Ecology in architecture design: Testing an advanced educational path

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ABSTRACT

In the last years, the terms "ecological, sustainable, green" have been used and abused, also in buildings and settlements design. Further, usually, "ecological" aspects are not yet effectively integrated in the design laboratories of architecture and technological faculties and schools. Finally, with the use of internet and of new communication technologies, also the didactic approach and the available educational tools are evolving.

This paper introduces the advanced educational experience of a project regarding a blended eLearning course, that integrates Swiss Universities, laboratories and Superior Technical School with expertise in architecture, energy, ecology, technology, pedagogy, design and communication. The Ecology in Architecture Design (EAD) course covers the basic concept and knowledge about integration of ecology into the architectural design.

At the end of the course, the students would be able to integrate autonomously the ecological considerations in the project, to understand the consequences of different choices and to evaluate alternatives, in order to optimize the project.

The educational tools are in English, but translations in other languages (Italian, French, German) are under evaluation.

Software training and usage are previewed as basic tools.

1. INTRODUCTION

The importance of environment and climate in Architecture Design has been known since many centuries and there are many examples of ancient buildings and settlements built respecting and valorizing site climatic characteristics (vernacular architecture etc). Fortunately, in the last years, due to the concretization of the sustainable development concept, there is an increasing consideration of this theme, also for the new low energy technologies and bioclimatic approach applications. This trend involves economy, society, policy, technologies and, of course, the "actors" of architecture design. On the other hand, nowadays, the terms "ecological, sustainable, green" have become synonymous of "fashionable" and there are many examples of buildings defined "sustainable", without actual sustainable features and performances.

One reason of this misunderstanding could be imputed also to a cultural and formative leak: the relationship between environment and design can't be condensed in a book (other tools are needed); and usually, "ecological" aspects are not yet well integrated in the design laboratories of architecture and technological faculties and schools; but new didactic approaches and educational tools, now available, could be helpful to that end: EAD would represent a model to promote an advanced educational path for sustainable architecture.

2. MAIN CHARACTERISTICS OF EAD PROJECT

2.1 Financer, partners and target users

In 2004, The Swiss University Conference decided to finance the project EAD, presented by Academy of Architecture (Mendrisio), in collaboration with the Centre Universitaire d'Etude des Problèmes de l'Energie (CUEPE, Genève),

the Fachhoschule Zentralschweiz (Luzern) and the SUPSI (Lugano) and supported, for the communication aspect by eLab (USI, Lugano). In the reported institutions, ecology has been already integrated in learning courses and all the partners have officially declared their willingness to recognize EAD into their curricula.

The target public are students in architecture and engineering curricula.

In order to provide a further diffusion of the course, the modular organization of the course and the strong reduction of presence teaching will enhance flexibility and allow reusing selected modules for professional architects and engineers needing retraining on a particular topic.

2.2 Aims and description

EAD is a project with the main aim of developing a blended learning course about how to integrate ecological contents in the architectural design, both at the level of a single building and of the planning of the urban landscape.

At the end of the course, the students would be able to integrate autonomously the ecological considerations into the project, to understand the consequences of different choices and to evaluate alternatives, in order to optimize the project.

The aim of the course is not only to analyze the ecological implications of buildings construction, but also to give next generation of architects the skills to include these components in their professional activity.

Thanks to eLearning, students will experience directly the case studies (through audiovisual guided tours) and, through exercises and simulations, will test the impact of different architectural choices on energy, air, and water fluxes, as well as on the human environment.

2.3 Subjects and structure

The EAD course is divided in two main sections: *building* and *landscape*; each section is structured in 6 modules: climate, soil, air, water, energy and population.

The first section is related to the construction of buildings and includes the analysis and planning of the material and energy fluxes in a building, as well as its integration in the social and natural environment.

The second section is related to the construction of urbanized landscape and includes the analysis of the material, energy and informational fluxes in an urbanized landscape, including consideration of the social, political and legal themes linked to landscape.

The overall structure, the module organization and the components of a module are represented in Figure 1.

2.4 Learning modality: blended learning form

The EAD course is designed in a blended learning form; this means that each EAD module is part of a university course given in presence (Cantoni et al., 2005). Students are provided with online materials and resources, but they also attend lessons in class and in laboratory. Activities are performed both on line and in presence. It follows a description of online learning contents for each module.

The pivotal component of each module is the learning task, around which every module is developed. A learning task is a complex, open-ended activity which students have to accomplish to pass the module, and which is at the core of the module structure.

The design team tried to develop an authentic learning task for each module, which means a learning task simulating a real problem which an architect can encounter during his work. To accomplish the learning task students have at their disposal different learning resources: a script, where they can find all the theoretical information needed to solve the task steps; several case studies, where they can learn how the task questions have been answered by famous architects; resources, a list of online and paper references used to write the script; interviews to experts, where they can listen to the point of view

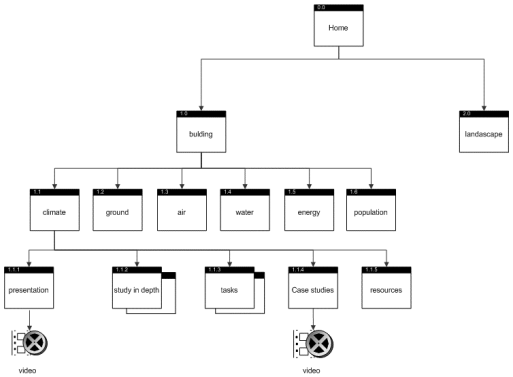

Figure 1: Structure of the project and of each section, module organization and components of each module.

of professors and architects on the issue arose by the module.

2.5 Course Management System (CMS)

The CMS, a software package designed to help educators in the creation of quality online courses, offers opportunities and constraints about the design of the course. The CMS used to implement EAD course is WebCT Vista. This choice depends on two main reasons:

- WebCT is a trusted industry leader in providing eLearning systems for educational institutions (thousands of institutions in more than 70 countries worldwide are expanding the boundaries of teaching and learning with WebCT).
- The SVC project (Swiss Virtual Campus), of which EAD is a part, adopted WebCT Vista as the main CMS for the entire Switzerland.

2.6 Representation and communication, graphic aspects

In order to design the “Look and Feel” of EAD course, the following aspects have been considered:

- technology: the course is implemented inside the WebCT Vista framework;
- management approach: fast prototyping;
- instructional design and content design (the task design, the map of content, the typologies of contents);
- semiotic: meaning of a course on ecology and related visualization.

The chosen CMS offers to the graphic designer many constraints, for instance, in WebCT Vista there are only three typologies of layouts that can be adapted:

- Organizer pages;
- Learning Modules;
- Content pages.

In order to use in a creative way these constraints, some solutions have been proposed:

- editorial box vs. the standard WebCT Vista icons;
- replication of one pixel colour vs. standard WebCT Vista colours.

The boxes are formed by a photo, a background, a title, an arrow and a text that introduce the content of the section.

For the semiotic aspects, a benchmarking research on the representation of ecology, architecture and ecology architecture on the web was done.

The graphic representation (colors, colors combinations, logo, etc) have been elaborated during several phases, considering usability, graphic design rules and, of course, feedbacks of partners. The final version is based on a low saturated green for background, blue and a different tonality of green (for semiotic: green and blue are natural colors; green recalls ecology) for the navigation elements. Figure 2 represents the last version of the informative web-page of the project.

On the homepage template, the main navigation elements are centered.

On the content page, the editorial boxes for external link and study in depth are on the right, the main navigation is on the left.

To design the editorial boxes, the metaphor of the post-it has been used (color/tonality changes for each typology of content).

The content layout is implemented using a single page for chapter with scrolling; the students can navigate on the paragraphs with anchors.

2.7 State of EAD project

The EAD project began last July and it will finish at the end of June 2006. At the moment, (B = Building) B_Climate, B_Population and B_Energy modules has been completed; and B_Ground, B_Air and B_Water modules are in the developing phase.

B_Climate represents the prototype module; it was tested on a students class, also for a preliminary evaluation of the effectiveness of the blended e_learning EAD course.

Figure 2: Informative page of the project as last results of the graphical path.

3. B_CLIMATE MODULE

3.1 Fast prototype

On the basis of the idea of considering EAD project like a spiral process, the following “scheme” has been applied: hypotheses, evaluation, feedbacks, course improving with the partners and students suggestions, step by step. For this reason, after the intense first phase of working, the first ready module, B_Climate, has been considered as prototype and tested.

3.2 Contents and tools of B_Climate

The module contains the elements and the tools for comprehending the importance of the climate-building relationship and for integrating the climatic aspects in building design (Fig. 3).

The “scripts” (basic texts of the lectures), that have as references “basic mile stones” of the related literature (ASHRAE Handbook, 2001; Szokolay, 1980; Butera, 1995; Liébard and De Herde, 1996), have been created as hypertext, with representative images (useful for memorizing), links to external web-pages, attached files for studying in depth subjects and tests (Figs. 4 and 5).

Other useful tools are interviews to experts,

Figure 3: Homepage of the B_Climate prototype module; introduction and tools boxes (in the first graphic option).

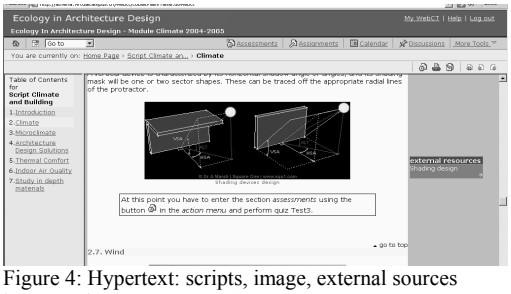

Figure 4: Hypertext: scripts, image, external sources boxes and assessment (test).

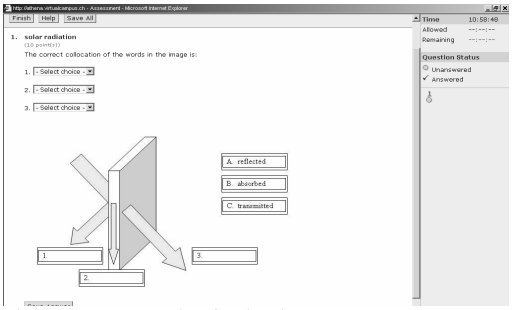

Figure 5: An example of a simple test.

Figure 6: Example of interview to the expert tool.

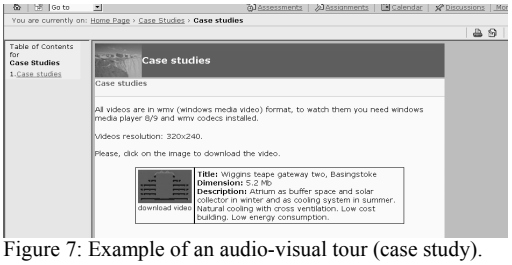

Figure 7: Example of an audio-visual tour (case study).

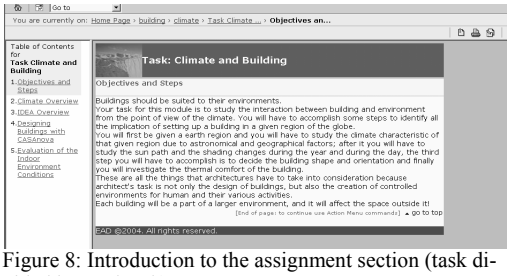

Figure 8: Introduction to the assignment section (task divided into subtask).

for example regarding the design of sustainable or bioclimatic buildings (Fig. 6); audio-visual tours of case studies (best example of realized building, designed by taking into account and valorizing climatic aspects, Fig. 7); and, of course, the task section.

For the prototype module, it has been used only one software package (IDEA software package) for supporting task activities (Figs. 9

and 10). The decision depends on practical and economical reasons. Furthermore, the tools package was chosen among the external software elaborated with the collaboration of CUEPE (one of the partners), that has a well known expertise in building climatic and energy analysis, related methodologies and supporting tools.

3.3 Testing the prototype module

The prototype was tested in an academic course of Accademia di Architettura of Mendrisio, from October to December 2004.

With an alternate scheduled timetable of ex-cathedra lectures (with presentation of realized projects) and lectures in multimedia laboratories (with content files and tools usage), the course blended, in a actual manner, the new aspects of learning into the typical academic course structure.

Figures 10 and 11 shows statistics about tools usage: the most used section is the student evaluation section (tests, task with simulation software) and the files with building images and many references to building design projects.

From students point of view, the blended course gives them much more tools for studying

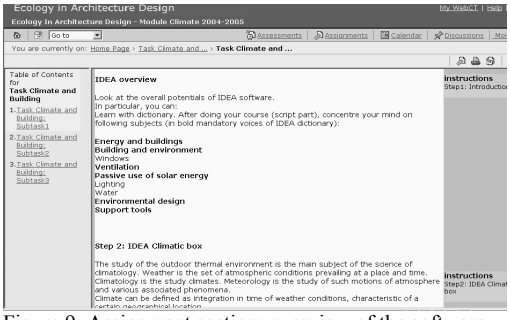

Figure 9: Assignment section: overview of the software and subtask instructions.

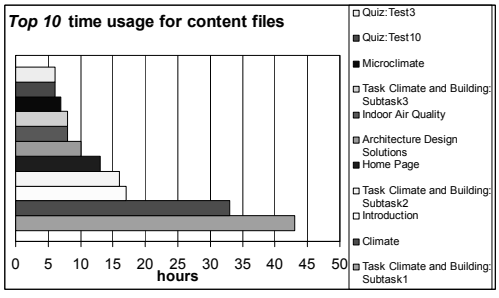

Figure 10: Usage statistics: most used files (hours).

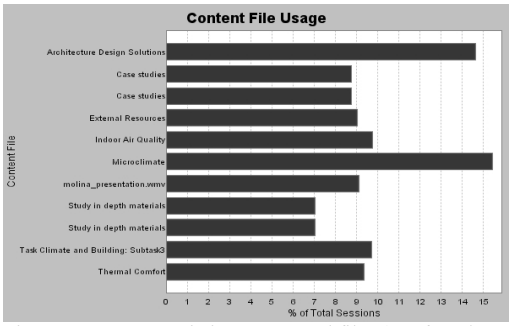

Figure 11: Usage statistics: most used files (% of total sessions).

(presentation of projects, case studies, links); further, the evaluation section is the most used, and the (simple) simulation software utilization is a key for a full comprehension of the building physics theory, like also the ex cathedra lessons.

3.4 Conclusions and developments

The results of prototype usage demonstrate the effectiveness of EAD and encourage all the partners to go on with the project composition. At the moment, an assessment has been carried out by sending students a questionnaire for an overall evaluation of the prototype (icons, web page better length, new tools, etc).

In the next future, partners would optimize the EAD tools package (maybe with the directly integration of the software in the web-platform) and to verify and to upgrade the effectiveness of EAD in architecture design laboratories.

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