

EFTWeb: a working model to support Education, Learning and Training

Luís Gouveia^a, Joaquim Borges Gouveia^b, Francisco Restivo^c

lmbg@mail.telepac.pt, bgouveia@egi.ua.pt, fjr@fe.up.pt

^a GIOTE, IDIT - Technology and Operations Innovation Group,
Espargo - 4520 - 102 Santa Maria da Feira
Portugal

^b SAGEI - University of Aveiro
Campus de Santiago - 3810-193 Aveiro
Portugal

^c FEUP DEEC - Engineering Faculty of Oporto University
Rua dos Bragas – 4099 Porto
Portugal

The authors propose a model to support Education, Learning and Training that take advantage of existing World Wide Web facilities. The model is designed to assume users (teachers and students) as clients. In particular, students can choose a particular profile, use credits, and be certified both as users and content producers. The authors believe that these characteristics are fundamental in order to support users maximum flexibility. The model can be used for both presence and distance learning.

1. INTRODUCTION

Education, learning and training is on move. Each day we see new signs of more difference between what students want, and what society needs and what institutions can do. Even the teachers seems somewhere lost by the pace of change and by the lack of interest among students to attend, discuss, and produce work in a traditional education environment [1].

Opportunities to take advantage of information technologies in educational contexts are reported by several authors: Harasim [2], Puttnam [3], and Papert [4]. In particular, it is possible to support innovation by reinventing time and space constraints in educational settings [5], or by introducing computer and network support on presence teaching [6].

Most of the systems and models reported in literature address specific areas of education, learning and training [7]. This includes a clear distinction between support for presence and distance systems [8], [9].

The current research proposes a unifying approach where a single model can respond to different education contexts. The base assumption is that current technologies and

World Wide Web use can help in getting this possible. This can lead to a redefinition of the roles and processes associated with both teachers and students activity.

This paper introduces the achieved model to be used as a reference for producing a working prototype.

2. MODEL GOALS

The proposed model is the result of the authors discussion about how can technology satisfy both teachers and students needs. These needs where compiled taking into account a society where information and knowledge represent their most acknowledged values.

The initial studies for this model where conducted by the authors in different contexts, namely, the use of laptops computers in traditional university environment [10], and Web content support for graduate courses [11].

Results are reported with figures, in [6], [10] and [12], also available online at http://www.ufp.pt/staf/lmbg/lg_com.htm. From these initial studies a number of conclusions where made:

- the need for content reuse from teachers perspective;
- the need of learning orientation from students perspective;
- easen technology learning by proving better support to access content and services;
- provide a unifying tool to use in both presence and distance learning.

The main goal of the proposed model is to offer an infrastructure for content use supporting in education, learning and training by using proven and available information and communication technologies.

In particular the model was designed to allow the following functionality:

- skills trading: tracing where to find the right content offer for each specific situation of education, learning and training;
- processes innovation: where the normal settings for traditional situations of education, learning and training can be reengineered and its functioning supported by the system;
- configuration flexibility: allowing end users to configure the system for their needs;
- contents reuse: made available contents for reuse, maintaining its intellectual property rights and tracing version changes;
- maximise benefits from content production and distribution, by allowing reuse and reference from different grouping units as disciplines, modules, or other forms of content clustering;
- create the conditions to have an education business, in particular of education contents and contexts. Made this possible by implementing a system with security considerations and some sort of mechanism that allocate to each user a number of credits that can be used and serve as pay credit for using the system.

3. ASSOCIATED CONCEPTS

In order to describe the model, we need to introduce the used concepts. These concepts are education functions, education facilities, and education actions.

By education functions we understand the four types of activities involved in the process of education, learning and training. They are:

- lecturing: the activity of content transmission and facilitation;
- certifying: the activity of validating contents and education contexts;
- evaluating: validate and assess client (both teachers and students) knowledge
- production: the activity of content creation, methodology elaboration and technology selection.

By education facilities we mean the three main groups of services that may be offered to a client of the model. They are:

- distribution: involving the communication, broadcasting, and exchange of system resources. It also, involves the security issues of using the system resources, by giving permissions, membership and resources allocation;
- content: this service includes the production, adaptation, and redesign of contents. It also include the format, codification and dimension issues used to register and represent content;
- structure: this service involves the creation of some order sequences to refer contents, and the criteria by which content is been organised. It includes the necessary arrangements to combine contents, structure them, and provide the means for content relationship.

By education actions, we propose three main education types:

- lecturing: actions that involve one individual responsible for knowledge transmission to an audience composed by group of individuals that may have different goals;
- training: actions oriented to the content, where the intended audience have common and well defined goals;
- instruction: actions oriented to the context, where the intended audience has a well know profile and a group of tasks to be executed.

From these definitions two important issues arise. First, there is a need to deal with the resources in a flexible way. Second, the resources are contents and contexts. The model must support the need to store, represent and maintain both contents and semantic of contents in order to allow contents relations in an independent and not previous known ways. This characteristic allows context support along with contents.

4. MODEL DESCRIPTION

4.1. Model approach

The *EFTWeb* model main goal is to support Education, Learning and Training activities by creating a system offering of content and context. Based on that, some customisable degrees of freedom to the education functions and facilities are assigned to each user.

The *EFTWeb* user can be an individual or a group of individuals like a class. The education functions, also presented, support the different activities involved in education, learning and training actions (lecturing, certifying, evaluating, and production). The education facilities, already presented, show a basic service grouping to support de model (distribution, content and structure).

For the access model, the idea of giving total permission to use the above model resources and facilities, and to each user assign a particular profile that defines what it can use or not use, denotes the degree of freedom with which the user can access resources.

To support it the model implements a system of credits allowing each user the access to a given resource based on a cost of each unit used on the system. Each user receives a given amount of credits that can use with some degree of freedom (based on the credits amounts, and what profile he or she has).

Another important aspect of the model is that each system user is considered a client (and treated as one!). To the *EFTWeb* model, both teachers and students are clients, giving the system maximum flexibility to design the more appropriate education action for a given situation.

One last system goal is to provide the means to contents and contexts reuse. The model allows the necessary flexibility to consider both types of user as potential consumers and producers. This way, the system provides support to organise student's works and integrate them in the content offering by appropriate control of author rights, versioning and certification of its contents.

4.2. Technology support

The *EFTWeb* model can be implemented with available technology. From the above description of facilities, it is possible to select technologies that are now well spread and used, and allow a good ratio of cost / performance.

To support distribution, the World Wide Web (Web) becomes the natural solution. It has a lot of information available that needs to be mediated for being trusted. Its information can be searchable and exists in a digital format. The Web access is possible with a personal computer (with the necessary communications hardware and software) and its cost is acceptable. We can risk saying that this can be, along with the television, one of the selected mediums to universal education distribution. Some other Internet services can be of interest and the strategy for this model is to implement them using the Web interface (the most known example is the Webmail).

To support content, the database technology was chosen. This technology eases the storage and retrieval of contents and supports multiple and concurrent access to contents. It also supports multimedia storage and logs activity. At last, provides proven means for search and dynamic maintenance of contents and model data structures.

To support structure, where relations between contents are of importance, the chosen technology was the use of thesaurus. This will provide the necessary flexibility to access content by using a set of ordered concepts that allows to store, with each content, independent semantic and high order relationships.

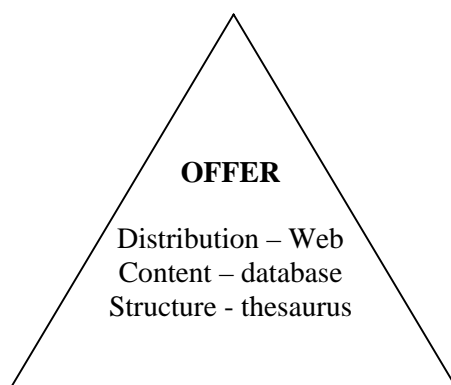


Figure 1. The offer in the *EFTWeb* model

The model proposes a system offer where each facility has a main technology support. This offer constitutes the system core and acts as its add value. Figure 1 represents the model offer.

One of the more relevant features of this model is the use of thesaurus technology to structure the offer. The thesaurus is used to describe a particular model of knowledge about a given area in terms of keywords and relations between these keywords. The resulting structure is similar to the one proposed by the Dublin Core group and provides a reference to classify content with the same keywords used in the thesaurus. The system allows the creation of several different structures in the thesaurus, for different overlapping classification systems to use at the same time. Just one rule applies, the use of a keyword must occur always with the same meaning in the same or different thesaurus.

To allow extra functionality, the model introduces the concept of catalogue, where to some or all the keywords is given a weight. This will introduce the possibility to add different views to existent thesaurus structures, where to the same conceptual relations different perspectives may apply. This is the case when we can use an agreed relation between two concepts but conflicts occur when different perspectives values in different ways those concepts. They can use the same thesaurus (structure) but need different catalogues (perspective views). This facility thesaurus/catalogues allows maximum flexibility to search the available content.

From the user perspective, the Web browser integrates system functionality by offering a common and easy to use hypermedia interface. Thus although providing a set of services using technologies as the Web, a database and thesaurus, a normal Web browser serves as its interface. This option allows for the technology integration without increasing user client complexity to configure and use. Its also allow for the use of other Internet and Intranet existent facilities.

4.3. Model entities

The entities represent the interface with external issues like the client, the security, and billing (figure 2). These three entities show a clear business orientation followed by the *EFTWeb* model. If we propose a model for support true situations of Education, Learning, and Training it is almost a high priority requirement that it support in its core, the means to consider security and billing issues as well as the necessary flexibility requirements already introduced.

This way, the entities are:

- client: includes both teachers and students and offer a unique interface to treat people. The model allows for both type of clients to be consumers and producers;
- security: deals with the need of protecting client identification, client use of the system. Other more common issues are also included like who enters the system, how assure that is the individual itself, what are the operations allowed and what can the user really do, modify, comment and add as content and context information. Notice that some security issues will be needed to use full system functionality like user knowledge assessments, and content certification;
- billing: allow the necessary arrangements to use the system in a commercial way, where different types of promotions, paying programmes, and fees can be used.

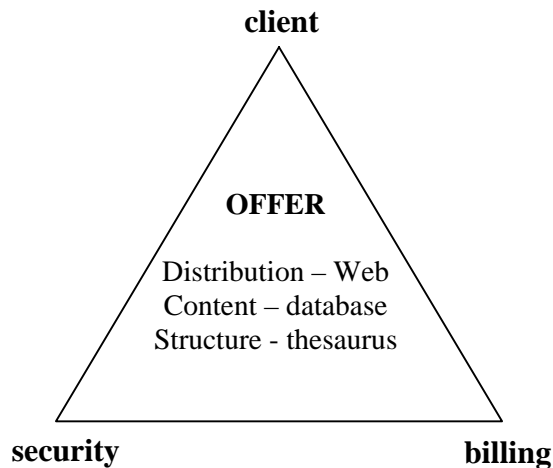


Figure 2. The entities in the EFTWeb model

4.4. Model mechanisms

The model mechanisms are used to interface with the entities already presented. The mechanisms receive the information from corresponding entities and provide the necessary information processing and storing for deal with entity requirements in a flexible and independent way. So, for each entity, the model offers a correspondent mechanism that acts like a system translator between each entity requirements and the functioning of the system to provide the correct action with the offer (see 4.2 for the offer definition). The three entities have equivalents as mechanisms in the model: the client has scripts; the security has profiles; and billing has credits.

The model mechanisms (figure 3) can be defined as:

- scripts: having the distribution, content and structure as an organised and available offer, to each client (or group of clients) can correspond a particular path that shows a valid and base set of selected offer to be include to a given client use;
- profiles: corresponds to how each client (or group of clients) can interact with the offer, by allowing different levels of functionality to take place, like using, reading, executing, commenting, adding, certifying, evaluating and more actions to be defined;
- credits: systems that allow the provisions to the client use and interact with the offer in a cost based approach. Each content and each kind of interaction can cost or give credits. The credits allow also some system usage regulation, once the total number of credits is known both by the user and the system and can be used to control usage, acting as a system regulator. To the client have access to more content about a given theme, the credits can be used as some sort of trade off of how many credits he or she have and how many he or she need to complete the chosen script. For the system, knowing how many credits where given, allows for a more precise system operation management. The credits mechanism interact with the billing by allowing a internal unifying cost usage and commercial independent prices, once the same credits can have different costs for different types of user or users enrolled in different programmes. This also allows the system use in a business oriented perspective.

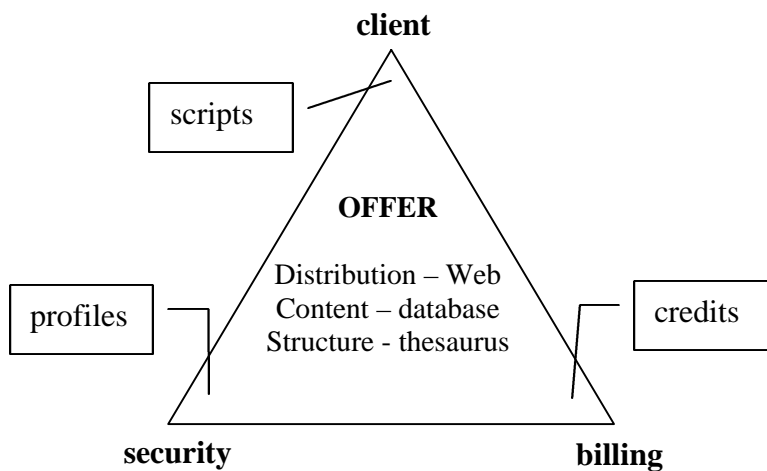


Figure 3. The mechanisms in the EFTWeb model

4.5. Model services

With the offer, entities and mechanisms the model define all the relation from the client until what the system has to offer, presenting the business perspective in which the model was designed. Once the system core deals with the use of Web, database and thesaurus technologies, organised with the already described mechanisms, it is necessary to support a number of services that can treat the relation between the offer and the client according to given processes. This need will be accomplished by the services that provide the interface to use the model mechanisms and offer.

Three types of users were considered. The normal user can be a teacher or a student. The administrative users are responsible for the normal definition of the system offer and data operation. There are two types of administrative users: the ones that deal with the base offer definitions and the thesaurus administrative users that are responsible for maintain the thesaurus to be used.

The model propose two types of services: the administrative services that allow users with proper rights (administrative users and thesaurus administrative users) to enter the information necessary to the system operation, like user information, and offer content and structure.

The administrative services are:

- certifying and authoring: certifying contents and authoring scripts;
- version control: promoting and maintain related content collections;
- catalogue creation: complementing the thesaurus with additional information by introducing lists of available thesaurus keywords with weight factors.

The operational services include, among possible others (not yet defined), the following services:

- client interface;
- scripts generation: prepare new scripts by compiling a list of related system offer to be include in the script along with its sequence;
- assessment facilities to evaluate client knowledge about a given script;
- keyword search engine, that allows users to search for related content available in the system offer and not included in the script. This facility uses the thesaurus and catalogues to provide a structure and a weighted view of the structure.

5. COMPARING EFTWEB WITH OTHER SYSTEMS

A number of existent systems offer Web based learning environments similar to the EFTWeb. Among them several have been compared with EFTWeb [13]: *AulaNet*, LES, PUC - Rio, Brazil; *Classnet*, Iowa State University Computation Center; *LiveBOOKs*, University of Waterloo, Ontario, Canada; *Learning Space*, IBM/Lotus; *Serf*, University of Delaware; *Virtual-U*, Simon Fraser University; *Web-Course-in-a-Box*, Virginia Commonwealth University; and *WebCT*, University of British Columbia.

Figure 4 gives a brief comparison of these systems including EFTWeb. Notice that two of the EFTWeb strengths are its ability to deal with both presence and distance education and support learning and training activities with the same set of services.

	AulaNet	Classnet	EFTWeb	Learning Space	LiveBooks	Serf	Virtual-U	WCB	WebCT
1	- interest group - discussion group - message to teachers - conference/ Debate	- electronic mail - Net forum - conference/ Debate	- electronic mail - discussion group - conference/ Debate	- electronic mail - discussion group	- teacher contact - tutor contact - monitor contact	- interest group - discussion - teacher contact - conference/ Debate	- electronic mail - discussion group - debates	- teacher contact - conference/ Debate - WCB Forum	- electronic mail - discussion group - conference/ Debate
2	- agenda - course news and warnings - classes - registry and students info - documents and content certification	- password management - registry and students info - delivery deadlines	- agenda - password management - registry and students info - content classification	- agenda		- agenda - course news - registry - progress monitoring and success prediction	- agenda - progress tracking	- agenda - course news	- news board - marks announcement - course tracking
3	- tests - projects - exercises - tasks - assessment - results	- exercises - tasks - projects - results	- exercises - tasks - credits	- exercises - tasks	- self assessment	- exercises - tasks	- exercises - tasks	- exercises - results	- periodical - tests
4	- class plan - recorded presentation - slides - class text - book text - demos - bibliography - Internet references - individual notepad - remote control	- accomplished integrating other products Classnet is a management tool	- guides - units - contents - shared folders - documents, support material	- media center	- LiveBOOK - footnotes - electronic library	- class plan - class text - multimedia resources	- seminars controlled by students - team projects - goal manager - real time conference	- slides - Internet references	- indexed glossary - annotation facility - course reference material - shared interactive whiteboard
5	- profiles - Internet tutorials - student homepages - search engine - statistics - content reuse		- profiles - individual folders - search engine - thesaurus - statistics - content quantification and qualification - content reuse	- student and teacher profiles - evaluation manager		- assistants for system use - search engine	- statistics - resource sharing	- students homepages - teachers homepages - WCB Forum	- students presentation area - indexed image files - search and automatic classification
6	- yes	- yes	- yes	- yes	- yes	- yes	- yes	- no	- yes
7	- yes, possible to adapt to any language	- yes (with Java Classnet)	- currently no, but possible	- no	- no	- no	- no	- no	- no

Figure 4. Comparing EFTWeb with other systems [13] (legend: 1 - communication tools; 2 - administrative tools; 3 - assessment tools; 4 - pedagogical tools; 5 - system support tools; 6 - cooperative support; 7 - multilanguage support)

6. CONCLUSION

The *EFTWeb* model proposes a technology infrastructure to support Education, Learning and Training in a flexible and integrate way. It considers both teachers and students as consumers and producers of content and integrates the notion of education contexts as possible to be represented in a database format. The system also proposes a solution for reuse contents and trace them in a way that take advantage of the potential of having a group of people producing content (students) that, most of the times, is not used by others or integrated into available databases for future reference.

Regarding the education actions, where we define three different types (lecturing, training, and instruction) we propose a possible implementation for their integration in the system, based in the scripts mechanism. This way, when we consider each one of the three education actions we can characterise them regarding the model offer:

- lecturing: from the offer to the client
- training: from the client to the offer
- instruction: adapting the offering to the client

The *EFTWeb* model implements these concepts using the script mechanism:

- lecturing: previous prepared scripts
- training: customised scripts
- instruction: ordered scripts

The proposed model is still on development but from its current prototype and preliminary use shows how actual technology can assist in education, learning and training, and how it can help not just as support but also to reinvent it.

7. APPLICATION AND FUTURE WORK

A prototype is currently been developed to implement the *EFTWeb* model. A working version can be tested in the following url: *194.79.88.252/Contacto* (you must ask for a password to access the system).

Based on the current prototype, the model is further enhanced to the need of its prime contractor. Its use will be as a support for distance and distributed training for graduate students where each student contribution (works, essays and information) must be offered to the others and used according to well precise quality rules.

Its use on real education settings is planned to the first semester of the year 2000 in two classes of graduate students, as a support system for presence teaching. The evaluation phase will lead to the necessary corrections in user functionality and practicalities of a real system to support education actions.

REFERENCES

1. L. Gouveia, Expectativas dos alunos em relação ao seu curso e saídas profissionais. UFP relatório interno. February (1998).
2. L. Harasim et al., Learning Networks. The MIT Press. (1995).
3. D. Puttnam, Communication and Education. The Ninth Colin Cherry lecture. Imperial College, London. June (1996).
4. S. Papert, The Children's machine. BasicBooks. (1993).

5. L. Gouveia, On Education, Learning and Training: bring windows where just walls exist. UFP Journal, Edições UFP. No 3 (1999) May. ISSN – 0873-8181.
6. L. Gouveia, Digital Support for Teachers' Teaching. Current Experience on Using Internet Facilities in Virtual University Environments. Educational Media International Journal, Routledge. Vol 36, no 1 March (1999). ISSN – 0952-3987.
7. M. Moore and G. Kearsley, Distance Education. A Systems View. Wadsworth Publishing Company. (1996)
8. L. Harasim, A Framework for Online Learning: The Virtual-U. Computer, IEEE Computer Society. September (1999).
9. LES (Laboratório de Engenharia de Software), Projeto AulaNet. Ajudando Professores a Fazer seu Dever de Casa. PUC, Rio de Janeiro. Brasil. (1999).
10. L. Gouveia, The NetLab experience. Moving the action to electronic learning environments. In Proceedings of BITE International Conference, Maastricht, The Netherlands, 25-27 March. (1998).
11. J. Gouveia, F. Restivo, L. Gouveia, Integração e convergência no ensino, formação e treino. Uma proposta para a criação de redes de competência. 2ª Conferência sobre Redes de Computadores. Évora, Portugal. 18-19 Outubro. (1999).
12. L. Gouveia, Group Assessment: alternative forms to evaluate student skills. Revista da UFP nº2, Vol. 2, pp 519-526. Edições UFP. ISSN 0873-8181. (1998).
13. F. Lima, Prototipagem rápida de conteúdos e sua formalização para a Internet. Master Thesis. FEUP-DEEC. University of Porto, September, unpublished. (1999).