Employing Innovative Learning Strategies using an eLearning Platform

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Abstract: Web-based learning environments have become an integral part of learning. The way that they are employed in the learning process, or in other words the learning strategy followed in that respect, is an important issue that has to be carefully thought of, deciding upon topics such as suitable pedagogical approaches and appropriate assessment techniques for a given context. The chapter deals with this exact issue by visiting the relevant literature on the subject, describing selected learning strategies that have been employed in the use of an innovative eLearning platform in schools in Europe and finally outlining and comparing two real case studies from two European countries.

Keyword: pedagogical strategies, assessment techniques, learning scenario, eLearning, pedagogical framework, case study

Introduction

Informal learning today becomes the dominant form of learning (Tuomi, 2007). Peer-to-peer and problem-based learning in real-world contexts as well as learning through games and entertainment is becoming more and more popular. At the same time, eLearning systems are still being frequently used for teaching (transmissive learning), but noticeably less for autonomous learning, reflection, social and communication skills development, problem solving capacities (expansive learning) and alike (Ulf, 2007). To overcome this, every attempt to design an eLearning experience should begin with the pedagogical strategies that drive it and continue with setting the learning goals and designing learning activities that require the appropriate eLearning content to meet those learning goals, *cf.* (Kelly *et al.*, 2005). The selection of technologies has to be performed then within the context of these pedagogical choices so as to understand both the potential of learning and the development of successful eLearning resources.

Learning often seems to be a natural process; however, the many definitions of and theories on learning confirm that human learning is a complex activity. Literature concerning learning strategies explores different ways of learning. Learning strategies, as defined by Nisbet and Shucksmith (1986), are seen as the processes that underlie performance on thinking tasks, while Mayer (1988) defines learning strategies as behaviors, manners of a learner that are intended to influence a person's cognitive processes during learning. In line with the latter definition, an implementation of theoretical foundations in praxis is illustrated in the chapter. Concerns about the gap between theory and practice, about what instructional designers have learned and experienced in the workplace as well as the lack of a unifying perspective on human learning have raised the question – how an innovative learning strategy can be employed using a Web-based learning environment. Specifically, our objective is to

indicate how taken "pedagogical decisions" implicate the selection of suitable pedagogical approaches and assessment techniques to be employed in an innovative eLearning platform.

This chapter first presents a literature review of the area of pedagogy in eLearning, focusing on learning theories and the concept of a learning scenario. It later summarizes the several issues/problems one encounters when it comes to employing an eLearning system and implementing a pedagogical framework for eLearning. A proposal solution for overcoming some of these obstacles is presented in detail, supporting it with the results of two real world case studies. Finally, conclusions are drawn and future research trends are identified.

Pedagogy in eLearning

Learning Theories

Teaching and learning activities can be designed and implemented to take principles of learning into account, emphasizing on the fact that learning occurs within certain context and that is active, social as well as reflective (Driscoll, 2002). The spectrum of learning theories consists of a plethora of methodologies and approaches explaining how people learn, with behaviourism, cognitivism and constructivism being well-known categories of these. It is clear that the lack of a unifying theory on human learning gives rise to gaps between the theory and practice of instructional design. Nevertheless, ideas about learning in general fall under two headings – the generic heading of socio-cultural theory, including for example "communities of practice" (Wenger, 1998), and "activity theory" (Engestrom, 1987). Since, from this perspective, the basic unit of analysis is larger than the individual learner (e.g. the "activity system") these theories are able to account for learning in collaborative contexts. The idea of "distributed learning" is important here but it is a term that is not always used consistently. From a socio-cultural point of view learning takes place through the co-construction of meanings, specifically it is distributed across learners (agents/actors). This is a stronger claim than the simple proposition that learning can be distributed, say across a network, in the form of content or other resources. An emphasis on "practice" and "activity" is consistent with constructivist and socio-constructivist theories of learning which place the learner as agent at the heart of the learning process.

Another key idea is that of "situated learning". This is important because it draws attention not only to social context but also to material culture, including technology. A recent and significant development in cognitive science is the emergence of an "embodied-embedded approach", see for example (Wheeler, 2005). Here cognition and, by implication learning, is "outsourced" to the non-neuronal body and the environment, including the social environment. This too is broadly consistent with a socio-cultural approach but, importantly, it also draws attention to the active learner in a material context, where things in the world (texts, artifacts, languages) are not simply tools for learning; they actually do a lot of cognitive work for the learner. Examples of how, hitherto difficult-to-access, concepts and processes are made available to learners through information and communications technology (ICT) are not difficult to find.

Theories about learning such as the ones mentioned above have helped broaden the focus of attention, defining learning in a broad sense as a process that continues from birth to death, in and out of formal environments such as schools. Livingstone (2004), cited in (Taylor and Evans, 2005), defines four categories of learning in terms of the extent to which it is internally or externally structured or initiated, resulting in the matrix depicted in Figure 1.

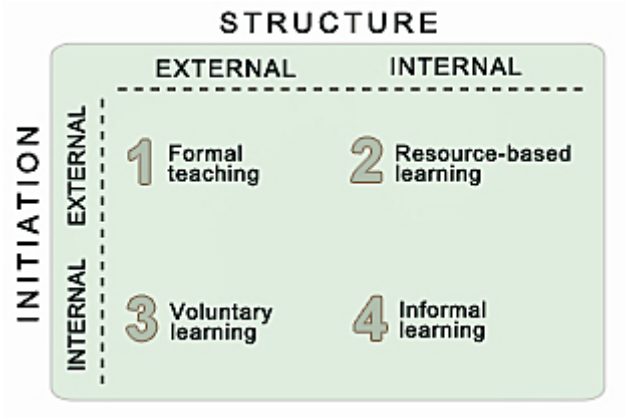

Figure 1. Livingstone's Categories of Learning

In resource-based learning learners are encouraged to access resources (including online resources) independently, managing their own learning but towards goals that are set by the curriculum. An example of the third category would be "voluntary learning" in a school setting where students choose to follow certain courses or participate in extracurricular programs. With respect to the formal/informal learning range, examples of eLearning can be found where the roles of teacher and learner are fluid and therefore difficult to define.

Rather than providing an overview of mLearning technologies addressing the specific curriculum areas, Naismith *et al.* (2004) take up an activity-centered viewpoint, considering new practices against existing theories. More specifically, they identify six theory-based categories of learning activities and related examples of the use of mobile technology in each category. mLearning concepts and technology can be considered within the following learning theories:

a) *behaviourist*: in the course of activities that endorse learning as a change in learners' behavior,
b) *constructivist*: in the course of activities in which learners construct new ideas or concepts based on their previous and current knowledge,
c) *situated*: in the course of activities where learning takes place within an authentic context and culture,
d) *collaborative*: in the course of activities in which learners gain knowledge through social interaction,
e) *informal and lifelong*: in the course of activities that promote learning outside a formal learning environment and curriculum, and
f) *learning and teaching support*: in the course of activities that support the coordination of learners and resources.

The Learning Scenario Concept

Evans and Taylor (2005) define scenarios as "stories focused on a user or group of users, which would provide information on the nature of the users, the goals they want to achieve and the context in which the activities will take place. They are written in ordinary language, and are therefore understandable to various stakeholders, including users. They may also contain different degrees of detail." As described in (UNITE Public Deliverable 1, 2006) a learning scenario should involve all the methods that need to be applied in planned activities within classrooms, the roles of the actors in the learning process (students, teachers, school headmasters and administrators) and the kind of cooperation among different groups (i.e. classroom as whole, small groups of students in the same classroom or in different classrooms). It should be flexible enough so as to be creatively reusable, to allow teacher's intervention and be adaptable to changes according to the number of students and classes to

which is implemented. According to Erskine *et al*. (1997) in scenario-based design the first step is to write down the scenario in a detailed narrative form. Subsequently, claims about the usability and usefulness of particular artifacts envisioned in the scenario are made. These claims are also recorded in a manner that maintains their link to the scenarios they analyze. This process of scenario construction and claims analysis is conducted as an iterative cycle. In the end, the accumulated scenarios and claims constitute the design's description and rationale.

Scenarios support a mutually informing dialogue between technology experts, pedagogues and evaluators (Taylor and Evans, 2005). This is why scenarios call for continuous feedback among them with the view to constantly improving scenarios according to the settled pedagogical objectives, the technical requirements and evaluation offered by all involved agents. Carroll (1999), who also studied the concept of a learning scenario, described it as a sequence of *actions* and *events* that take place in a particular *setting* and are performed by *agents* or *actors* who try to meet certain *goals* or *objectives*.

Important Issues

New skills – technical, intellectual and social – are becoming essential for living, working and participating actively in a knowledge society and while their scope extends well beyond "digital literacy", they are the basis on which the society depends on (European Commission, 2001). The ability to use ICT is essential in many sectors. A European Reference Framework (European Commission, 2005) sets out the eight key competences: Communication in the mother tongue; Communication in the foreign languages; Mathematical competence and basic competences in science and technology; Digital competence; Learning to learn; Interpersonal, intercultural and social competences and civic competence; Entrepreneurship; and Cultural expression. eLearning platforms can contribute to the development of these competences through specialized courses. Competences like "learning to learn" and "interpersonal, intercultural and social competences" can be developed using new approaches of learning and eLearning functionalities that promote collaboration, group work and communication.

Having outlined the importance of acquiring the key competences and the opportunity of using an eLearning system for that purpose, we will introduce several concerns related to employing innovative learning strategies within the context of using an innovative eLearning platform. eLearning requires certain digital literacy skills in order to offer a beneficial learning experience. The question that emerges is the following one: do we need eLearning systems to help to cope with competence challenges or competencies are needed to cope with eLearning systems? Therefore, the tools for eLearning should not necessarily require a high level of digital literacy before a learner can engage in an eLearning activity (Selinger, 2005).

In order to support the improvement of the learners' subject matter knowledge and the implementation of a learning strategy, eLearning environments should be designed to address learners' diversity in terms of learning styles, prior knowledge, culture and self-regulation skills (Vovides, 2007). Individualized learning and reflective learning are two important ingredients that can enhance an eLearning system that supports learning and instruction offering the necessary scaffolds for the development of meta-cognitive and self-regulatory skills. In essence, the scaffolds within an eLearning system need to be adaptive in order to foster student self-regulation in open-ended learning environments, *cf.* (Azevedo, 2005). The roots of the theory behind software scaffolding lie in Vygotsky's (1978) work on the Zone of Proximal Development (ZPD). In this respect, the software would play the role of the knowledgeable peer who provides the learner with adequately challenging activities and

offers the appropriate assistance both in quantity and in quality. As the learner learns that assistance would be gradually withdrawn (Luckin *et al*., 2003).

Another issue is that of compatibility of cognitive styles and technology which directly impact perceptions of learning effectiveness, motivation and performance. When cognitive styles and technology are compatible, individuals are better equipped to pay attention to and understand relevant information, which are important to learning and learning outcomes (Workman, 2004).

Issues related to the design and implementation of a "pedagogical framework" comprise also learners' diversity in terms of meta-cognitive skills, learning styles, prior knowledge and cultures in addition to the role of the instructor in an eLearning platform. One of the effective ways of understanding, describing and evaluating the aspects of the design and implementation of an eLearning system that directly affect learning is Reeves' (1994) scale consisting of the fourteen pedagogical dimensions. The pedagogical dimensions refer to the capabilities of an eLearning system to initiate powerful instructional interactions, monitor learner progress, empower effective teachers, accommodate individual differences or promote cooperative learning. As such, dimensions have the potential to provide improved criteria for understanding and comparing eLearning systems. Reeves' methodology will also be used in the chapter to present the findings and to compare the two case studies described.

Among several other problems that inhibit the implementation of innovation strategies in European learning, Dondi (2006) explains the lack of the culture for support in European education and training systems since innovation plans are implemented at a very slow pace and sometimes even abandoned before their final implementation. Another problem he points out is that of low level of effectiveness and efficiency of the accumulation and utilization of available knowledge in the education field (in comparison to health or transport sector for example). Balacheff (2006) states that the academic research community has the responsibility to develop a research domain that is both scientifically robust and productive. He fears the possibility of "reinventing the wheel and developing technologies that are forgotten soon after their development". Also, he is afraid that research needs are not expressed in the same way by all the European nations (since the needs are not the same either). As we firsthand observed while conducting a "national specifics" survey in 14 European countries (Ćukušić *et al.*, 2007), it is difficult to express these "needs" since the educational systems and context in general vary widely between countries. Therefore a common framework could be developed but some issues surely arise in real-life settings upon implementation.

A different issue is that of a competent eLearning team. The team that produces quality eLearning material in a large, complex eLearning project according to Horton (2001) should consist of about sixteen people: one person should manage the whole project, three people should design the course (lead designer, module designers and subject matter experts), six people should build the content (course integrator, writers, graphics specialists, multimedia developers, html/xml coders and programmers), three members should provide the technical infrastructure (network administrators, server/database programmers and technical support specialists) and three members should conduct eLearning (curriculum administrator, course facilitator and online instructor). Downsizing to fit the needs of simpler projects is possible and of course necessary. The actual makeup of the team depends on size and the scope of the project, amount of work outsourced, specific media and technologies required and a like (*ibid*.). Besides, it is possible that the same required skills can be provided by different combinations of team members. The sustainability of an eLearning platform depends on whether there are more than few people involved in the maintenance of the

system after its implementation: which structures are in place to support students in their eLearning and which structures are in place to support staff in their implementation of eLearning (support to the pedagogical framework).

Varis (2005) poses other important questions that challenge the implementation of learning in virtual environments: approaches to learning, ways to combine traditional and new ways of learning and the like. How do self-directed, facilitated web-based learning, virtual classrooms and discussion formats perform in practice? What is the present stage of development of experiential and interactive learning models? Are teachers and supporting staff equipped with the right knowledge to apply these approaches? Vuorikari (2004) reflects on use of ICT in learning. According to her study's conclusions, ICT is used but teaching is still "traditional". She offers two possible reasons: teachers are just starting to learn how to use ICT in a more constructive way and eLearning systems hardly support the desired change in the learning and teaching paradigm in school. Tools for new ways of collaborative exercises that support learner-centered pedagogy do not exist; therefore it is easier for a teacher to practice "traditional" teaching. In situation changes special focus is put on pedagogical approaches and ways they could be supported by ICT. To introduce an eLearning system in daily practice, teachers' training in the application of pedagogical models using the system should give them a solid starting point. An ongoing pedagogical support could and should be provided to help teachers with the new practice. The foreknowledge of teachers is not equal and many of them have problems getting enough time to apply the techniques within the school curriculum. Personal motivation is of great importance for those teachers.

This section attempted to pinpoint different eLearning realities affecting pedagogy directly or indirectly. Issues that potentially hinder the successful employment of innovative eLearning platforms, as well as the implementation of a pedagogical framework in that context, were described. For achieving effective and efficient eLearning, that offers learners an optimal learning experience, the issues raised above should be dealt with.

Solutions and Recommendations

Designing and using an innovative eLearning platform

Solutions and recommendations to some of the issues presented hereinafter will be based on our firsthand experience from the UNITE (Unified eLearning environment for the school) project. UNITE (2006) is a thirty-month long European research project (February 2006 – July 2008) aiming to provide novel services in education for young Europeans by combining different state-of-the-art (SOTA) technologies in e/mLearning, also taking into consideration innovation in technology and pedagogy. Deployment of UNITE's principles and methods is accomplished through incremental introduction coupled with continuous evaluation. The design and the implementation phase comprised joint work of project partners and partner schools (network of 14 European schools) related to setting up the infrastructure, planning, creation and delivery of new and/or customized learning scenarios as well as validation of performed activities (Ćukušić *et al.*, 2008a).

The UNITE platform is considered an "add-on" to currently used forms of interaction and contributes to developments of interactive learning in the European-wide network of schools (as an illustration see the platform's user interface in Figure 2). It is important to point out that in some participating schools whole-class teaching prevailed before an employment of the new e/mLearning system. Teaching and learning with the UNITE platform implies the use of curriculum material delivered, not only in English, but also in the partners' mother tongue: *eLearning scenario template* along with more than 40 different scenario examples

(UNITE Public Deliverable 5.3, 2008), *Content development handbook* (Tzanavari, 2007) and *Teachers' handbook* conveying the pedagogical principles (Ćukušić *et al.*, 2007).

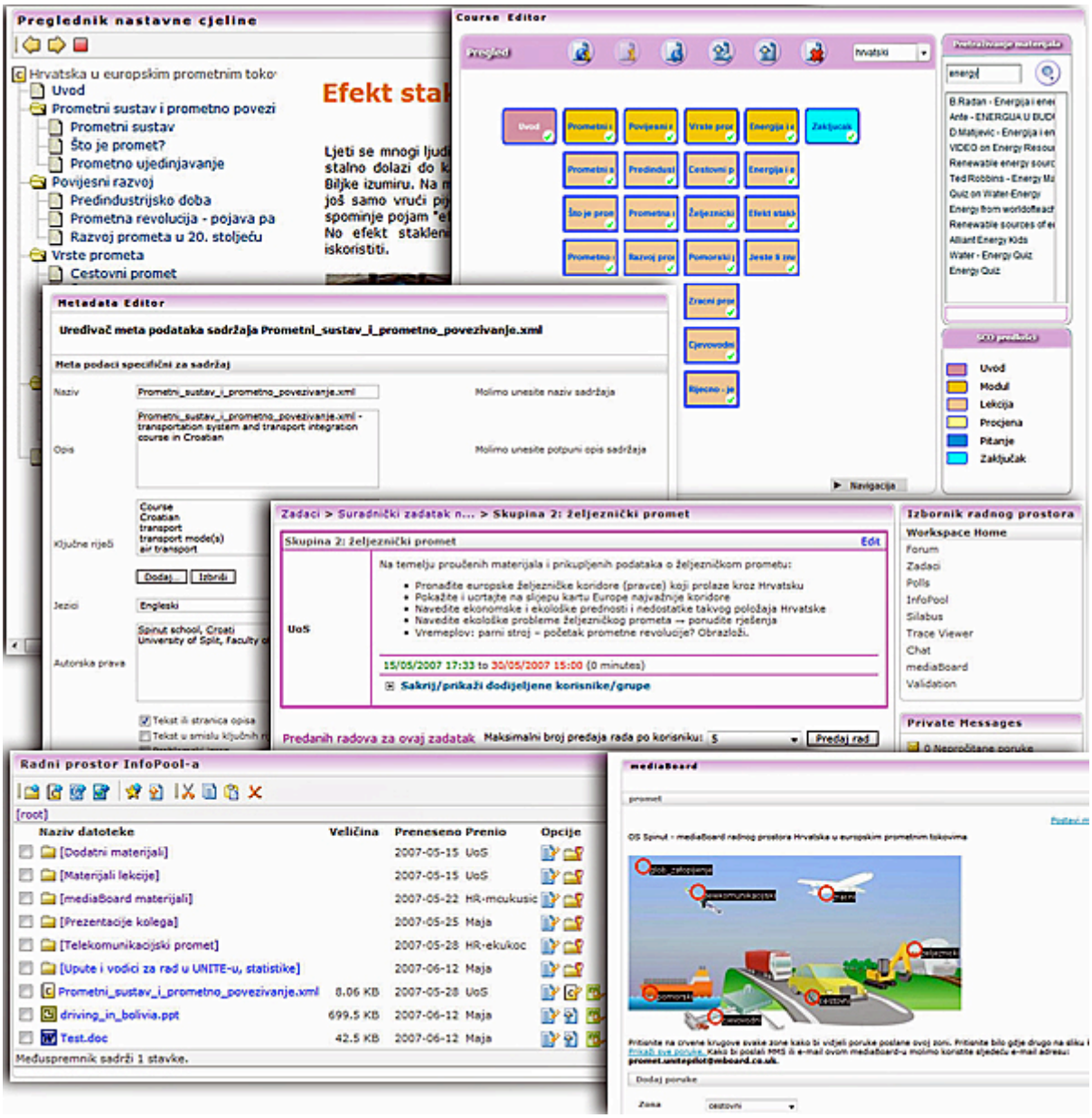

Figure 2. Screenshots of the UNITE Platform's User Interface

While designing the pedagogical framework of the UNITE e/mLearning system, three main aspects were taken into account. First, the existing state-of-the-art models of exploitation of the potential of new technologies in pedagogy along with the list of user requirements related to the pedagogical framework were thoroughly analyzed. Both SOTA models in pedagogy and user requirements are available in (UNITE Public Deliverable 1, 2006). Second, in order to acknowledge local context of the network of schools, national and school specifics regarding educational characteristics and existing pedagogical practices were collected and formulated. Finally, the pedagogical experts analyzed a wider context in order to find out which components should assemble a "best-practice" pedagogical framework (see Figure 3).

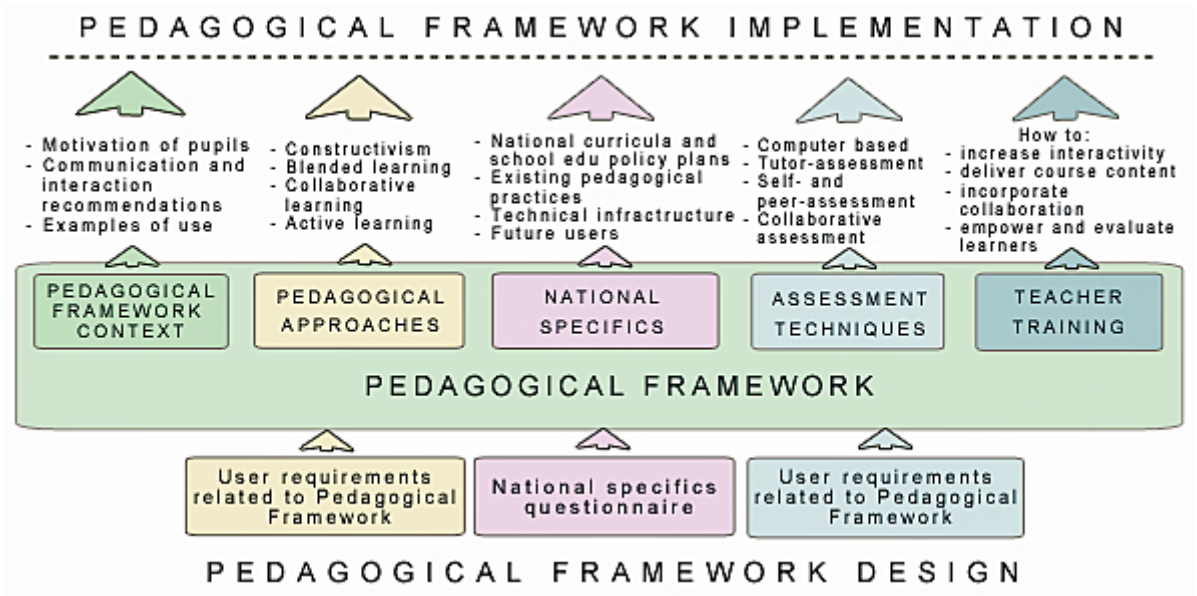

Figure 3. UNITE Pedagogical Framework (Granić & Ćukušić, 2007)

Consequently, the following five-component *pedagogical framework* with suitable and beneficial theories and practices was developed (Granić & Ćukušić, 2007):

a) pedagogical framework context; defines areas that influence the framework itself and forms the basis for further development of UNITE's theories,
b) pedagogical approaches/strategies; promotes principles of constructivist theory, along with blended, collaborative and active learning in particular,
c) knowledge evaluation techniques/strategies; defines and supports diverse types of assessments,
d) teacher training; enables successful online teaching and thus is introduced as an important part of the pedagogical framework and
e) current pedagogical practices and national specifics; implementation of pedagogical changes in the schools already has and will have impact on pedagogical process, assessments and pedagogical assumptions in general.

Because the pedagogical and assessment strategies directly influence and inform the learning and teaching process, they are the fundamental part of any pedagogical framework. Namely, pedagogical innovation, if any, should be made clear in pedagogy or assessment applied in or out of everyday teaching classroom environment. Selected key pedagogical strategies along with employed assessment strategies are briefly described in subsections which follow the subsequent one related to eLearning scenario templates.

As previously mentioned, the list of user requirements related to the pedagogical framework formed the main point of reference for the first learning strategy design phase. Requirements were classified and categorized using a simple matrix (see Figure 4), as one of many possible ways of categorization. On the one hand, matrix rows are associated with autonomous/directed learning and active/passive learning, while on the other hand its columns are related to individualized/collaborative learning.

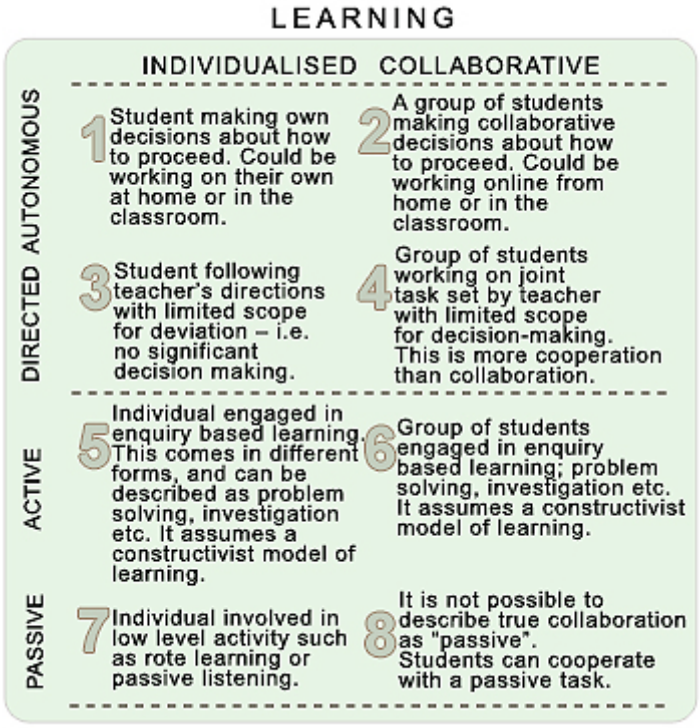

Figure 4. Categorization of User Requirements for the Pedagogical Framework

Learning scenarios are crucial mechanisms for eLearning, holding together pedagogy and technical development through a focus on concrete experience. That is why scenario planning, in which pedagogic and assessment strategies are clearly articulated through detailed descriptions of learning contexts, is very important.

UNITE eLearning Scenario Template

The development process of an eLearning scenario is fundamental because it refers to the codification of the scenario itself, after which it can be implemented in the school environment and potentially or perhaps ideally be reused by others. The quality of this codification, i.e. how well the scenario is described and documented, is directly related to how successful the scenario will be with respect to its reuse by others, its flexibility in implementation and a like (Zoakou *et al.*, 2007).

Within the framework of the UNITE project, an appropriate solution for capturing scenarios was carefully selected based on the state-of-the-art analysis performed. In fact two solutions were identified that qualified as good candidates but would however have to be adapted to the project's particular needs. These were the Kynigos template (Kynigos, 1995) and the JISC template (JISC Template, 2004). The first one follows a narrative format and thus is easier for someone to create, whereas the second is in a structured tabular form with fields to fill-in and so more detailed but also time-consuming. The two of them were studied in relation to UNITE, leading to the creation of a hybrid solution, the *UNITE eLearning scenario template*, which is described in Table 1.

Table 1. UNITE eLearning Scenario Template, adapted from (Zoakou *et al*, 2006)

1. Curriculum area
1.1 Subject/discipline area
1.2 Context/level of study
1.3 Topic/domain
1.4 Pre-requisite skills/ knowledge
1.5 Pedagogical Approach Brief description of the general pedagogical approach that will inform practice in the scenario outline in section 2. It refers to the theoretical underpinning channeling the modes of delivery and the learning activities that will follow e.g. Constructivist approach with particular focus on problem- based learning or experiential learning, etc.
2. Pedagogic Activities
2.1 Learning Activities The learning scenario should be outlined as a sequence of activities (i.e. a narrative) including information about what different actors (e.g. students, teachers) are doing at each stage. The way in which activities address learning objectives i.e. the modes of delivery should be clear, and this should be consistent with the overall approach specified in section 1.
2.2 Learning objectives/ outcome(s) These should be stated in terms of one of the four categories: knowledge (facts), understanding (concepts), skills and attitudes/values. They can be taken directly from prescribed schemes of work where appropriate.
2.3 Tools/ Resources Any physical/virtual tool (hardware, software) or resource (e.g. textbook) can be specified here. E-/M-learning resources in particular should be described in some detail
2.4 Assessment Strategy (Feedback and/or Evidence) With an emphasis on formative assessment key activities should be selected. Assessment strategies might include peer-commentary, the use of e-portfolios, self generated success criteria, photographic records
2.5 Time allocated

The scenario template was polished and revised, primarily based on the UNITE pedagogical framework, before its final version was developed. The template aims to help teachers organize their eLearning lesson in the most efficient way and have an overall view of the steps they are going to follow. Consequently, it consists of two parts. The first one is related to the curriculum area (see section 1 in Table 1) and the second one is related to the pedagogical activities planned to take place during the scenario implementation (see section 2 in Table 1); each pedagogical activity is matched with a learning objective, the tools/resources the teacher plans to use, how he/she is going to evaluate each learning activity and how long it is going to last..

Pedagogical strategies

The principles and praxis integrated into eLearning scenarios through the pedagogical framework were addressed in the *Teachers' Handbook* (Ćukušić *et al.*, 2007) and are presented below.

1) Constructivism

Constructivism (Alessi & Trollip, 2001) conveys the concept of student as the creator of knowledge and meaning through their interaction with one another, their environment and

with teachers. Teachers can be thought of as being coaches, facilitators or even partners with learners in the learning process. Formalization of the theory of constructivism is commonly credited to Piaget who suggested that through processes of accommodation and assimilation, individuals construct new knowledge from their experiences (for more details see Piaget, 1953). The cognitive or radical constructivism is believed to arise largely from Piaget's work while the social or realist constructivist practice is often held to draw from the work of Vygotsky (Hua Liu & Matthews, 2005). The constructivist approach to teaching and learning forms the theoretical basis upon which the pedagogical model presented here is designed. It was/will be implemented in various educational contexts in diverse ways (hands-on learning, reflection, interaction, investigation and analysis, *cf.* e.g. (Gray, 2001; Ullrich, 2005)) requiring from teachers to design instruction correspondingly. This emphasizes the fact that in constructivist classroom teacher and student share responsibility and decision making as well as demonstrate mutual respect.

2) Blended learning

Teachers used and will use eLearning systems as a technological enhancement to their everyday teaching process. They use the best of both traditional, specifically face-to-face, and online communication according to the principles of blended (hybrid) learning. It has been argued that up to 80% of verbal exchange in the classroom is attributed to the teacher (Grogan, 2006). Conversely, in eLearning courses teachers do not "speak" more than their students (Marcelo, 2006) suggesting that learners, who are too shy to contribute in the classroom, feel more empowered to do so online (Jonassen, 1996). Therefore, blended learning seems as an ideal teaching concept for the future and its employment in UNITE affects and empowers students to considerably contribute online as well.

3) Collaborative learning

Collaborative learning (Prince, 2004) is a term used for a variety of educational approaches involving joint intellectual effort by students or students and teachers together. It covers a number of approaches with variability in the amount of in-class or out-of-class time built around groups of students working and mutually searching for understanding, solutions and/or meanings. Some forms of collaborative problem solving include: (i) guided design as a very structured approach to group problem solving where students, working in small groups, practice decision-making in sequenced tasks, with detailed feedback at every step, (ii) cases, stories or real life situations setting up a problem for students to analyze and resolve in class or in study group session and (iii) peer writing involving students working in small groups at every stage of the writing process, formulating ideas, clarifying their positions, testing an argument or focusing a thesis statement (*ibid*.). One of the key notions in Vygotsky's approach to cognitive development is the Zone of Proximal Development (ZPD), which has significant implications for peer collaboration. Vygotsky (1978, p. 86) defines the ZPD as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers". In other words, learners who lack certain skills may learn more effectively in the social context provided by someone with the necessary knowledge (Eysenck & Flanagan, 2001).

4) Active learning

Active learning is defined as "any instructional method that engages students in the learning process" (Prince, 2004). It requires from students to think about what they are doing as opposed to passively receiving information from the teacher in traditional teaching methods. There is evidence of importance and effects of active learning to the quality of learning, innovations in education and alike. Some studies find higher class scores and less variably on items presented via active learning (Yoder & Hochevar, 2005) while others as benefits of

active learning stress valuable contribution to the development of independent learning skills and ability to apply knowledge, preparing students for future careers (Sivan *et al.*, 2000).

UNITE scenarios engage individuals and/or groups in various forms of active learning like problem solving, case studying and enquiry-based learning, which contributes to the development of qualities like critical thinking and problem solving. Through these activities students are able to discover new information and become self-managed learners. Starting from the late 1980s both cognitive scientists and technologists have suggested that learners might understand the phenomena from the science and technology area better if they could build and manipulate the models of these phenomena (Bransford *et al.*, 2000). This assumption is tested frequently in the classrooms with technology-based modeling tools. Of course, electronic devices and systems can enhance learners' performance but only in the case where they are used as a part of a consistent teaching and learning process consisting of suitable pedagogical and assessment approaches.

Assessment strategies

Apart from introducing pedagogical principles and approaches, the pedagogical framework also reinforces the use of summative and particularly formative assessments in teaching and learning. Summative assessment is still the predominant way of evaluation of students' achievements. It is usually used at the end of a teaching unit to determine what has been learned by the student. On the other hand, problem solving, stimulations and project work with formative or on-going evaluation, present a step forward in order to acknowledge that assessment is actually part of the learning process. Formative assessment presents "all the activities undertaken by teachers and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged" (Mödritscher *et al.*, 2006).

How and what is to be assessed depends on the goals and purpose of learning and the types of learning involved. Assessment needs to be embedded in the course design (Laurillard, 2002) to reflect and support the learning processes involved. The assessment of collaborative work is managed whereby individual contributions are recognized on the basis of individual work, with another value to reflect the group effort (Weller, 2002). On the other hand, self-assessment is experienced as promoting autonomy in that the students make their rules and negotiate them with their teachers. Learners are actively involved in decisions about their own criteria for assessment and the process of judging their own and others' work (McConnell, 2000).

There are a number of online assessment techniques (sometimes referred to as "alternative assessments") serving as a tool to support either formative or summative assessment. Tittelboom (2003) introduces Statements of Relevance, Interactive exercises and Peer-assessment of forum activities that support both formative and summative assessment:

- Formative: Pupils are presented with a number of questions which they can ask themselves and prepare Statements of Relevance as an exercise in introspection. These statements are not marked but are read and commented by the tutor. Interactive exercises range from reading reference materials and doing multiple choices, matching, gap-filling etc. and receiving programmed feedback messages after each answer (immediate feedback) or at the end of the exercise (delayed feedback). The students assess themselves (based of the feedback and the score indications they receive). They can also be asked to assess and give constructive comments on the contributions made by their group members using forums.

- Summative: At the end of the course, students have to submit a final Statement of Relevance summarizing the reflections they have recorded throughout the course (assessed by the tutor). The scores earned by the students in interactive exercises are not tracked or retained. The quality of the comments in forums is not directly marked but tutor assessment of the students' activities is incorporated in their final score for the course.

Assessment techniques of the pedagogical framework promoted in UNITE learning scenarios are introduced in the following.

1) Computer-based assessment

Quizzes are one of computer-based assessment techniques that were introduced in UNITE. Those multiple-choice type tests or quiz type questions were assigned: (i) at the beginning of a course for diagnostic purposes to indicate any areas where prerequisite knowledge may be inadequate, (ii) during a course in order to measure progress in understanding and/or (iii) at the end of a course to assist in revision. Several other assessment techniques mentioned above were employed based on the intended learning objectives, kind of competencies to be mediated to students, extent to which the competencies should be mastered by students, reliability in grading, prevention of cheating, exam construction and a like, *cf.* (Mödritscher, 2006).

2) Tutor-assessment

eLearning systems offer students exceptional opportunities for individual communication with their teachers/tutors. Using the platform functionalities and e-mail, teachers were contacted throughout the day and as a result students actually always had a personal tutor available. Since the assessment and the grading were not realized only by computer-based tests, teachers used open-ended questions as well (e.g. writing essays or submitting some project work). In such a case the evaluation process is extremely time-consuming and self-/peer-assessment could ease the teacher's assessment overload.

3) Self-assessment

Student involvement in their own assessment is an important part of their preparation for life and future work. Through self-assessment, which is quite opposite to traditional assessment where written tests and oral exams still prevail, students track their personal development and deepen the learning experience. They take more responsibility for their own learning and also become more aware of their own knowledge gaps (if any), since they assess themselves in relation to the course objectives. Using an eLearning platform students accomplish exercises at their own pace and receive private feedback messages. Moreover, they are actively involved in taking decisions about their own assessment criteria as well as in judging their own and others' work, *cf.* (McConnell, 2006).

4) Peer-assessment

In peer-assessment students are engaged in helping each other to develop, review and assess other's course work. The UNITE system is well suited for peer-assessment because in forums students can easily share and comment on other students work and contributions. Forum discussions are more "relaxed" and can be used for low-stakes testing only. Exchange of ideas, evaluation and comments on the work of their peers makes peer-assessment part of learning process and valuable resource for mutual learning. In order to overcome and avoid comments like "I don't like his/her work", explicit instructions on what and how to assess, what aspects of the work should be taken into account and similar were provided.

Case Studies

The eLearning Scenarios

UNITE has followed a certain procedure in order to implement its theories and practices in schools. UNITE's implementation process advances through four major phases including (i) scenario planning, (ii) scenario implementation, (iii) validation and (iv) platform and process improvement respectively (Ćukušić *et al.,* 2008a).

The Croatia Case

In the Elementary school Spinut (2008), a state school based in Split, a team of five people was formed, consisting of the school's headmaster, the pedagogue and three subject teachers. Support in terms of organizational and technical assistance was provided by the University of Split (UNITE project partner). After implementing two scenarios with older students (13 and 14 year-old), the third scenario approaches younger students also (from 11 to 15 years) and intends to stimulate their interest in science and technology (S&T). Current trends in the EU are showing that innovative experiments on science teaching are proving benefits for education (Buysse, 2007). An elective course entitled *Wonderful World of Inventions* for talented students was therefore developed in order to encourage students' desire to learn and to give a playful dimension to the knowledge acquisition through the new learning scenario. Within its framework and parallel to the activities performed within the school environment, the activities taking place in more informal contexts like field trips, museums, institute laboratories and a like were undertaken.

According to the diverse areas/stages of the course, different pedagogical approaches are implemented. For example there was project work where students were encouraged to take a more active role, that of researchers, and to come up with their own sketches and designs (of a parachute, a plane or similar). Subsequently, students tried-out their designs in practice and actually learned-by-doing. There were elements of exploratory learning, with cooperative learning in groups, along with some couple-work. Students were also taught how to work/learn alone as individuals. The teacher acted mostly as students' mentor and not as a "typical" teacher. Field work, numerous visits and workshops were a great value-add to this scenario and an opportunity for students to learn astrology, robotics and science in general in a real-life environment(s). These new methods make science teaching more exciting.

UNITE is used as a repository of the learning material and problem-based tasks (either provided by the mentor or collected by students as a part of their research assignment) as well as an irreplaceable communication platform. Both synchronous and asynchronous communication and collaboration functionalities of UNITE are important for this scenario since the course is attended by a heterogeneous group of students. They attend their regular courses in different times of day; they go to different classes and the like. Furthermore, mobile learning capabilities, notes, journals and similar functionalities of the UNITE system were of great importance since students were able to track their progress, update their portfolio, reflect, explore and discuss. In this way, every student was provided with the opportunity to express her/himself, to experiment and to learn.

The Cyprus Case

In the English School (2008), a prestigious private secondary school based in the capital Nicosia, the team involved in eLearning scenario design, development and implementation consisted of the Head Teacher, a senior teacher of English, a senior teacher of Environmental Studies and a researcher from the University of Cyprus (UNITE project partner). The scenario topics were chosen by the teachers themselves, taking into account what the platform had to offer. One of the eLearning scenarios developed within the

Environmental Studies subject was entitled *Traffic Survey* and originated from the real problem that students, teachers and parents faced everyday – traffic around and on campus. The students involved in this project were 16-17 years old.

Students were expected to a have good understanding of how modern cities are increasingly dependant on cars leading to all the associated problems. A group of Environmental Studies students carried out a stratified survey of the entire school student population with a 10 to 15% sample. The survey aimed at finding out how students come to school, how long it takes them, how they view the traffic problem on school grounds. The scenario involved activities that took place in the classroom, outdoors (for data collection), in the Geography computer lab and possibly at home.

The students followed an enquiry based approach whereby they set up a hypothesis and tested it. This involved a stage where a clear aim was set, stating what the objective was, designing methods of collecting data, organizing the logistics and the timing of the data collection. What followed was the collaboration of putting together the data collected, analyzing it, presenting it in a visually effective manner and finally assessing the successes and validity of the results.

Both UNITE's learning resource repository and its communication facilities were used as well as its mLearning component, for visualization and classification of images even while the field work is under way.

Comparison of the pedagogical dimensions of the two scenarios

Reeves' (1994) methodology was considered suitable and thus was applied in order to explain how UNITE "enhances the learning experience". Pedagogical dimensions, as aspects of the design and implementation of the system that directly affect learning (see Table 2), have the potential to provide criteria for understanding and comparing scenarios/learning programmes. Consequently, the pedagogical dimensions of the scenarios *Wonderful World of Inventions* and *Traffic Survey* (among others) were qualitatively and graphically compared.

Table 2. Pedagogical Dimensions of Computer Based Education (Reeves, 1994)

Pedagogical dimensions of Computer Based Education			
1. Epistemology	*Objectivism*	◄——►	*Constructivism*
2. Pedagogical philosophy	*Instructivist*	◄——►	*Constructivist*
3. Underlying psychology	*Behavioural*	◄——►	*Cognitive*
4. Goal orientation	*Sharply-focused*	◄——►	*Unfocused*
5. Experiential value	*Abstract*	◄——►	*Concrete*
6. Teacher role	*Didactic*	◄——►	*Facilitative*
7. Program flexibility	*Teacher-Proof*	◄——►	*Easily Modifiable*
8. Value of errors	*Errorless Learning*	◄——►	*Learning from Experience*
9. Motivation	*Extrinsic*	◄——►	*Intrinsic*
10. Accommodation of individual differences	*Non-existent*	◄——►	*Multi-faceted*
11. Learner control	*Non-existent*	◄——►	*Unrestricted*
12. User activity	*Mathemagenic*	◄——►	*Generative*
13. Cooperative learning	*Unsupported*	◄——►	*Integral*
14. Cultural sensitivity	*Non-existent*	◄——►	*Integral*

In February 2008, the project partners with the pedagogical background referred back to the fourteen scenarios and rated their pedagogical dimensions (Ćukušić *et al.*, 2008b). The purpose of the exercise was to provide a qualitative and graphical comparison of the scenarios

and to create a "profile" of the particular scenario. Figure 5 illustrates how the scenarios *Wonderful World of Inventions* and *Traffic Survey* performed on Reeves' scale. In order to have an insight and be able to compare the profiles of selected scenarios, the third one is presented as well. The *Creating Databases* scenario was developed and implemented in the Riga Secondary school No 3, Latvia, within the information and technical science discipline area. A group of pupils of an 11th grade (17 year-olds) developed a school database that could be used in the school library. They learned how to create, plan and modify databases, communicate to each other and work in groups.

Concrete experiences for students, collaborative learning, intrinsic motivation and a generative learning environment are features of all three scenarios. The role of teachers in the scenarios is that of integral facilitators who seeks to meet local and individual needs in the context of a loosely structured programme (*ibid.*). An evaluation of the UNITE scenarios based on Reeves' (1994) pedagogical dimensions revealed that UNITE is based on constructivist and cognitive foundations. The pedagogical dimensions of UNITE are best represented by the Social Sciences and Student Research Project scenarios (two of which are *Traffic Survey* and *Wonderful World of Inventions*) and are least represented by the ICT scenarios (e.g. *Creating Databases*). Understandably, student research projects like the two presented above, promote learning theories which are more inline with UNITE concepts (presented in the Solutions and Recommendations section). The plotted trend-line shows that the *Traffic Survey* and *Wonderful World of Inventions* scenarios go more towards the right side, more towards the constructivist and cognitive foundations, whereas the *Creating Databases* scenario is very concrete and objective. The majority of the activities were based upon predefined content and scenario workflow whereas the majority of the learning objectives were focused on very specific results. Students could choose among two or three alternatives with respect to learning paths.

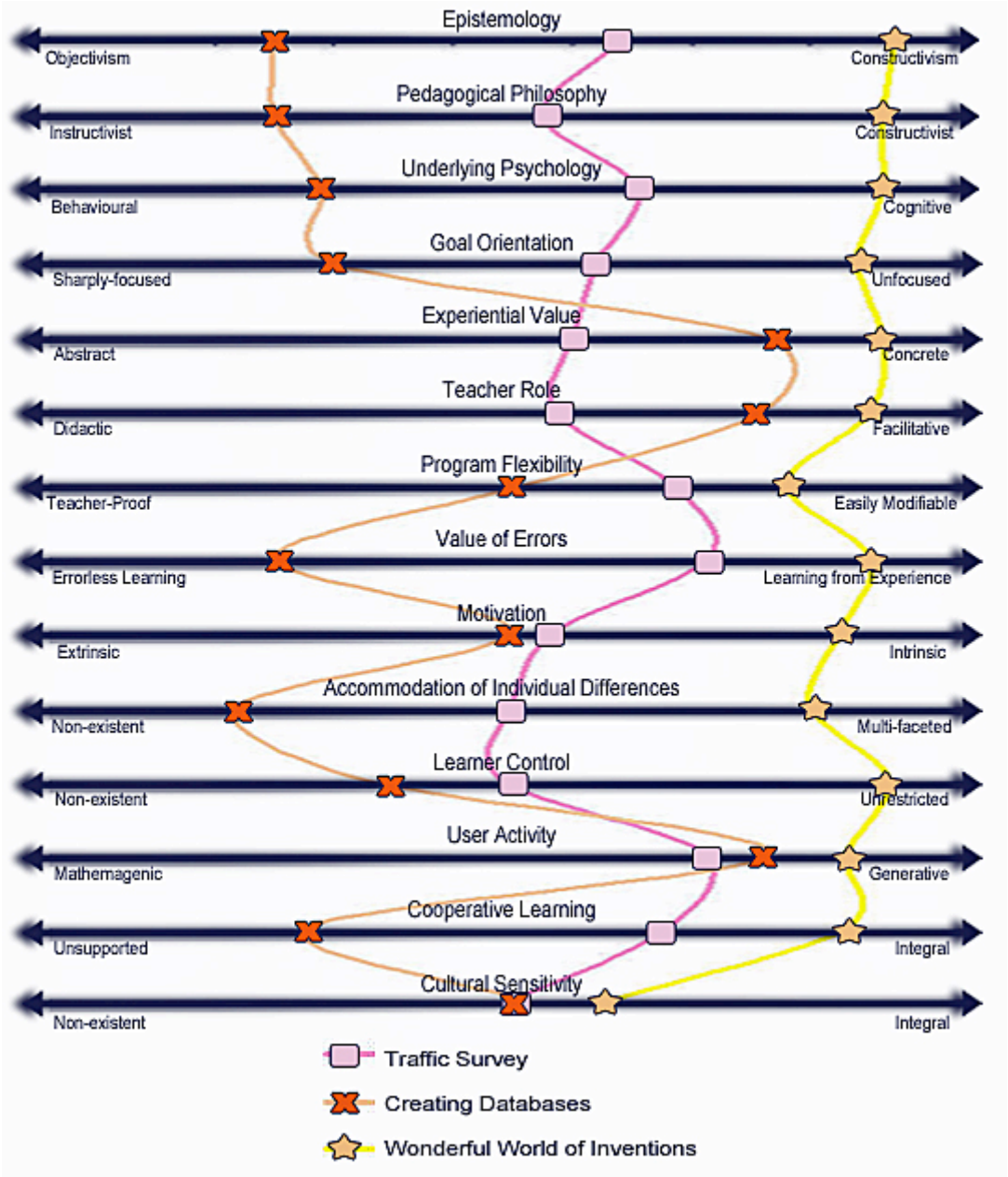

Figure 5. Pedagogical Dimensions of the *Traffic Survey* and *Wonderful World of Inventions* Scenarios Compared to the *Creating Databases* Scenario

Future Trends

In the latest biennial joint report of the European Council and Commission (Joint progress report, 2008), education and training are identified as crucial to economic and social change. At the same time lifelong learning is considered highly important since it supports creativity and innovation, enabling full economic and social participation. Early school leavers, upper secondary attainment and key competences are reported as major problem areas where there has not been enough progress since 2000 to reach the EU benchmarks by 2010 (in some countries performance has even worsened between 2000 and 2006). Many young people leave education without the skills necessary for participation in the knowledge society and employment. According to the same report, at the moment 15,3 % people aged 18 to 24 in

EU-27 leave school with no more than lower secondary education (*ibid.*). Save for the risk of social exclusion, these people are shut out of lifelong learning early in their lives.

Having outlined the importance of institutional and funded support and the necessity of developments in the EU education area, we will present some more favorable facts and trends in the eLearning field. The Education and Training 2010 work programme (European Commision, 2007) does provide practical support for education and training reforms and significant progress has been achieved since the programme was launched in 2002. Technological innovation is expanding the range of possible solutions that can support teaching and learning processes. The technology that is used for eLearning is as ordinary as a telephone and easy to use, in most cases. The technological challenges of the eLearning process (e.g. providing a usable, stable, universally available technological platform) have essentially been met (Rosenberg, 2001). We have presented UNITE, one of many available eLearning platforms which offers a wide range of capabilities, in both technical and methodological sense.

Challenges for the eLearning area are of the non-technological nature. As we move into the future it is important that we continue to identify successful models, learning strategies for eLearning at the institutional, program, course and activity levels that can be adapted to various contexts (Bonk & Graham, 2006). Only then we will understand and get the most out of the technology. Future research efforts within the eLearning domain will therefore be directed towards building adequate learning and assessment strategies that meet the challenges addressed at the beginning of this chapter. The eLearning environments should be designed to focus on learners' diversity in terms of learning styles, prior knowledge, culture and self-regulation skills (Vovides, 2007). Another important research direction is that of adaptation and self-regulation in the intelligent tutoring systems.

Additionally, the compatibility of cognitive styles and technology which directly impact perceptions of learning effectiveness, motivation and performance is important. In this case, learners are better equipped to pay attention to and understand relevant learning material and achieve learning outcomes (Workman, 2004). Bonk, Kim and Zeng (2006) summarize future trends in the eLearning area focusing on the most usual use of the eLearning systems – the blended learning (see Table 3).

Table 3. Trends and Predictions Related to Blended Learning (Bonk, Kim & Zeng, 2006)

Trends and predictions related to blended learning linked to the expansion of the online environments usage
Mobile Blended Learning
Greater Visualization, Individualization, and Hands-on Learning
Self-Determined Blended Learning
Increased Connectedness, Community, and Collaboration
Increased Authenticity and On-Demand Learning
Linking Work and Learning
Changed Calendaring
Blended Learning Course Designations
Changed Instructor Roles
The Emergence of Blended Learning Specialists

As one may notice, there is only one trend from the Table 3 related to the technological side of the learning – the usage of mobile devices for teaching and learning. The use of mobile and handheld devices can and indeed has created rich and exciting learning opportunities. To a greater extent students bring their computing/mobile devices (e.g. pocket PCs, Smart Phones, notebooks, tablet PCs, graphical calculators, electronic dictionaries and a like) into the classrooms. These devices enable students to access the eLearning content everywhere and anytime, in a variety of situations in and out of school settings. This movement can be referred to as *ubiquitous learning* or *uLearning* (Milrad, 2007). Consequently, in order to identify the driving forces behind innovative learning practices, special focus should be placed on three different learning domains: (i) enhancing teaching practice with ubiquitous technologies in teacher education, (ii) collaborative mobile learning games in corporate settings and (iii) people on the move in a disturbed environment (Sharples, 2007). We find that these domains outstandingly underline three very important spheres of future research efforts of the technology-enhanced learning area. For successful "evolution" from eLearning to mLearning models, it is not enough just to take up mobile devices. Implementations of mLearning should primarily take into consideration several "eLearned" lessons (Wagner, 2005). Wagner also points out the necessity of a rich presentation layer that runs efficiently on a variety of platforms and a variety of form factors (*ibid*, p. 52). The major difference between eLearning and mLearning material is the advancement from more text- and graphics-based lessons to more voice-, graphics- and animation-based ones (Cobcroft, 2006).

Besides the trends caused by rapid development of mobile learning devices, eLearning environments also develop fast. They are becoming individualized; foster greater student responsibility and autonomy, furthermore focusing on real world experiences (using scenarios, simulations, role-play, problem-based learning concepts and a like). The role of an instructor also changes to one of a mentor, coach and counselor. In the years to come, there will no longer be a need to use the prefix "e" in eLearning or "m" in mLearning. The convenience and availability of the learning platforms will be as attractive as they are today and the technology will only be one more resource in the teaching and learning process.

Conclusion

This chapter, after visiting the relevant literature on the subject of learning strategies, provided evidence showing the importance of acquiring key competences today and raised some concerns with respect to using eLearning systems for that purpose, which mainly had to do with the appropriate learning and assessment strategies that need to be employed for an optimal learning experience.

Within the framework of a relevant European research project, whose main objective was to provide novel services in education for young Europeans by combining different state-of-the-art technologies in e/mLearning, also taking into consideration innovation in technology and pedagogy, the issue of employment of learning strategies was investigated. An innovative eLearning platform with a great range of functionalities was developed within the course of the project to support these objectives.

Subsequent to carrying out a state-of-the-art analysis, forming a user requirements list and researching into the various parameters that might affect pedagogical decisions, a pedagogical framework consisting of particular learning and assessment strategies was

designed and tested in real settings. The chapter described these strategies in detail presenting their background, benefits and implementation possibilities.

The particular strategies were successfully employed in all learning environments involved in the aforementioned research project. Products resulting from this employment included the design and implementation of forty eLearning scenarios. Two of these scenarios, designed by teachers from two European countries, were presented and compared.

It is important that we continue to identify successful models and learning strategies for eLearning at different levels that can be adapted to various contexts. Addressing learners' diversity in terms of learning styles, prior knowledge, culture, self-regulation, cognitive styles, access to technology and other relevant issues will be the focus of future eLearning research efforts in a world that advances towards mobile learning, visualization, individualization, hands-on learning and similar.

Acknowledgements

This work has been carried out within the project UNITE 026964: Unified eLearning environment for the school, partially supported by the European Community under the Information Society Technologies (IST) priority of the 6th Framework Programme for Research and Development. The research has also been supported within the project 177-0361994-1998 Usability and Adaptivity of Interfaces for Intelligent Authoring Shells funded by the Ministry of Science, Education and Sports of the Republic of Croatia.

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