ABSTRACT
This paper presents the main outputs, and their pedagogical fundamentals, of the Socrates/Minerva project Individualized Learning Enhanced by Virtual Reality (IDENTITY) 229930-CP-1-2006-I-RO-MINERVA-M. The overall project objective is to produce a high level quality learning environment in an academic European network ensuring an open access to improved educational resources, as well as to the best practices. The main project outputs, short described in this article, are: The Enhanced Individualized Learning Environment (EILE) and The VR-Learning Resources Centre (VR-LRC).

Categories and Subject Descriptors
K.3.1 Computer Uses in Education: Collaborative learning; Computer-assisted instruction (CAI); Computer-managed instruction (CMI); Distance learning.

General Terms
Theory

Keywords
Individualized Learning; Virtual Reality; Remote experiments

1. INTRODUCTION
Radical changes are nowadays generated by globalization and knowledge community, especially with regards to how economies design, produce, distribute and consume products and services. Engineering activities are at the heart of these changes, producing these changes and being affected by them. The ability to work in a global community is an important requirement for engineering: they need to have broad skills and know-how, propositional knowledge and to be flexible, and able to work in internationally team [5]. The European university recognizes these needs for a dramatically different kind of engineer and, they agree substantially on their desired traits.

In this context, digital technology permits significant changes in the way in which learning and teaching are guided. It affects the information sources, the interactions that strengthen learning and teaching. It is remodelling the time, place and pace of education and it has the potential to increase the accessibility of education to increasing number of people. Such learning environment allows diversity, complexity and flexibility. Opposite with classical e-Learning, VR provides several unique attributes that set it apart from other computer technologies currently used in schools. In [7], Pantelidis gives a "Decalogue" for the reasons to use VR in education: 1) Provides motivation; 2) Can more accurately illustrate some features, processes, etc. than by other means; 3) Allows extreme close-up examination of an object; 4) Allows observation from a great distance; 5) Allows the disabled to participate in an experiment or learning environment when they cannot do so otherwise; 6) Gives the opportunities for insight; 7) Allows the learner to proceed through an experience at their own pace; 8) Allows the learner to proceed through the experience during a broad time period not fixed by a regular class schedule; 9) Provides experience with new technologies through actual use; 10) Requires interaction, encourages active participation rather than passivity.

2. THE INNOVATIVE LEARNING SCHEME
According to this Decalogue, and others works, with the actual educational aims, the overall objective of the project Individualized Learning Enhanced by Virtual Reality (IDENTITY) is to produce a high level quality learning environment in an academic European network ensuring an open
access to improved educational resources, as well as to the best practices.

The project Individualized Learning Enhanced by Virtual Reality (http://iesc.unitbv.ro/identity/) involves 10 partners from 7 EU countries. The IDENTITY project gives learners a free access to advanced user-friendly software for simulation and virtual reality enabling interactive investigation and analysis. The project proposes an innovative learning scheme for training in which VR is the main feature. The proposed scheme integrates the VR based e-learning, practical laboratory activity and face-to-face tutorial. It implies the application of knowledge to real tasks with a component of “learning-by-doing”.

The outputs will create an innovative, prototype training environment which is adaptive to the learners’ style, knowledge level etc., and provide support where and when required. It includes new learning environment for complex, high-tech situations using advanced simulation and VR. There are two innovative tools foreseen to be developed and experienced by an EU public/private partnership, with the purpose of giving support for students to learn certain technical disciplines to the fullness of their individual ability:

The Enhanced Individualized Learning Environment (EILE) aimed to provide the learning frame in which tutor and student can interact across the barriers of time and distance in order to support and guide the student in the individualized learning required by the educational process.

VR-Learning Resources Centre, (VR-LRC) a structured, compliant and expandable learning resource repository populated with appropriate VR applications and e-learning products to be provided by the EU public/private project partnership.

As pedagogical approach, EILE valorises the postulates of the current learning approaches (constructivist and socio-cultural), that propose knowledge construction by interaction with the information and the social environment. Traditional E-learning favours theoretical knowledge construction and limits psychomotor skill formation, which represent a strong inconvenient in the technical disciplines. This difficulty is diminished by the VR tools, which offer multi-sensorial information and allow object manipulation and activity simulation in the VR environment.

Visualizing of very rapid or very slow electric/electronic processes, inaccessible in the real reality, synthesis representations, multi-sensorial involvement, the possibility of object/ instruments manipulations in simulated activities make learning more durable and allow student to accumulate practical skills and experience.

3. ENHANCED INDIVIDUALIZED LEARNING ENVIRONMENT (EILE)

EILE will be dedicated to endorse the asynchronous learning part, without time-constraints, also united to space or mobility restrictions – distance-learning and ubiquitous (mobile) m-learning, respectively. EILE provides each student and tutor with a “tailored panel” to identify the student’s learning needs and the adequate adjustments and to assure an efficient progress of each student. EILE also provides each student with access to the VR-LRC needed to learn to the fullness of their individual ability. The necessary activities for the learning with VR are grouped depending on the time sequences.

Before starting the course, same public/transparent pedagogical activities are executed:

Step 1 – identifying and publishing the behavioural objectives for each course unit;

Step 2 - identifying the students pre requests and building the scholar group profile

Before or simultaneously with the first activities, teacher executes other closed activities, unnoticeable for the students:

Step 1 – selecting and preparing, according to the students needs, the contents for each course unit, and on line posting;

Step 2 – identifying the strategies that assure the learning objectives achievement;

Step 3 - edit their course (text, tasks, vocabulary, messages for personalized learning);

Step 4 – preparing the tutorial and assure computer mediate communication with the students.

Along the courses, the teacher is not directly present into learning environment, but she/he works for good learning.

Step 1 – building and maintaining the web course;

Step 2 – building and maintaining the labs, and the tutorials. The tutorial includes formative assessment, counselling and supportive activities; these activities regard student’s personal development, communication, collaborative learning and group leadership.

After finishing the course, the teacher executes public and closed activities.

Step 1 – managing of student’ assessment, collect and deliver the grades for students;

Step 2 – managing of web course assessment, of tutorials, and group work ;

Step 3 – utilizing the feedback for objectives, didactical activities, equipments improvement.

In our project, the pedagogical described activities are constituted the assumption for elaborating the structure and functions for Panels main menu witch two parts:

- “Tutor panel” (Fig.1) includes the following major functions: module-course information; student assistance; student progress reports, best practice guide;

- “Student panel” (Fig.1) main menu includes the following major functions: learning information, progress information; resources (VR-LRC) access; contacts (tutor, students, administrative desk). Also the panels are both something like symmetric and their building responds to fundamental standards of didactics, specific for a constructivist and socio-cultural approach. For establishing the structure of both panels (teacher and student) we have deferred the pedagogical norms.

The First aria is complex, and includes many learning information:
• E-Learning objectives – that guides cognitive demarche and will frame of reference for assessment;

• Milestones - an identifiable set of functional skills or specific tasks that can serve as a guide to normal learning dynamic. The simple skills need to be reached before the more complex skills can be learned. These milestones help teacher to determine the calls when a student may help to learn.

• Pre requests – knowledge needed for starting in the following unit, that guide assessment and self assessment, and support accomplishment the residual;

• Reports description witch presents the details about each didactical task proposed for each objective.

The second aria, with the students assistance, and editing/delivering the web course are the pedagogical e-Learning kern. Concerning learner, the second aria includes the dates about progress. Same the learning systems have the following facilities: automatic recording of the homework submission, sent the homework to a tutor, archive this homework and the comments, presents success ratio, and list individual and group performances.

The 4th aria - Best practice guide – offers models for task solving or working. The 5th tutor aria, student progress report, closes the learning cycle. The feedback measures the progress into each unit and determines the time for future modules. In this aria, it is possible to manage formative and final assessment. The 5th student aria permits online communications /contacts with tutor, other students, administrative manager.

The 3rd aria are dedicated VR-LRC aimed to give support to the students mostly for performing remote experiments by using VR applications.

4. VR-LEARNING RESOURCES CENTRE (VR-LRC)

VR-LRC consists of a structured, compliant and expandable learning resource repository aimed to give support to the students mostly for performing remote experiments by using VR applications (multimedia products), in order to improve the student practical skills before and after executing real experiments. VR-LRC can be accessed by EILE but it could be used separately as an independent product to be included in various e-learning platforms. Our project proposes a VR-LRC that covers a specific domain: electrical engineering. As a result, the VR applications to be included in VR-LRC will be related to the following topics: Electric Circuits, Analog and Digital Electronics, Electrical Machines and Drives, Measurement & Automated Test Systems, Home appliance systems and Industrial Process Control. VR-LRC will include not only VR applications but also traditional learning material in electronic format. VR-LRC is to integrate already available appropriate e-learning products provided by the project partnership.

The main system components are depicted in Fig.2, in which the interactions among the three main subsystems (EILE, VR-LRC and VLab servers), are shown. VLab servers are the servers in charge of delivering remote experiments (experiments that need accessing a remote server in order to communicate with real instrumentation or simulators or both).

According to the constructivist approach, the learner translates the world in a mental model. Each person that builds a cognitive model of world has active, work, learning by doing. Teacher is not simple information’s sender, and the student is not a simple receiver. For the higher performances, the student has constrained worked, it in not enough to listen. The cognitive model of world, laws, formulas, facts, is build simultaneous with their cognitive

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**Fig. 1. Tutor panel and Student panel**
structure. This process is oriented to find a new equilibrium, to a 
good adjustment. In this context, the teachers rule is to build a 
rich environment, structured, to the student’s needs diagnosis. If 
the assessment detects the errors on scholar task, and home works, 
the program introduces other tasks, analyze the items, finds 
inaccurate images and concepts, which is a learning handicap.

According to the constructivist and neo constructivist theories, 
EILE posts the student, the teacher and the knowledge in the same 
situation. The Contacts aria (student Panel) permits online 
communications with tutor, other students, web manager. Also the 
learning is not an individual problem, the student learns with 
other, in group, he/she collates the opinions, solving cognitive 
conflicts, and improves. Also, collaborative learning assures the 
progress for each person and increases their special and general 
competences appropriate for engineering activities.

Fig. 2. Teacher as system actor

5. SYSTEM DESIGN

The system design reflects the actoral quality of teacher and 
student. In the designed system the teachers are able to perform 
the following activities (Fig. 2):

- Edit their course;
- Have access to the tailored panel (lab. Idee will describe 
  further this part);
- Decide to insert a resource from the VR-LRC;
- Login the VR-LRC;
- Search the repository (VR-LRC) using metadata as search criteria;
- Collect info on learning resources (including copyright 
  and usage conditions);
- Download the learning resource;
- Insert it into the course;
- Test it.

In the designed system, the students are an actor too, able to 
perform the following activities (Fig. 3):

- Have access to the tailored panel;
- Use VR-LRC resources assigned to them by the teacher;
- Can access the VR-LRC as anonymous user via web;
- Search the repository using metadata as search criteria;
- Download resources if they are not protected by copyright;
- Communicates with other and changes individual 
  learning into collaborative learning.

6. COLLABORATIVE LEARNING

In a collaborative approach, learning in an electronic 
medium, doesn’t mean to be alone but with the possibility of 
setting up connections with the learning group, with equals or 
with the tutor. The most techniques that can be used in 
asynchronous CMC are: one-to-one approaches ((1-1), one-to-
many approaches (1-M), many-to-one approaches (M-1), and 
many-to-many approaches (M-M). In our opinion, there are three 
functions by means of which feedback can operate to influence 
the further behaviour of learner:

1. It may contribute to knowledge about the results of 
   performance.
2. It can serve to motivate continued effort to persist with a course of action.

3. It may provide reinforcement thereby strengthening the behaviour that led to it and increasing the chances that individual will behave in a like manner in the future.

Using the techniques many-to-many approaches (M-M), group scenarios (Fig. 4) bring about interactions at a cognitive level between the students, the students and tutor questions and answers, solutions that are opposite or the same. Group scenarios come out in favour of social interactions who’s dynamic leads to the building of knowledge by partitioned cognition which in the end, has to be assimilated by each participant [1] [4].

E-learning has introduced scenarios of a hypermedia type, interactive, influenced by the IT facilities and by the learning psychology of an adult: a contextualised learning, functional, which demands initiatives from behalf the student [8].
The learning scenarios described all the individual learning and in cooperation activities (collaborative learning), tied together. They are differentiated after their central activity or ability (to discover or apply a law, to evaluate, to build an example, to create a group text which will be posted on the forum, etc.). They respond to some commune demands, resulted from the specific of the activity, but also to demands which concern the adaptation to the specific features of the students, of the group or of an interactive system which enables personalised support approaches of those who learn. The formation scenarios (Fig.4) describe the tutor/professor approach, an ensemble of interventions used by a learning scenario, the necessary means (instruments, documents) and the products of those who learn.

The group offers varied reference points for a student, resulted from the diversity of the proximal learning zones [2] which allows the distribution of the roles, the coordination of the interactions between those who learn and the appearance of new solutions. The interactivity of the persons: student – student and student – professor, allows the setting in one place of the competences, the access to the other, the opening of a giant window towards the world [10]. In these conditions, the role of the tutor is one of bringing about and sustaining the interaction, the reflexive and auto-reflexive attitude of the students, the critical analysis of the documents, the identification of errors (as learning sources) and their correction. This is not only important for their progress in formal education, but also afterwards in their professional careers in which they have to be able to maintain their professional and academic competences [11]. The quality of reflection can also be influenced by external factors like external feedback [6] and the interaction of students with a tutor [9]. This external feedback provides the students with information with which they can confirm, add to, overwrite, tune, or restructure information in memory. In [3], Chi M.T.H. differentiates between three kinds of tutor feedback: corrective and suggestive feedback, and didactic explanations.

7. CONCLUSIONS

Collaborative and constructivist views of learning in VR medium have several implications for instruction. Also, teachers should: put instructional activities in the form of problems for students to solve, try to view students' solutions to problems. The error of students point of view from an adult point of view are students to solve, try to view students' solutions to problems. The formation scenarios (Fig.4), Chi M.T.H. differentiates between three kinds of tutor feedback: corrective and suggestive feedback, and didactic explanations.

By implementation of the project outputs in the day-to-day didactical activity the project team expects obtaining contributions concerning: a) The future standardization of e-Learning platforms, regarding mainly the integration of virtual & remote experiments and the insertion of educational capabilities in the offer of standard service providers; b) Increasing the mobility and adaptability of the potential users, in a multi-national environment, by improving skills and updating knowledge; c) Making the study of the electrical engineering more attractive among young people and thus to contribute to facing the problems with low level of interest of students at technical universities and higher technical schools to study electrical engineering; d) Establishing a network supporting cooperation of academia, secondary high schools with the industry; e) Increasing compatibility and comparability of partner countries education systems. f) The EILIE and VLab offer to students an efficacy and most visible reality. This is a handily reality, that enhances the ability to perform as student, and work, as engineer in a global community and in internationally and professional team.

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9. REFERENCES


