eLearning Tool for Adults Training on Renewable Energy Systems Developed in the Leonardo Da Vinci Project RES&EM ICT Tools

A. Duta, I. Visa, E. B. Fazakas, G. Scutaru
Transilvania University of Brasov, Eroilor 29, 50036 Brasov, Romania

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Abstract. The paper presents the eLearning tool developed in the frame of the *Leonardo da Vinci* pilot project "Renewable Energy Sources and Environment Friendly ICT Tools – RES&EM ICT Tools". This product aims to offer training and information to a broad spectrum of target groups, with different education background and interest, in a subject able to support the (re)insertion in the working market, either as worker or as entrepreneur/manager.

1 Introduction

Sustainable Development is the path that allows for our common future progress (new or innovative technologies, products and processes) and life (environment, health, food). The principles of Sustainable Development have been formulated but their implementation requires an effort both at individual and at society level. Training/learning is an important tool that must be used in order to be able to take the necessary steps that will re-shape our way of living into a sustainable one. In terms of sustainability, time is running short, wide groups have to be trained mostly in non formal or informal systems, therefore a special attention is given to the adults education, especially to lifelong learning. The EU community programme Leonardo da Vinci offers a frame for developing projects that answers to the previous presented needs. The project "Renewable Energy Sources Users Friendly ICT Tools" (RES&EM ICT Tools) is such a project, running till December 2003.
The project aims to develop a dynamic, user-friendly e-Training tool that will empower the interested users to browse along the technological development in RES&EM, sensing good practice projects around the world.
This tool will make the knowledge accessible to a large group of people and promotes good practice dissemination at European level. It is based on ICTs, addresses to continuing vocational training and has a component of distance training. It transforms the

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information, knowledge and experience existing on RES&EM coming from science, production, trading into an interactive education tool.
Through this tool, the continuous vocational training will develop in terms of subject, products, methodology and quality. The tool addresses to a broad spectrum of users:

- *The individuals* to whom this project addresses are young people, graduating highschools, technical schools or universities, looking for professional (re)insertion in their national and in the European working market. It also addresses to those who intend to develop their own business/company in RES and/or EM;
- *The trainers and training planners* who represent a core of human resources, meant to fulfil the project objectives and ensure the dissemination of the project's outcomes. They are members of the partners' institutions;
- *The companies* coming from different sectors: industry, architecture, building construction, agriculture, forestry, trade, environmental protection; they represent the "source" providing individuals that test the tool and are those who are empowered to make RES&EM a wide spread reality;
- *Local, regional and national bodies* responsible for the environment quality, for training and promoting RES and EM are also primary targets and beneficiaries of the project outcomes;
- *The decision-makers* in terms of the policies regarding EM and energy are those who directly are asked to benefit and – based on the new acquired skills, to use the eLearning tool.

The product is the result of the joint work of the entire partnership, each module involving at least two partners. The participating groups are coming from Romania (the Transilvania University of Brasov, The Brasov County Council, the Foundation for the Promotion of SME, the National Centre for Sustainable Development), Spain (University of Zaragoza), Germany (FH Aachen), Greece (Technological Research Center, Patras and Euro New Horizons, Aigion), the Netherlands (TU Delft and the Netherlands Energy Center).
The eLearning tool will start to be used, in its primary form, in October 2004 on "testing groups" of users and, based on the registered feedback, the final form will be developed till October 2005.
This paper presents aspects related to the content, structure and basic features of the eLearning tool developed under the RES&M ICT Tools project.

2 The eLearning environment

The CD based product uses a platform developed by a group in the University of Zaragoza, Spain (partner in the project). The learning environment is called GAME (Gestor – Author for Educative Multimedia) and it allows the development of a simple electronic book that provides to the student the basic document of the subject, in digital format and contains the typical utilities of this type of programs: text finder, note marker, possibility of evaluation. An eLearning tool based on GAME has to fulfill some basic requirements:

1. The facility for the progressive development in two ways:

a). the modifications affecting the extension and the own incorporated contents

b). the facility to increase and to redefine all the interactions between the different elements that compose the contents.

2. The facility to incorporate any external development, as basic utilities (calculating, spreadsheet, word processing, program of design, the viewfinder of the data base multimedia), as specific tools or programs of existing demonstration or design in the market.
3. Possibility of collaborative work between professors of a same department in a university or between several institutions.
4. General design of the interface that fulfills the requirements of resemblance, hierarchies and integration of components so that it is intuitive and very simple to operate not only on the part of the user (professor or student) but also of the author.

In Fig 1 there is presented the sequence of actions taken to create the contents in a subject of any matter if the philosophy of pedagogical adaptation is followed.

The necessity is evident to diminish the time required or for the assembly of a subject or the corresponding connections. The different experiences carried out in successive phases of the development of materials for the GAME indicates that the time of assembly can be reduced with a factor between 10 and 50.

An internal data base of GAME allows the fast identification of the contents so that it is easy to reuse the digitized materials, the editing of images or texts and the cancellation of undesirable increases of used disk memory. The GAME support is a data base that integrates all the contents that the author will handle.

The data base will store, process and allow later to recover images, texts, relations and references defined by the author.

The Game environment has a certain degree of flexibility that is successfully exploited by the conception of the entire RES&EM eLearning tool.

Consequently, it became necessary to construct a viewfinder (viewer) of elements in the base that allows searches by key words, or by references or visualization of a reduced size clone. This special module of the data base will harness the reusability of the different materials stored or referenced in the data base.

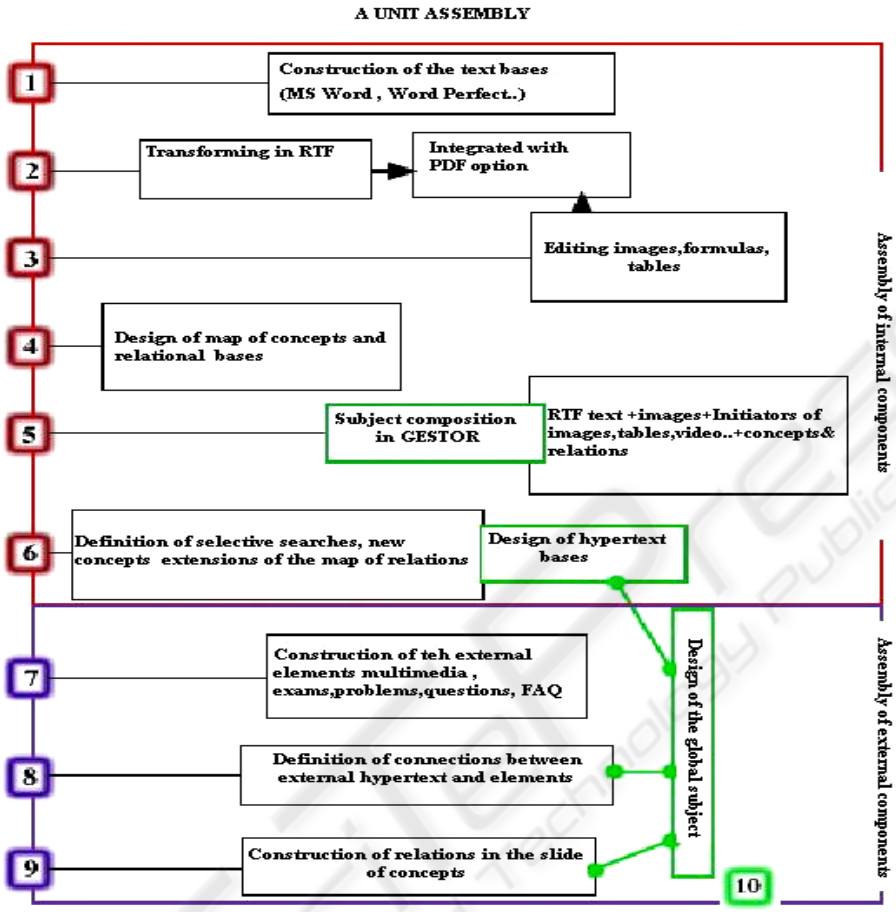

Fig. 1. Steps in developing an eLearning tool using GAME.

3 The Content and the Structure of the eLearning Tool

The starting point in developing the eLearning tool had to consider two aspects:

- the variety of the Renewable Energy Sources and the corresponding Systems (RES);
- the variety of the target group, both in terms of instruction level and of interest.

Considering these, the content of the eLearning tool was developed on ten modules (there were selected the RES mostly developed in the partners' countries), on three levels of difficulty. The content of each module allows the training for different final aims (as employer or employee):

- production,
- implementation,
- market,
- consultancy,
- policies and strategies.

In Fig. 2 there is presented a scheme that correlates the needs for covering the subjects and for meeting the beneficiaries' expectations.

A common structure of the modules offers unity to the tool and enables the trainee/user to brows easily through the information. The common structure is respected for each level of complexity, as Fig. 3 shows.

The Basic level is designated for primary information. The content can be used as whole or partially for developing first degree courses (young workers, high school students/graduates) for media presentations, for local/regional authorities, etc. because it consists of the following chapters:

- History,
- Systems,
- Components,
- Market,
- Policies,
- Social & Environmental Issues,
- Case studies.

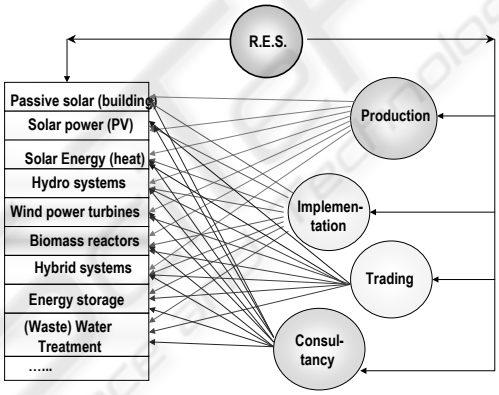

Fig. 2. eLearning tool content.

The Design level addresses to the group ready to develop production schemes, to implement, or to commercialize the RES. The steps are the state-of art in product design:

- Input data,
- Design criteria,
- General concept,
- Component design,
- Operation and maintenance,
- Systems' economics.

The Advanced level guides the user through the RES conceptual details and enables the trainee, at the end of the training sequence, to design parts and/or systems. It addresses to users in the field of production and consultancy and it contains also cost calculation details. The tools in at this level explain how the existing software can be adapted to the RES design:

- Design tools,
- Component design,
- Quality evaluation,
- Management,
- Guidance.

Permanently available on the screen, there are the buttons that allow the access to supplementary information (such as "Links", "Glossary" and Frequently Asked Questions – FAQ) or the evaluation ("Assessment").

Consequent to this structure, the trainee can individualize his/her training rout, by selecting the modules and the units of interest. The (self)evaluation, following the complexity levels, represents a good exercise for the final step of their training: the tutor evaluation, partially ICT based.

Fig. 3. Schematic presentation of the structure of the Learning Tool on levels of difficulty:

1. Basic
2. Design
3. Advanced

The eLearning tool has all the common advantages of the educational software: interactivity, accessibility and is ready to use at the pace and the time suitable for the trainee.
The degree of innovation lies in the "unity in diversity" of the content, in the presentation of the information (possible due to the platform developed), in the navigation possibilities between modules, etc.

4 GAME: the learning environment for RES&EM eLearning tool

Positively exploiting the advantages of GAME, the RES&EM eLearning tool was developed by choosing and personalizing the features according to the subject, project and beneficiary.
The background chosen is a reminder to Leonardo da Vinci. The basic colors (brown and yellow) are common to each slide but the details are changed from one level to another.
The toolbar of the platform allows the "author" mode (when it can be filled in, using a password) or the "user" mode (as student/trainee, when no filling in is possible), Fig. 4.

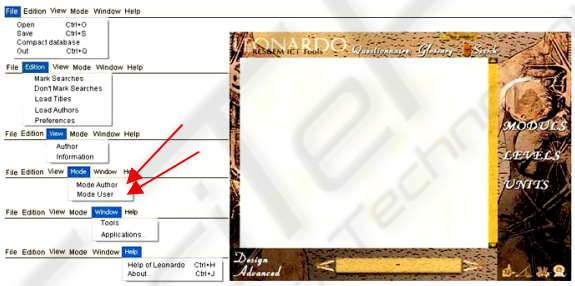

Fig. 4. The toolbar with the "Author" and "User" Modes.

As author, a toolkit is available that makes possible the introduction of the module's content, of virtual experiments, of evaluation sequences, Fig. 5. Considering the heterogeneous level of knowledge of the target groups, a Glossary is accessible either from the screen button or directly from the text. It leads to a brief definition of the notion (in the five languages of the partners' countries) and the related notions, Fig. 5.
The platform can be loaded with text and image on the same screen or the image/picture can be called with a button, Fig. 7. In the same way, the platform supports tables, videos (with case studies, virtual experiments).
The Evaluation is also designed on levels of complexity and is accessible from each unit of each module. Still, the trainee is advised to go through the entire level of a module and then proceed to the evaluation for being able to complete the tests. In Fig. 7 there are presented the options of the trainer and of the trainee in developing/using the evaluation facilities.

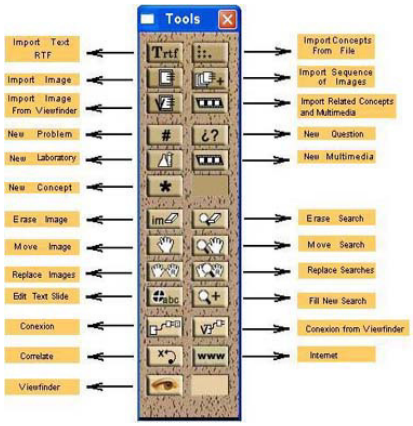

Fig. 5. The toolkit.

Fig. 6. The Glossary, accessible form the text or from a screen button.

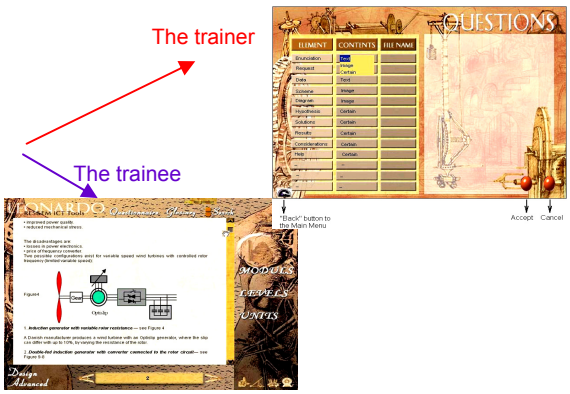

Fig. 7. The evaluation sequence.

5 Conclusions

The eLearning tool on RES&EM is a flexible training instrument that:

- Allows continuous up-dating;
- Allows a suggestive presentation of the information;
- With a large storage capacity.

It is developed on levels of difficulty considering the target groups with very different educational background and interests:

- Adapted to the differentiated curricula;
- Also suitable for "special training".

It has a users' friendly interface:

- That can be designed according to the subjects;
- That can be changed as suitable.

That fulfills the educational objectives as set in the Leonardo da Vinci project RES&EM ICT Tools. The level of conformity with the expectations of the target groups will be tested on selected trainee's groups. Based on the registered impact, changes in the content presentation can be expected.

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