

Table 1: Schools participating in the UNITE project.

Country	Name of school(s)
Bulgaria	134 Hebrew and English Language School 'Dimcho Debelainov'
	National High School of Mathematics and Science 'Acad. L. Tchakalov'
Cyprus	The English School
Croatia	Elementary School Spinut
Germany	Berüfliche Schule Elektrotechnik / Elektronik
	Erasmus-Gymnasium Rostock
Greece	Ellinogermaniki Agogi School
Latvia	Riga 3. secondary school
Lithuania	Kaunas University of Technology Gymnasium
Malta	Stella Maris College
	Margaret Mortimer, Girls' Junior Lyceum
Slovenia	Gimnazija in ekonomska srednja šola, Trbovlje
United Kingdom	King Edward VI School
	Lynn Grove VA High School

2 ABOUT THE PROJECT

2.1 Project Goal and Objectives

The main goal of the UNITE project is "... to contribute to the improvement of Europe-wide education in secondary schools based on common, innovative principles in technology, pedagogy and in learning scenarios, tested by a well-defined validation framework" (Description of Work, 2005). In order to achieve the main goal, a number of key objectives were set up:

- The *Pedagogical Framework*, designed and implemented in the first phase of the project, should initiate daily use of the platform in classrooms and provide pedagogical concepts for the e-/m-Learning scenarios,
- The *Technical Platform* with its communication and cooperation functionalities should support wide-spread learning along with other learning concepts of the pedagogical framework and
- The *Learning Scenarios* should use the full potential of the platform and developed pedagogical concepts so as to motivate learners and deliver innovation in the classroom.

It is important to note that additional objectives concern the establishment of a *Network of Schools*, development of a Europe-wide repository of *re-usable e-Learning content*, the development of an adequate *validation framework*, detailed *socio-economic evaluation* of UNITE as well as a carefully designed *exploitation plan*.

2.2 Technical Platform

The UNITE platform seamlessly integrates three distinct technologies including their quite diverse functionalities into usable and effective e-/m-Learning environment (Kouloumbis *et al.*, 2006):

- A *eLearning Portal*, supporting the learning process and specifically, group-oriented learning in classes of pupils,
- A *eKnowledge Repository*, containing traditional eLearning material (like assets, pages and courses), but also images shot during "learning at excursions", knowledge sharing sessions and best practices and
- A *Mobile Learning Component*, that allows to contact both other learners as well as the school-server and to communicate taking in mobile learning scenarios.

The UNITE platform is a web-based system with two access points: (i) the learning portal and the learning management system are directly accessed via a web server (<http://pilot.unite-ist.org>), while (ii) the mobile devices are connected to the platform via a dial-in server. The knowledge repository is a background service behind the web server.

Because future users, here primarily referring to school teachers and students, were involved in the platform development process (for example definition of user requirements, mock-up validation activities along with usability assessments), the UNITE technical solution fits their needs. Innovative learning by means of the platform can now take place in the classroom, at home or anywhere else, wherever indoor or outdoor. The system offers numerous possibilities for successful knowledge delivery and acquisition, and it is now up to teachers and schools how they will make use them.

2.3 Supporting Mechanisms

Implementation of the system in partners' schools comprises the combined work of the project partners and school teachers related not only to the creation and delivery of new and/or customised learning scenarios, but also to the additional supporting material provided by the project. 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. In order to illustrate the significant role of supporting mechanisms, selected implementation instruments are briefly introduced in the following:

- *Teachers' Handbook* (Ćukušić *et al.*, 2007); this is a practical guide and covers how to design lesson plans for scenarios, how to design an e-/m-Learning scenario and how to plan content production; the first version of the *Handbook* was available as an easy-to-navigate and printable PDF file format; the current new handbook is presented as a web portal with many additional features;
- *Content Development Handbook* (Tzanavari, 2007) is a practical guide to developing content for the platform; it includes learning content's technical features, making decisions about the development of learning content, access to available resources and offers useful guidelines for the development of reusable e-Learning content; the *Handbook* does not require many technical skills from teachers (who are the actual content developers in most cases);
- *UNITE e-Learning Scenario Template* (Zoakou *et al.*, 2006) is designed to encourage scenario development which is grounded in pedagogical principles specified in the UNITE's pedagogical framework; three scenario examples are provided as a first point of reference, to provide models for teachers to follow.

The abovementioned three documents (see Figure 1) helped teachers to become familiar with the pedagogical framework and content development concepts as well as their implementation in the scenario development phase.

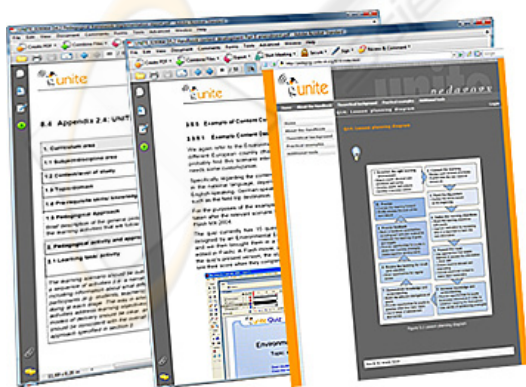


Figure 1: Supporting manuscripts.

3 THE IMPLEMENTATION OF UNITE IN SPINUT SCHOOL

3.1 School and the Team

Elementary Spinut School is a state school which was founded in 1954 and soon became a place to practice the pedagogic skills of the students from the Faculty of Natural Sciences, Mathematics and Education. The results of joint work among teachers, professors and students can be seen in mutual projects, exhibitions, workshops, various teaching praxis and the like. The age range of students is from 7 to 15 and currently there are about 650 students enrolled. The school staff are willing and eager to put in extra effort, which can be seen in the excellent results they have achieved within the framework of the new Croatian National Educational Standard programme. Precisely for this reason the school is a great partner for "trying-out" an e-Learning project, even though they have had no prior experience with technology enhanced learning.

A team of five people was formed, consisting of the school's headmaster, the pedagogue and three subject teachers. Support in terms of organisational and technical assistance was provided by UoS. In the first two scenario implementations approximately 50 students took part (mostly 13 and 14 year-olds).

3.2 Preliminary Activities/ Research

Prior to the development of UNITE's supporting mechanisms and platform integration, many research activities took place. The results of these activities helped to build up knowledge about Network of Schools as a whole (see more details in (Limanauskienė & Stuiškys, 2007)), but they also provided necessary impressions and insight of schools' perception of e-/m-Learning, national specifics, the overall context and similar.

First, the *school fact-finding questionnaire* (A. Granić, raw interview data, April 4, 2006) along with other technology and pedagogy related questionnaires revealed school characteristics and the degree of expected commitment to the project. In terms of the Information and Communication Technology (ICT) in general and e-Learning in particular, Spinut School was taking initial steps since there was no 'strategy' related to their adoption. On the other hand, the motivation of teachers was high from the beginning. They expected improvements in teaching and learning process, progress in the distribution of teaching contents and opportunities to gain new training-skills programs.

Second, after having been introduced to the e-/m-Learning concepts, the UNITE goals and the existing technologies through several workshops, the school team was asked to compile a *user requirements list*. As the school unquestionably fell into the category of "e-Learning unaware" schools, acquired user requirements were on a more general level (e.g. students should be able to learn particular domain knowledge, the system should make possible lifelong learning or the system should provide some mechanisms for student on-line motivation (A. Granić, raw interview data, April 15, 2006)). Conversely, teachers were quite aware of the importance of contemporary learning trends (e.g. adjustment of tasks to individual student's needs or system should allow collaborative learning). Formulated requirements were merged with the ones provided by other partners' schools, processed, extracted, evaluated and prioritised to form the pool

Third, according to the *Croatian national curricula and school educational policy plans*, the school's current pedagogical practice tends to limit the widespread practice of whole class teaching in favour of group work, practical assignments, research work and collaboration. Every teacher uses his/hers own individual methodological approach, so pedagogical practice often depends on the teacher and his/her personal educational philosophy. Concerning the technical infrastructure, the situation could be much better. Currently there are about 40 computers available (one for every 16 students). Such information was essential to identify the national dimension and formulate crucial procedures in order to integrate UNITE in daily activities.

Fourth, the *walkthrough usability test* of UNITE design mock-up with future users (teachers and students) was performed. The benefits of this

evaluation were considerable: (i) usability problems were detected at a very early stage of the design process, (ii) communication and collaboration between designers and users was encouraged, (iii) iterative design and multiple evaluations were supported and (iv) users got "the feel" of the system. Both the teachers and the students were very keen to start using UNITE after seeing the mock-ups for the first time. They did have some improvement suggestions (e.g. too small fonts, not very clear and self-explanatory icons) which were taken into account in the first version of the platform.

Once the school team was involved in initial development activities and had had some hands-on experience of using the system, they were prepared for the next phase – the launch of UNITE in their school.

3.3 The Implementation Process

As any other good-practice project, UNITE has followed a certain process in order to implement its theories and practices in schools. This matches the idea behind Deming's iterative four-step problem-solving *Plan-Do-Check-Act* (PDCA) or *Plan-Do-Study-Act* (PDSA) process (Moen & Norman, 2006). Deming broadened the use of the original cycle to apply it to all situations at all levels with the emphasis on learning and improvement. Aligning with the PDSA cycle, 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 (Figure 2).

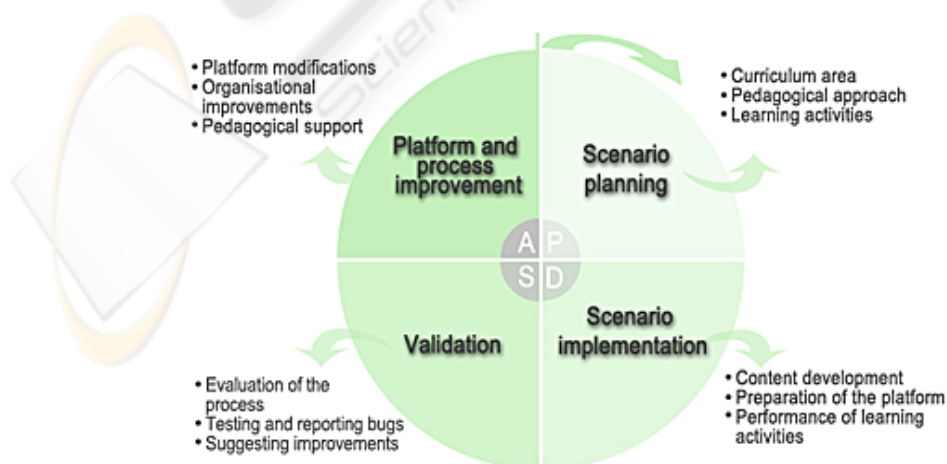


Figure 2: The launch of UNITE in the school.

A fundamental principle of this process is iteration: once our assumptions are confirmed or negated in the validation phase, we execute the cycle once again with the intention of extending the knowledge further on. Below we present the results from the first iteration, the one that took place in Spinut School from February until July 2007.

3.3.1 Scenario Planning

The objective of the *planning phase* was the delivery of two innovative scenarios: (i) the custom scenario, planned and written using the scenario template and (ii) the adapted scenario, adjusted scenario sample in order to fit the curriculum. Initially teachers were provided with Croatian translations of Teachers' and Content Development Handbooks. Frequent meetings (at least twice a week) were held in order to introduce/remind the school team of the pedagogical principles and technological aspects, thus helping them to enjoy and enrich their e-/m-Learning experience. The outcome was a paper-based version of the two scenarios developed according to the teachers' understanding of pedagogical and technological considerations. The development was supported by the scenario template

which also helped to deliver the results in accordance with the specifications. Components of the first scenario, which addresses parts of Physics and Geography curriculum (specifically lessons related to European transport system) are presented hereinafter (Zoakou *et al.*, 2007).

a) Curriculum Area

As the first part of the scenario, *curriculum area* encompasses information about scenario's subject, context of the study, domain and pre-requisite knowledge for the specific case (for illustration see example in Table 2).

b) Pedagogical Approach

The curriculum area is followed by the description of scenario's pedagogical basis. In this specific case, students were supposed to work in groups of five and collaboratively make decisions about their roles and individual responsibilities, the structure of their presentations and the like. They had to use the platform in order to agree on the abovementioned aspects and/or to organise their work. Students were encouraged to take more active role, the role of researchers, and to come up with their own solutions and suggestions to the questions of their teacher.

Table 2: *Curriculum area*; a part of the scenario.

Subject / discipline area	This interdisciplinary scenario covers certain topics from at least two different subjects i.e. Geography and Physics along with some content from subjects like Technical education, ICT, History and Biology.
Context / level of study	Scenario is intended for 13 and 14-year-old students attending one 7 th grade class. Its purpose is to: <ul style="list-style-type: none"> - strengthen existing knowledge about all transportation modes and their importance for connecting Croatia and Europe - adopt basic understanding about interrelation of traffic connectivity, population, economic development and traffic density - get acquainted with economically and ecologically acceptable modes of transportation and energy sources - develop ecological conscience; point out environmental issues, global warming, greenhouse effect, ozone holes... - foster critical thinking and discussion about environmental issues. First, the teacher introduces the subject matter and afterwards students work in groups, explore, solve their assignments and eventually adopt or deepen their knowledge of key terms like: transport; transportation system; traffic development; transport mode(s); transport integration; pan-European transportation corridor; container transport; road transport; pipeline...
Topic / domain	Based on the school's monthly plan, intersection of related contents was found in two subjects. Topics from the national Curriculum plan and program for elementary school were selected and integrated into e-/m-Learning scenario: (i) "Transportation systems and transport connectivity of Europe" from Geography; (ii) "Transformation of inner energy through work and heat" and non-compulsory (iii) "Energy and energetic" from Physics. The main sources of information for students are taken from the course books. Topic titled "Croatia in European transport flows" is additionally presented through a variety of interactive platform content.
Pre-requisite skills / knowledge	Understanding of terms like land traffic (road traffic, railway traffic), water traffic (sea traffic), air traffic, telecommunication, global warming, energy sources, energy preservation and conversion. Basic skills of Internet search; group work, creation of PowerPoint presentations and skills of presentation.

While preparing the scenario, teachers considered collaborative and exploratory learning principles in addition to blended learning and active learning techniques. Furthermore, students acquired knowledge through their interaction with mobile devices and their environment, thus practicing constructivism as an active learning process. For example, students were able to move in and interact with the real dynamic world, additionally creating knowledge and meaning through their interaction with one another, synthesising and reflecting on the data with their teacher back in the classroom and building conceptual connections to their existing knowledge base.

c) Learning Activities

The most important part of the scenario is related to *learning activities*. Every learning activity should accomplish established learning objective(s). All the tasks are outlined as a sequence of activities along with students and teachers actions. Moreover, each activity should be complemented with an assessment strategy (e.g. peer-/self-assessment, tutor-assessment and the like) thus conveying foreseen pedagogical principles. In order to illustrate the above reasoning, an excerpt from the scenario related to the one of the four introductory learning activities taking place at Geography classroom is presented in Table 3.

3.3.2 Scenario Implementation

The *Scenario implementation phase* encompassed the development of e-/m-Learning content, the

preparation of the system along with performance of learning activities from the scenario using the platform and mobile devices. This phase can be perceived as testing the scenario against the platform.

The most relevant material (tools and resources) collected by teachers were subsequently employed in the course preparation, hence being available for those who wanted to know more about related subject matter (for this purpose modules *Course Editor* and *Course Viewer* were used) (Granić & Čukušić, 2007). Six groups of approximately equal numbers of students aged 13 and 14 were formed. Student assignments were placed within the system (module *Tasks*) and appropriate instructions were provided. Students consulted their online textbooks and internet sources as well as their teachers in order to find material related to the problem defined in their assignment. The most relevant resources were placed in the platform using mobiles, PDAs, laptops and PCs (modules *InfoPool* and *mediaBoard*).

UoS provided support to students as technical expert/advisor throughout few workshops and the whole time via the platform (using *my Messages*, *Chat* and *Forum*). Activities undertaken enabled students to express their own competence and knowledge about the various aspects of related subject matter and eventually about the system. The platform allowed them to create and to edit presentations encompassing answers to all the questions provided in allocated assignments.

Table 3: Excerpt from *learning activities*; a part of the scenario.

Learning task / activity	Learning objectives / outcomes	Tools / Resources	Assessment strategy	Time allocated
mediaBoard will be introduced even before the rest of the platform since it will presumably be a motivating experience for students to use mobile devices in the process of learning (while collecting learning material). This way, students will become familiar with one of the UNITE's components and at the same time will populate data repository. mediaBoard zones are created based on assigned transport modes with one additional zone for general discussion (global warming zone). Students are encouraged to send e-mails, SMS and MMS messages. Written how-to instructions are provided.	To engage students for easier adoption of UNITE. To enliven the topic and to inspire students for additional research. To motivate students for intensive thinking about their assignments and autonomous research.	The UNITE platform: <i>Workspace</i> "Hrvatska u europskim prometnim tokovima": <i>Infopool</i> (written how-to instructions for sending messages to mediaBoard) <i>mediaBoard</i> : one mediaBoard for all the students. 7 zones, one for every group assignment and one for general discussion about global warming: - cestovni - zeljeznicki - zracni - pomorski - cjevovodni - telekomunikacijski - glob_zatopljenje	Answers to questions and clarifying possible uncertainties	25 min

Various aspects of students' work were assessed. First, each group completed tests available within the presented course. Second, each presentation was followed by an oral examination and discussion among students and their teacher, who provided qualitative evaluation according to their answers. Third, coordination among the group members along with their contributions was assessed. Moreover, every student group provided additional feedback related to their own group work employing peer-assessment and/or self-assessment against their own criteria.

Snapshots of some of the abovementioned platform components or modules are illustrated in Figure 3 and Figure 4.



Figure 3: *Course Editor*, structuring the course.

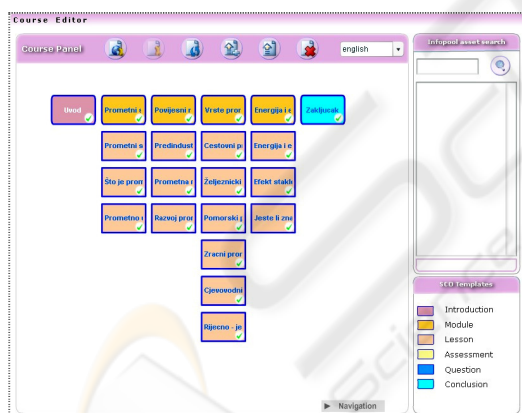


Figure 4: *mediaBoard Zones* (correlating with lesson's mind map).

3.3.3 Validation

The objective of the *validation phase* was to monitor and evaluate the processes and results against our goals, reporting the outcome in "case record" format. This phase also included testing and reporting bugs via system forum or e-mail, suggesting platform improvements, introducing and organising diverse validation activities in the school (e.g. filling subjective satisfaction questionnaires).

The most valuable validation feedback came from case records. One form was completed by every teacher, while most of the students completed the form as well, either as individual or group exercise. Teachers and students observations are concisely addressed in the following.

Teachers pointed out the importance of planning and preparation for successful realisation of e-/m-Learning activities. They were also concerned about how to assign additional specific tasks to students not actually contributing to a group work in any way. While teachers were very satisfied with students' interest in these new ways of communication and teaching, students did not share their opinion. Students stated that they mostly interacted with their teacher in the classroom and not on-line. Asked how would they rate the suitability of specific platform communication functionalities on a scale from 1 to 5 (five being the highest mark), students rated *Messages* with 5, *Forum* with 4 and *Chat* with 3 or 2, since they used it mainly for personal messages. The possibility to communicate with students from other European schools was in students' opinion a great advantage of such kind of shared platform.

Students pointed out a problem related to m-learning. They found it extremely useful and fun to use their mobile phones for learning, but were worried about the cost of using their devices for this purpose. Nevertheless, *mediaBoard zones* (see Figure 4) were populated enough with relevant resources. The use of phones was very effective because it was used as a different way of collecting data related to subject matter, but also as something very familiar to students that helped to steer their interest and motivate them for system usage.

Although at some point it seemed that students were critical of the scenario implementation, according to their comments and our personal attitude, they were very pleased with the UNITE system, e-Learning and m-Learning in general.

3.3.4 Platform and Process Improvement

The *Improvement phase* enabled revision and modification/enhancement of the previous ones, just before the start of next iteration. Based on timely validation information from the *Network of Schools* and earlier planning, there are already several platform improvements available, categorised mostly in four main areas: stability, user interface, functionality and performance (A. Koulombis, meeting presentation, June 21, 2007). To exemplify, one of recently introduced functionalities is

MyLearning author for Pocket PC, an authoring tool that allows teachers to create learning materials for Pocket PCs and Smart Phones.

Apart platform improvements, there will be additional modifications in terms of organisational nature (e.g. UNITE will be used as a tool during the whole semester for all lessons from one subject and not only for the selected ones) and pedagogical support (e.g. new portal for teachers is available).

4 CONCLUSIONS

The e-/m-Learning implementation of the UNITE project's principles and methods comprises joint work of project partners and partner schools in order to improve learning and teaching experience in the Network of 14 European schools. The paper reports on the case study concerning UoS and Spinut School's experience, the activities undertaken and the intermediate results achieved, when implementing the first e-/m-Learning system in school settings. Throughout the paper we show how the UNITE project accomplishes several of its objectives, consequently providing a significant step towards the development of an effective technology-enhanced learning in our partner school.

The implementation process undertaken matches the idea behind the iterative, four-step *Plan-Do-Study-Act* (PDSA) cycle. It is important to note that this similarity was not actually formalised in any of the UNITE project documents. However, the PDSA cycle was accepted by the authors since we claim that it quite clearly depicts and structures the implementation process to facilitate its comprehension. At this time, the four major cycle phases including the scenario planning, the scenario implementation, the validation as well as the platform and process improvement, are being reviewed and the next iteration planned (starting in end of 2007). We are looking forward to a new term with the UNITE platform.

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