of a WebCT server). Additionally the trainers state the difficulty to prepare and to adapt the learning content on the specific content management mechanism of WebCT. Finally much of the effort was paid on problems irrelevant to the learning processes. One first conclusion from this survey is the need for the development of dynamic learning environments. A critical decision could be the formulation of a paradigm on which there will be specific variables capable to provide the dynamic nature of the new learning system.

An other example forcing our research effort is a project called Aristotle, a system based on WebCT supporting the diffusion of learning content for students of secondary schools in the field of Internet (<http://larisa.heltrun.aueb.gr:8900>). In this project five schools and about 300 students from many regions of Greece have an e-learning experience using WebCT. The main observed problem that the development team face in the process for the creation of the learning content was the inability of the platform to support different level of knowledge abstraction and relevant learning templates. It was more than clear evident that the students would prefer a system on which the content could be organized on a different way than a sequential indication of learning notes.

Definition of the dynamic content of an e-learning system

Our research effort is trying to reveal the value of the learning processes that every distance learning system has to provide to each users. Figure one is a first try for the mapping and the definition of such learning processes. The distinction of ten specific learning processes implies different levels of technological requirement and consequently more sophisticated technological supported environments.

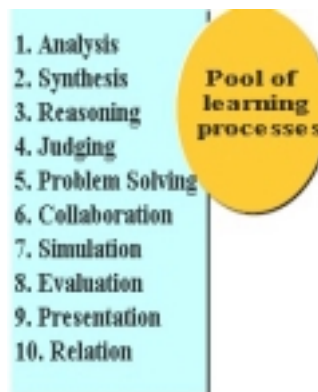


Figure Error! Unknown switch argument.. Learning Processes: A first variable for dynamic learning environments

Furthermore each learning process is a combination of *learning tasks*, which jointly structure the learning space for the user. It would be really very interesting to define each of these learning processes in terms of related learning tasks in order to be able to adapt traditional learning content. These learning processes provide for the trainer of an e-learning system, the author, constructional pieces that can be manipulated in different manner according to different types of knowledge and problems. Of course it would be a lot more useful if we could incorporate this ability and on the learner side. Let's think about an e-learning system on which the educational space is dynamically created according to the preferences of the learner or through a discovery of required learning processes. In the projects that we mentioned earlier the basic disadvantage was the absence of mechanisms that would be able to test the students abilities to discover the knowledge.

The evaluation metrics in the majority of the e-learning systems are rather inadequate. The most challenging issue on our research is the detailed analysis of the learning processes from a logical perspective as well as from information intensiveness that are required to support the logic and the functions of an e-learning system. Consequently the detailed analysis of the learning processes will provide an overview of the necessary data elements and procedures. The object oriented analysis of such a system is not only critical for the success of the research effort but relates the students satisfaction directly to the necessary processes and data of the integrated learning environment. The scope of such a system is not the satisfaction of the learner but the effectiveness of the learning process in terms of perceived value.

Figure two, defines the learning process Analysis as a combination of four relevant learning tasks: Find relevant objects, set interconnections, integrate meaning, provide new meaning. The Author of the e-learning system in order to use this learning process on a specific course that develops has to put effort in various requirements. For example he must provide to the knowledge base of such a system a

number of “relevant” objects such as theories, real world case studies, abstracts, experiments etc, in order to make capable the student to find them. Of course this operation is not very easy because its object would have to be accompanied from various metadata. The conclusion is that each learning task needs further analysis in order to set the requirements for its technological support in terms of databases, metadata, procedures that manipulate them. The underlying issue is an object-oriented approach: The e-learning environment derives value to the students but this value in typical e-learning systems is hidden. The major reason is the inability to define and to deliver this value in terms coherent to students.



Figure Error! Unknown switch argument.. The definition of learning process Analysis

A second variable for the establishment of dynamic learning environments would be the development of learning products with a different mix of value components in terms of knowledge, attributes etc. For example if we were interesting for the establishment of an e-learning system capable to provide content for Internet basic skills we would have to formulate different learning products. An advanced system would be responsible for the reconstruction of the learning products in format that could support the different learning processes.

Additionally the reusability of learning products is very important. Most of the learning environments that are dominant in the e-learning market today do not support a re-usability mechanism based on relevant attributes of the learning content. For example if we use WebCT or Blackboard as our delivering platforms for e-learning, our decision to reconstruct our course will be a pain-full procedure. In other words the content management in our expert e-learning system has to be based on an advanced content management mechanism. The author of such a system would have to characterize its material (html pages, pictures, texts, docs, images, image maps, screenshots, demos, simulations etc) according to specific characteristics (target audience, suitability for specific learning processes, metadata, keywords) in order to build the database of the educational products. A number of these elements constitute an educational product. The reader-student of the e-learning session will be able to discover the learning scenarios and its contents through specific learning processes. This approach is very important as it tries to justify the parathesis of learning content in an organized way. But the success still remains on the willingness of the teacher to prepare the learning content that will be suitable for the support of all the learning processes. Because if an author uses on his e-learning session a repeatable sequence of learning products that are suitable for only one learning process then the whole system will be malfunctioning.

From the author perspective, the availability of different learning processes on a first step would allow the building of learning scenarios. Each learning scenario could be a sequential or parallel continuum of learning processes that have to be customized in order to have value for the student. In general an intelligent e-learning system would have the functionality to drag and drop learning processes on an educational space layout. After the completion of such a procedure the author will have the overall learning scenario for a session or a course. It has to be clear that the author of such a

system will face the learning processes as black boxes at the beginning, without much information about their overall learning tasks.

The learning scenarios builder can be more intelligent if the information technology capabilities create an expert system on which an author will be able to find from a scenarios data base the appropriate learning scenario for its course or for its problem. Variables in this case would be the context of the problem, the type of the audience, the characteristics of the subject etc.

Logical presentation of the e-learning paradigm

The four dimensions of e-learning micro cell, personal value, knowledge web, human community, learning process, provide a context for analysis. The scope is not to exhaust their practical meaning but to understand the complexity of the related issues and the efforts that have to be paid in order to define the technological implications of the desirable learning environment.

The dimension of personal value for the e-school architecture is of critical importance. If we develop a customized learning environment with concern not only to class management characteristics then we could be able to prove the significance of personal value in school settings. The need to reveal the personal value could imply characteristics such as profiling capabilities needs recognition, customization of knowledge, learning styles classifications, personal webs and many others that have to be specified.

In correspondence the dimension of the knowledge web recognizes the prerequisite to create an advanced knowledge management mechanism since the knowledge component in schools reality is more than important. The establishment of customized knowledge situations, the capacity of e-school to support and deliver knowledge in various formats, the development of search facilities that ensure knowledge discovery are only a few of the technological implications of the knowledge web dimension.

The realization of the human community within the e-school requires the support of team building through distributed work, the establishment of complementary tasks, the promotion of dialogue and relations, the evolvement of motivational mechanisms and the setting of personal development.

Finally the endorsement of the learning process of e-school needs the detailed analysis of concepts such as learning scenarios, learning styles, learning situations, learning goals and their integration with technological capabilities.

To sum up, the e-school architecture has to build its capacity on Knowledge management mechanisms such as knowledge creation, knowledge codification, knowledge categorisation in concrete ways of learning templates in various fields, case studies templates specifically codified for the needs of primary and secondary education and communication mechanisms, including teleconference.

The e-school is not limited to a closed internal circuit. Its basic objective must be to be open to the society. In such a scope of participation the EU educational policy, the opinions of educational associations as well as the experts experience and moreover the social culture are not regarded as external push factors. They develop a wider web of access and constitute stakeholders with specific interest for the being of e-school. The government bodies, the teachers, the students, various scientific forums and associations, experts in various fields, the academic community have to pay a significant role for the e-school efficiency. All the above-mentioned stakeholders have to be connected with e-School architecture on a way that maximizes the potential usefulness of the whole system. Their connections to the e-school have to be analyzed in order to specify the technological requirements for the realization of the effort.

On e-School the object is to enhance the contributions from the various stakeholders and to facilitate their relations with specific procedures. The role of each stakeholder has to be analyzed and to organize very carefully. A critical question concerning this analysis is whether e-School is going to be

configured on a national base. Our intention through the analytical description of e-school is to establish an integrated system, on which there will be different levels of functionality and access permissions.

The knowledge diffusion within e-school links the two distinct components of e-school. Through the establishment of direct relations the school community proves its interest for the empowerment of the performance. Students provide personal data, use profiling techniques, publish info on personal webs, navigate through learning scenarios, discover knowledge, enroll in courses and in seminars, ask experts, prepare team works, and prove their many interests through special events such as an on-line newspaper. Teachers prepare learning content, use different media in order to test their educational value, organize virtual workshops, use self-training and implement evaluation of the learning process.

The government in general provides the context for the host of e-school on an (inter) national basis. The technological subsystems of e-school are developed in order to support a wider in terms of place and time school community. They support the operation of e-school in financial aspects and provide links for the e-school to government organizations etc.

Experts in various fields, e.g. academics, professors, associations, non-profit institutes, provide their expertise in order to expand the functionalities of e-school through forum discussions or e-seminars that organized for various target groups.

With no doubt the reinforcement of e-school micro-cell through this web of stakeholders requires a technological infrastructure and the development of innovative strategies for their effective implementation. The two levels of e-school conceptual approach the micro-cell and the macro-dimension constitute a knowledge management mechanism that tries to capitalize the tacit and the explicit knowledge of all the participating stakeholders.

The conclusion of the above stated conceptual ideas is the necessity to create an e-learning system on which the concentration will be on the establishment of value delivering mechanism to the students. The two-fold functionality of such a system will support authors and students not from a class management perspective but rather from a knowledge management perspective. The web of processes available for the students will address the need to maximize the value of an e-learning system for the students. In synopsis the major logical components of such a system include:

- A number of well defined learning processes. Every learning process has a number of learning tasks, as well as every learning process requires specific learning products for its effective implementation.
- Learning scenarios that manipulate learning processes on a manner that integrates meaning. These scenarios may be available through a template base or could be created dynamically and stored according to author's preferences.
- Learning products that incorporate value components such as needs, knowledge, motivational elements, problem solving capabilities, team synergy characteristics etc.
- Learning templates that facilitate the organization of educational products within specific learning processes.

Architecture of the e-learning system

The development of an e-learning system that will facilitate the realization of the concepts that we discuss earlier of course is not a common project. The need for extensive research in many dimension of the whole problem is required. But in this section we will try to state a number of research findings that seem to have an essential role in the architecture of the system.

E-School, our e-learning paradigm for national development, proves that information society is a critical success factor for the effectiveness of the school of tomorrow. From a technological perspective e-school uses leading edge technologies (web based training, teleconferencing, web databases, Internet programming, multimedia authoring tools) to set a complete Internet solution. The

diversification of the potential components of e-School, and their flexibility to create customized learning procedures that deliver value to its users.

Furthermore the specific development characteristics of E-School do not intend to substitute the traditional school with a complete virtual learning environment. The scope is to analyze the requirements of this school and from social perspective as well as from evolutionary psychology and to justify the use of information technology. To be more concrete e-school:

- Expands the learning capabilities of traditional school
- Enables excluded people to participate in learning
- Allows the implementation of flexible knowledge construction
- Secures the openness of the school of tomorrow to the society
- Establishes synchronous and asynchronous modes of communication for students, teachers, experts, government establishments, universities and other bodies that influence the school field.

The overall proposition of e-School is the total Internet solution that combines three levels of analysis:

- Learning Intranet,
- Learning Extranet and
- Learning Internet.

The first level is the internal web of capabilities that e-school has to utilise in order to support all of its users but especially those that are dominant in the traditional school e.g. student, teachers. The flexible IS technology is for e-School a critical issue. For this reason on this level too much attention is paid on customisation techniques that secure that e-School content is customised and reformed in templates due to user needs.

The second level expands the communication capabilities of the e-School. It brings together experts, associations and universities with the school community. Using technologies as teleconferencing the e-School gains flexibility and communication capabilities that can not be realized in the traditional school. The learning Extranet is mainly responsible for the adoption of distance seminars, teachers training and virtual web based seminars.

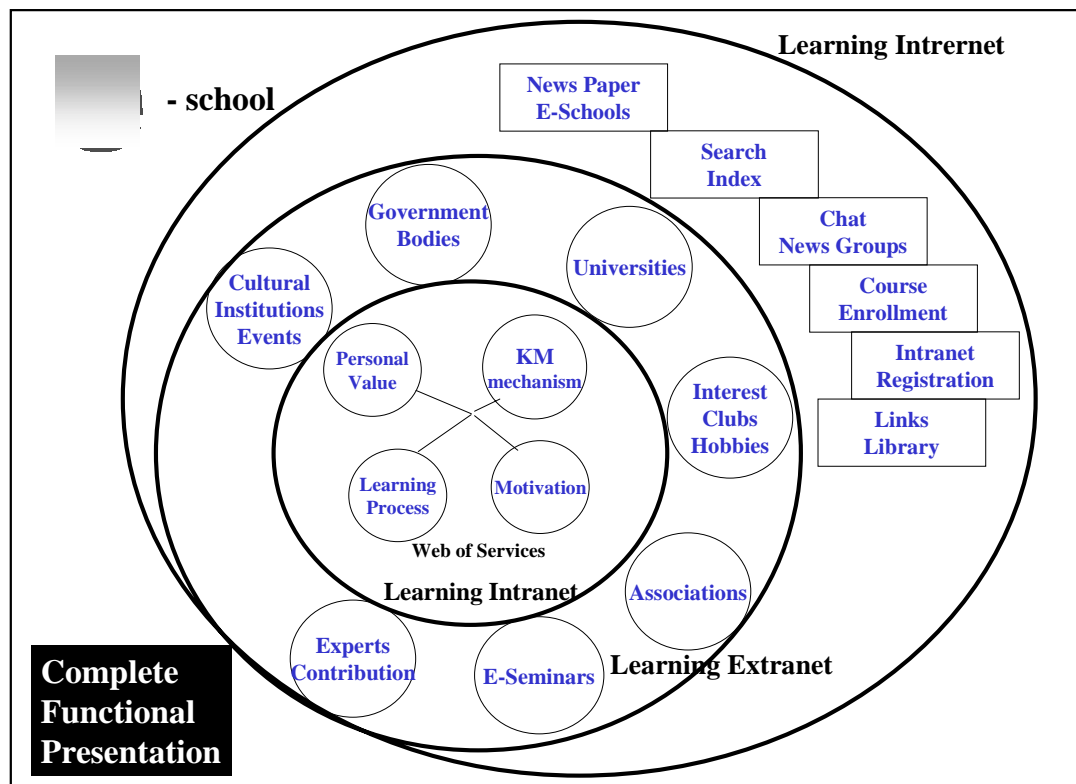
Finally on the third level of analysis the e-School is opened wider to the society. The resources on this level are available to everybody that has access on the Internet and all the facilities are facilitated through an integrated learning “portal”. Technological capabilities such search engines, indexing, chat, newsgroups, encyclopaedias are created with a problem solving orientation and team skills development.

The school of tomorrow must be open, flexible, capable, dynamic, and in this context the information technology provides personal value, Knowledge Management mechanisms, learning processes, dynamic linking of educational scenes, templates building, role playing in a systematic way. For the fulfilment of the pursuing objectives, the e-school needs firstly to create by the support of informational technology an internal core of knowledge management mechanism in a way that secures the personal value for its users, and secondly a wider web that can be accessed by each involved. In other words, the e-school consists of two distinct technological structures:

In general e-school derives its flexibility from three different but interconnected facilities:

- The **Learning Intranet**, which is a sophisticated system of KM mechanism, student profiling, motivation subsystem and learning processes management, the access of which is limited to students and teachers at the operational phase. Access is given through a system of registration and levels of security.

- The **Learning Extranet** with special technologies as teleconferencing and web based training through which the e-school opens to the society bodies. Via this subsystem the core knowledge of e-school can be accessed and multiplied with contributions from bodies that have specific interests in the schools matters.
- The **Learning Internet**, a wider subsystem that can be accessed potentially by citizens interested in the learning process and content of e-schools. Functionalities of this level include a sophisticated search index with categorized links for scientific fields and support material. The creation of such an index will be based on a specific evaluation methodology of the scientific value of web sites that refer to links. Additionally there is special interest for the establishment of asynchronous mechanisms of communication through chat rooms and newsgroups. Moreover the web of schools that have access to e-school technological infrastructure can publish information on a virtual newspaper. Through this level access is allowed to the learning Intranet and Learning Extranet.



Conclusions

The e-learning paradigm that presented in this paper will formulate a EUMEDIS proposal for the forthcoming submissions of proposals in January 2001. In the current stage our research effort is concentrated on the specification of the technological requirements. All learning processes involved are analyzed and very soon there will be a concrete description and in terms of technological requirements. Additionally ORACLE 8I is tested as a development platform for the components of the internal circuit of e-School in combination with platforms such as Blackboard and WebCT. We are looking forward to have comments on our research and proposals for collaboration in new projects concerning e-learning and knowledge management.

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