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VALUE DIMENSION OF THE E-LEARNING CONCEPT: COMPONENTS AND METRICS

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ABSTRACT

In the last decade e-learning face a tremendous development both in technological and scientific terms. The willingness of modern business units to expand their learning capabilities as well as the increased demand for learning on demand irrelevant of time or place, formulate a challenging environment for e-learning exploitation. This is why many platforms for e-learning were developed promising customized solutions with guaranteed learning performance. Unfortunately in the most of cases the performance of the e-learning solutions was overestimated. Poor learning satisfaction, unclear learning methodologies and indisposition of learners to use e-learning were only a few undesirable results of e-learning implementation. This paper discusses ways that justify e-learning as a value adding process both for learners and teachers. The proposed methodology can be followed in order to develop full functional e-learning solutions.

INTRODUCTION

The e-learning concept can be really treated as a technological advancement with advantages and disadvantages. The ability of the information and communication technologies to realize its various components formulate a wide range of applied informatics. On this continuum of available technologies we have to incorporate intelligence in order to enhance its performance and efficiency.

The common practice to buy an e-learning platform, to adopt content or to buy content and to deliver on 24-hour basis the learning material to various learners has a justification: It provides an easy way to claim your presence on e-learning irrelevant the absence of mechanisms that exploit the value diffusion for the learners and the trainers.

In the context of many European and national funded projects in our Research Unit (eLtrun, www.eltrun.aueb.gr) we had the opportunity to use and to evaluate a number of e-learning integrated solutions such as WebCT, Lotus Learning Space, Blackboard e.t.c. The prons and cons of each could be described in detail but our intention is just to reveal their limitation to support value adding learning processes. The dynamic nature of learning, the different learners preferences, the customized learning content and the establishment of non sequential learning scenarios seem to be crucial obstacles for the majority of e-learning platforms. From this point of view we understand that e-learning is not an effective solution nor either a motivational driver, when we don't capitalize on its value dimension.

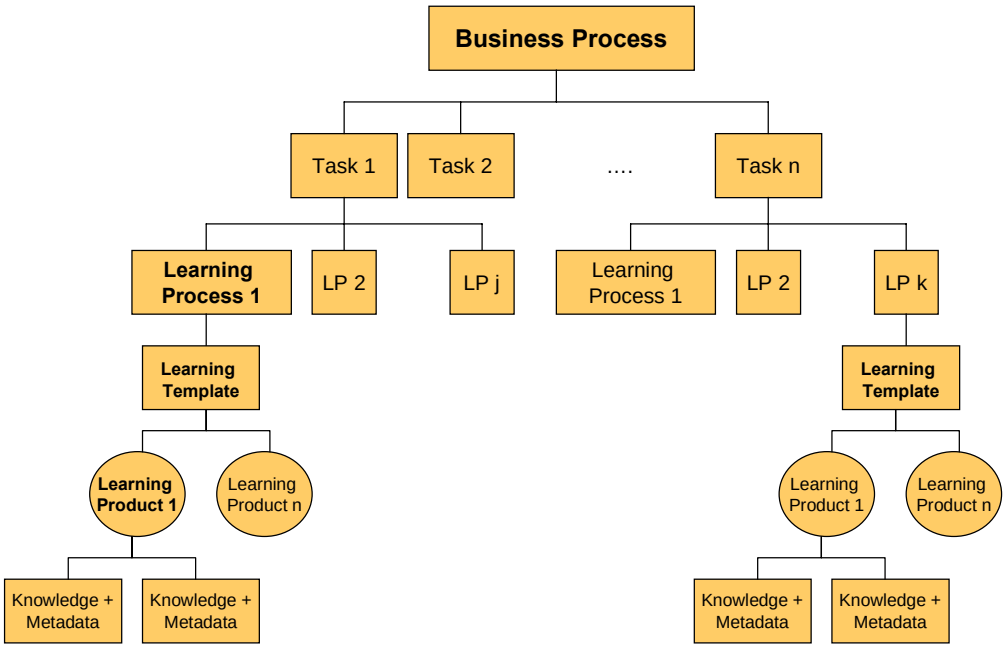
In general we can state that a number of variables define the potential performance of an e-learning environment. All these variables can be categorized in specific components that constitute the product of e-learning: Needs, Knowledge, Motivation, Problem Solving, Team Synergy and Packaging define the six parameters of any e-learning platform. The crucial research question that arises is whether we have ever imagine what value deliver:

- The examination of learners needs,
- The discovery and the construction of the required knowledge,
- The enhancement of motivation on an e-learning environment
- The ability of learning scenarios to solve specific problems that learners face
- The establishment of team synergy and collaboration mechanisms and
- The packaging, the right mixes of the relevant components, for the support of any specific learning situation.

Figure 1. : The concept of educational product.
A value delivering learning object

This learner-centric approach implies a very demanding information system capable to support the different e-learning product components. The analysis of this information system could support a flexible and dynamic knowledge management system that would be the basis of every e-learning system. It is also very interesting to analyze the extensive efforts of the teachers or the knowledge providers of such a system. The various components of the knowledge management mechanism have to be customized from the knowledge providers.

The cornerstone in our analysis is that every e-learning system irrelevant if it is present on a business environment or on academic institutions has to concentrate on business process training. Its process can be break down in several tasks, which represent a meaningful whole. The training for the accomplishment of each task requires the employment of specific learning processes. For each learning process a learning template provides the layout where various learning products or learning objects can be accessed in parallel with a number of



knowledge management mechanisms. The Figure 2 summarizes the logic of the e-learning knowledge management approach.

FIGURE 2: THE CONCEPTUAL TAXONOMY

THE MULTIDIMENSIONAL DYNAMIC E-LEARNING MODEL (MDL CUBE)

Our approach is setting or is currently researching the ability of a three-dimensional model to expand the traditional considerations for e-learning. The **Multidimensional Dynamic e-Learning (MDL) Model** is based on three complementary dimensions:

- The Knowledge Management dimension
- The e-Learning dimension
- The application integration dimension

Each of these describe in synopsis detailed considerations that confront the e-learning platforms such as knowledge management systems with embedded e-learning pedagogy and capacity of dynamic integration with other crucial business applications. To be more specific we will use three explanations for the three dimensions of MDL model.

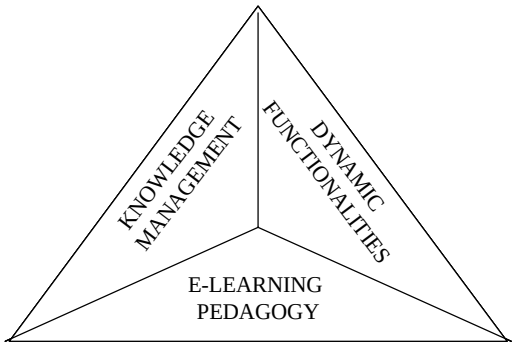


FIGURE 3: THE THREE DIMENSION OF VALUE ADDING E-LEARNING

The **Knowledge Management Sophistication** summarizes the ability of the e-learning platform to manage learning content in various formats, to re-use learning modules and to support knowledge management processes such as knowledge creation, knowledge codification, knowledge transformation and knowledge diffusion.

The **E–Learning Dimension** stands for the ability of an e-learning system to construct effective learning mechanisms and learning processes that support the achievement of different educational goals. With no doubt this dimension incorporates issues like learning styles, learning needs, learning templates as well as learning specification settings.

The **Application Integration Dimension** summarizes for the e-learning platforms the capacity of collaboration with other business applications in order to obtain learning content from real business operations. This dimension seems to be the less detected on the common e-learning platforms and this causes a number of gaps for the effective implementation of e-learning systems. The critical issue of insufficient content in many situations is due to the inability of the organizations to establish a knowledge generation mechanism through the operation of information systems that support the most important business processes. Because in general, the e-learning systems in corporate environments can play the role of the most significant intellectual capital exploitation mechanism. With the use of the MDL model every e-learning platform can be positioned somewhere on MDL cube.

More over this analysis with the three coordinates can be analyzed further. First of all by defining the scales for every dimension implying specific value metrics or different modes. This work is really very challenging and the experiences gained from the implementation of the projects can contribute important guidelines. The generic dimensions of the MDL model incorporate various issues that need explanation.

For example the e-learning dimension and the emergence of high and low value learning processes demand a well-justified way of differentiation. Our research work in this field relates with the distinction of various learning processes that suppose to be different in terms of delivered value to the learners. Each learning process has its own learning cycle, a continuum of learning tasks that reveal and exploit the learning content. Currently we have define ten different learning processes that have a different value in terms of learners satisfaction and learning content exploitation: Analysis, Synthesis, Reasoning, Judging, Problem solving, Collaboration, Simulation, Evaluation, Presentation and Relation.

These ten learning processes define a pool of learning processes capable of supporting different learning modes. Accordingly to our research work an e-learning platform must support such a pool in order to provide dynamic ways of constructing the learning scene for every learner.

The availability of these learning processes in the majority of the currently dominated e-learning platforms seems to be inadequate. In most of the cases this learning dimension is misunderstood or expertly missing. The critical question is whether can we gain effectiveness from an e-learning system if the employed technologies does not support sophisticated learning goal hierarchies?

The Knowledge Management Sophistication Dimension of MDL model is also critical. The majority of e-learning platforms do not support mechanisms that would enhance the re-usability of learning content. The enormous efforts that have to be paid in order to redesign learning content or to adopt traditional content for e-learning purposes burdens the effectiveness of these tools.

Our model, claims that the KM sophistication dimension is exploited enough when there are established knowledge processes that manipulate dynamic content. The re-usability of content and the support of high value learning processes presuppose the presence of an advanced KM subsystem capable to categorize, to enrich and to integrate various learning objects. Consequently the enrichment of learning content with various metadata is necessary for the application of dynamic learning. Very few learning platforms can nowadays provide metadata to the learning content and when this is applicable there is no a mechanism that allows the data mining of relevant learning objects from the learning warehouse system that manages the learning content.

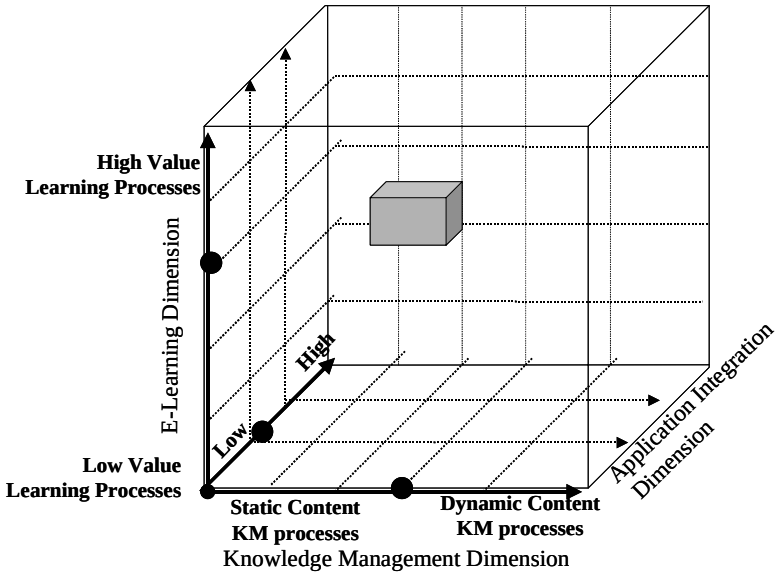
Finally the **Application Integration Dimension** is also very critical. The micro cell of any e-learning system has to be enriched very frequently with new learning content. In business environment this requirement is forced from the demanding business need for immediate and valid knowledge utilization. The current situation is very disappointing concerning the realization of the integration between e-learning systems and vital business applications. The development of learning content for business specific processes demands a whole development cycle with unclear quality standards. Many e-learning experts provide their expertise in order to develop the required learning material. But lets think about a module on an e-learning system that would be able to run together in background of business applications and to capture critical events from learning perspective. For example a screen-shoot, an important report, a table, and other business specific elements with more or less value for the achievement of the various business processes.

MDL CUBE PRESENTATION

The Multidimensional Dynamic e-Learning Model provides an analytical tool that can be used in order to position every e-learning system. The three dimensions of the model imply different degrees of delivered value. So from this point of view the MDL cube represents the whole e-learning utilization value. Potentially our exemplar for e-learning in business or academic environment delivers the maximum value when all the dimensions are satisfied to the maximum allowed scale.

The specific position for every e-learning platform has to be justified very clearly. Our research effort in this stage is concentrated on the limitation and the specification of the scale on every dimension. The establishment of such a system will allow the specification of e-learning modes. For example the three coordinates for every valid position on this cube will imply specific technological capabilities as well as learning scenarios. The selection of each mode and its implementation will of course require different levels of budget and effort. The most advanced e-learning systems positioned on the upper right corner of the cube will realize full e-learning solutions in terms of integration, knowledge management capabilities and effective learning.

Of course the most advanced e-learning cubes need advanced capabilities of information processing.



COMPONENTS JUSTIFICATION OF THE VALUE ADDING E-LEARNING SYSTEM

The analysis of the value dimension of e-learning is not an easy task. For several reasons we often shift the focus of the analysis on specific technological components that facilitate the realization of e-learning solutions. Thus many researchers promote taxonomies of e-learning systems according to their functionalities for learners and teachers.

Our approach is different: The realization that the majority of the web based training solutions lacks in terms of their ability to support different educational goals initiated our research for the value dimension of e-learning.

Our research work is based on a number of hypotheses or theoretical foundations that jointly formulate our scientific context of analysis:

H1: Every e-learning system delivers value to the trainers as well as to the teachers. If this hypothesis is true then all the available e-learning tools could be positioned some where on a value grid with different value levels.
H2: The value delivery of e-learning is based on specific value adding components, which in general constitute a kind of a learning product.
H3: The realization of the learning product requires the employment of specific learning processes capable to reveal the components of the various e-learning products.
H4: The value of e-learning is maximized when dynamic characteristics are embedded on e-learning solutions. The definition of these dynamic characteristics is of high priority for our research efforts.
H4: The value exploitation of e-learning products is directly related to specific metadata capable to support an integrated metadata management mechanism.

H5: The value dimension of e-learning is related directly to the knowledge management capabilities of the employed e-learning system.
H6: The value delivery of e-learning systems is related directly to its capability to cooperate effectively with the critical business information systems within an organization.

The above hypotheses can be presented graphically, in order to have an overall view of our recommendations. The main issue is the understanding that e-learning courses preparation needs a multidisciplinary contribution in terms or functionalities, pedagogy and knowledge management processes. The overall objective of our approach is to justify scientifically the value adding components of an e-learning mechanism that could support the knowledge exploitation within a business organization or an academic setting. This knowledge management approach to e-learning expands further the traditional approach of static content on e-learning environments and investigates ways that support dynamic value adding processes for e-learning systems.

Issues such as reusability of learning objects, dynamic (re) construction of learning modules, utilization of learning templates, and reinforcement of the capacities for effective actions through the usage of the e-learning system are of critical importance and represent crucial milestones in our research approach.

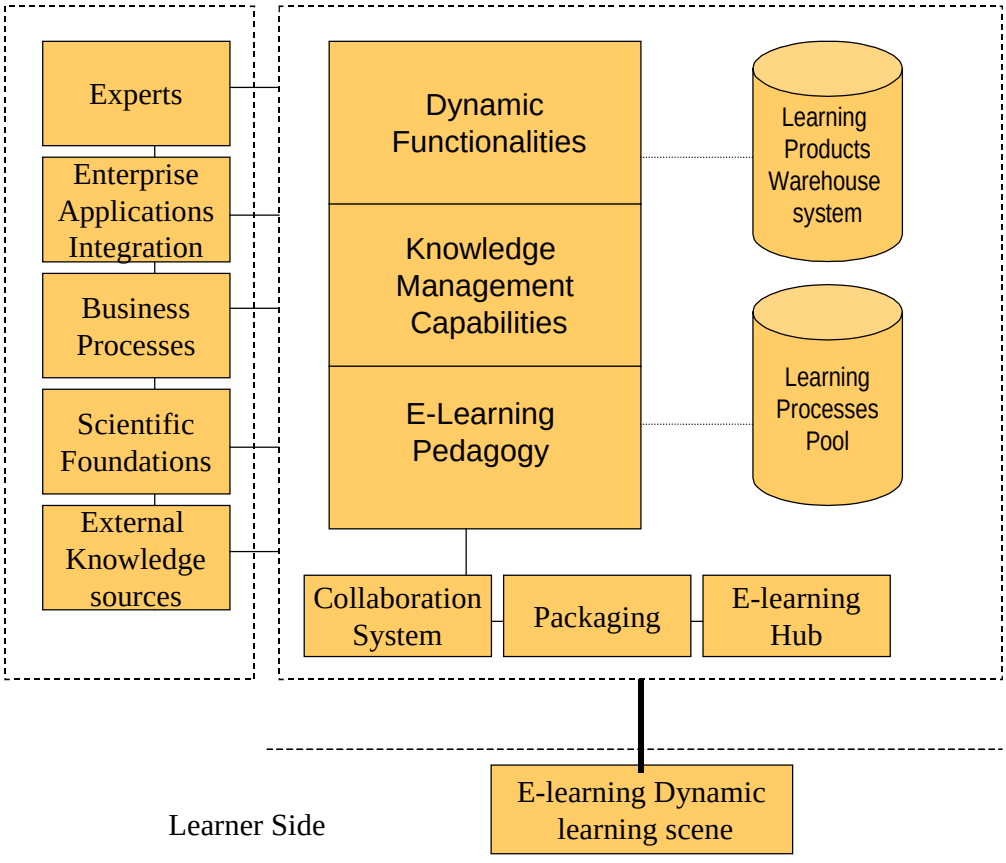


FIGURE 4: THE GENERIC ARCHITECTURE OF THE VALUE ADDING E-LEARNING KNOWLEDGE MANAGEMENT SYSTEM

Lets consider the generic architecture, which is presenting in figure 4. The whole system is utilizing the knowledge management of a number of knowledge elements that have specific knowledge sources. For example business processes are the most important knowledge sources in business settings. Thus the analysis of the business processes and the categorization of the required knowledge for their execution would promote a knowledge delivery to the whole e-learning system.

Other knowledge sources for such a system include experts in specific fields, e.g. consultants, external knowledge sources, e.g. business extranets, and finally other critical Enterprise Applications. The Enterprise Application Integration dimension of an e-learning knowledge management system is really very interesting. In most of the cases the business processes are implemented through a number of information systems that use and provide data, such as reports, documents, graphs, etc. From this point of view a very interesting e-learning corporate portal would facilitate the knowledge diffusion of enterprise critical resources for new employees training and organizational learning support.

All the knowledge sources provide raw data to the whole system. Their utilization and their transformation to reusable formats needs further analysis. The main block of the recommended value adding system adds new information to these data (metadata) and manages a data warehousing systems with specific data marts. The dynamic manipulation of the whole system from the learner's perspective customizes the educational scene of the system. In general this scene provides access to learning cases, which are constructed dynamically from the learning products warehouse system.

KNOWLEDGE MANAGEMENT CAPABILITIES

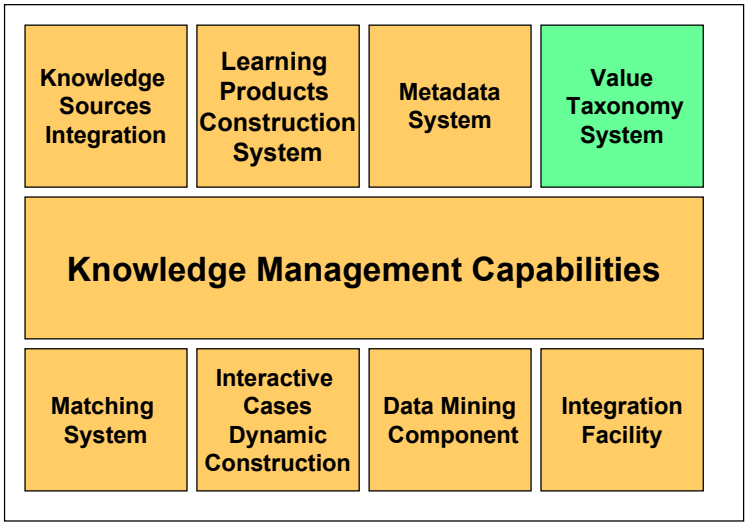


FIGURE 5: THE KNOWLEDGE MANAGEMENT CAPABILITIES

The Knowledge Management Capabilities of the value adding e-learning system formulate the core cell of the advanced system. The integration of the presented modules secures the value adding manipulation of the learning objects and their transformation to reusable formats. Lets consider in summary the main functionality of each components:

The **Knowledge Sources Integration** provides all the communication mechanisms that establish the required data flows to the system. A major challenge for the accomplishment of the scope of this module is the integration with critical business processes information systems. For example the data mining from the business intranet or a screen capture facility available to all business systems that would provide raw data to the knowledge management system constitute value drivers. All these raw data have to be enriched with a number of metadata that will support their consequent dynamic manipulation and their integration to interactive case studies.

The **Learning Products Construction System**, and the **Interactive Cases Dynamic Construction Subsystem**, provide a dynamic space where various knowledge elements (reports, html templates, text files, image maps, links, urls etc) are combined in order to formulate a meaningful case study. Both of the systems utilize the operation of the data warehouses.

The **Value Taxonomy System** is an advanced mechanism that calculates for each learning product or for each case the embodied value. The main data for its utilization are derived from the e-learning pedagogy module, where the learning processes that can manipulate each learning object provide a first measure for value delivery. In most of the cases we have seen e-learning implementation where the only available facility is the sequential browsing of static learning modules usually written in html, or PowerPoint presentations with static content. In the next section we will provide more information according

The **Matching system** is also an advanced mechanism, which is used in order to specify the required learning processes for a specific business case. Lets consider that the e-learning knowledge management system supports the process of e-commerce applications development. This general learning objective refers to a specific business process. This business process can be break down in several tasks, which have to be supported through an e-learning and knowledge management mechanism. Each business task has a different degree of difficulty for its effective execution. From this perspective the routine type of required work or the knowledge intensiveness for the accomplishment of each task demand different learning approaches.

Thus the learning products that would facilitate the understanding of each task would vary in specific dimensions. This gap in research has to be analyzed further. The implied connections of specific business tasks to learning processes that support different educational goals are of critical importance. The majority of e-learning platforms do not pay attention to this obvious relation.

THE E-LEARNING PEDAGOGY

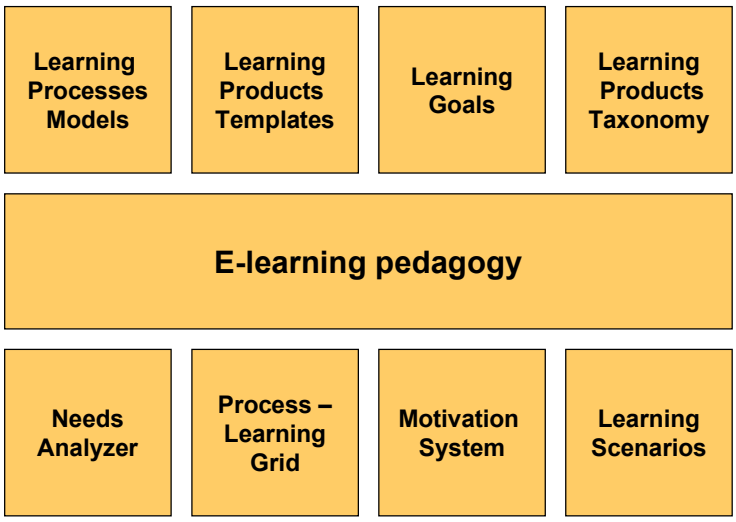


FIGURE 6: THE E-LEARNING PEDAGOGY COMPONENTS

The third internal component of the system includes the e-learning pedagogy. Our extensive bibliography research and the analysis of educational goals have formulated a new context for educational goals. The distinction of well-defined learning processes provides constructional variables for the customization of the e-learning dynamic learning scene. More over the analysis of each learning process is very critical since their detailed logic diagram specifies the required technological components. From this perspective the knowledge sources that refer to business processes have to relate to specific learning processes. In other words every business process has to break down in several learning processes that jointly formulate the learning scenario. In technological terms this would require a drag and drop facility capable to provide very fast the learning scenario for the e-learning scene. Lets see in more detail the analysis of the components of the e-learning pedagogy subsystem:

The **Learning Processes Models system** is a well defined capability that interoperates with the learning processes pull, and gives the opportunity to the designer of the whole system to

combine different learning processes and to construct the dynamic e-learning scene. This facility is of critical importance for the whole system since the learning processes represent different value levels. The well-known Bloom's Taxonomy of educational goals has been researched and we decide to revise the initial proposition to ten different learning process. Each of them supports a number of facilities and predetermined learning scenarios.

The **Learning Products Templates** stand for the ability of the whole system to develop learning content according to learning templates. These learning templates are integrated with the learning processes so that each learning processes corresponds a number of learning templates. In general the learning templates represent layouts and specific forms for dynamic html pages development.

The **Learning Goals Subsystem** is an explanation system that in general supports the development of the learning products and the customization of the educational scene. The main objective of the system is to provide help assistance mechanism capable to provide step by step and background support.

The **Learning Products Taxonomy** is used in order to specify for each learning product a corresponding position in a value grid, which represents for each product the embodied value.

The **Needs Analyzer** is an advanced facility, which can be used in order to determine for each user of the whole system the appropriate learning products for the knowledge exploitation as well as the recommendation of a dynamic mixture of learning processes that constitute its dynamic learning scene. In the most advanced evolution of this system the whole facility will be substituted by a well functioning expert system.

The **Process to Learning Processes Grid** is a facility, which controls the matchning system of the knowledge management component in order to define the appropriate learning scenarios for the business process training.

PAPER CONCLUSION

The MDL model approach sets a method for the evaluation of any e-learning platform. Of course the presentation of the method on this paper was limited due to the length limitation. The whole approach of MDL cube MODEL is supported by a number of accompanying frameworks and theoretical concepts, which in collaboration enhance the scientific justification.

The development of a system that will realize the upper right layers of the cube is currently our research priority. Of course the required modules need extensive justification and creative work. We believe than in one's year time we will be able to launch international an integrated e-learning knowledge management system with the characteristics that we mentioned on this paper. The refinement of our approach is a continuing process and will be supported by a number of new projects that we are going to propose in Greek and European Commission programs. We are looking forward in collaboration, as we understand that this ambitious e-learning system has to be based on teamwork covering a wide range of multidisciplinary contributions.

THE PRESENTATION INFORMATION

The PowerPoint presentation file will be available for the D2001 attendees the next day of the conference at the following URL: http://www.heltrun.aueb.gr

CONTACT INFORMATION

Our research unit ELTRUN is interesting in collaboration with other research units, universities, distance learning organizations and technology providers for participation in projects (IST, Leonardo Da Vinci, Socrates etc).

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