EFT*WEB*: AN APPLICATION TO SUPPORT SKILLS TRADING WITHIN EDUCATION, LEARNING, AND TRAINING ENVIRONMENTS

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ABSTRACT

The EFT*Web* is a World Wide Web based system that allows the interaction between users and contents. The users can be students and teachers that place, modify and use available contents. The system provide the means to control security, intellectual property rights, and billing issues, giving both type of users the necessary tools to access the system, organise materials and use them.

Although the core system relies in a database to store the system usage, it uses market concepts to support its operation, implementing client issues, security and credits as a reward currency.

The paper describes the application and discusses the role that systems like this one can have in modifying the traditional skills relationship in education settings between teachers and students, both in their skills and roles.

Keywords:, advanced network applications, World Wide Web, educational systems, databases, content management.

INTRODUCTION

Managing World Wide Web based Education, Learning and Training environments may require the integration of several operations concepts. The EFT*Web* system has been designed as a business support system, where all the interactions between users and the system are treated as business operations.

The paper describes the EFT*Web* system and presents its novelty regarding use and impact for modifying the traditional skills relationship in education settings. The paper ends up discussing why EFT*Web* can enhance operations management in delivering Education, Training and Learning by means of flexibility, diversification and differentiation.

THE EFT*WEB* SYSTEM

Based on a current project to support distributed education with strong co-ordination requirements, the authors developed a framework to assist education, learning and training needs using common available technologies like the World Wide Web (Web) and databases.

The framework is supported by an infrastructure that deals with structure, security and intellectual property rights - IPR - issues (Gouveia, 1999). This will lead to a novel

propose of a value added chain for the education business, where teachers and students play an equal part on the system as producers and consumers.

The system aim was to support with maximum flexibility both teachers and students and treat them as clients that produce, share and consume contents organised by well known sequences that can be customised according to different situations regarding the context of education, learning and training.

An issue also to be satisfied was the need of reuse ability. The concept of using the same materials and efforts in similar educational situations has been pointed as one of the major goals for several information and communication technology - ICT - systems proposals (Britain, 1999).

Motivation for research

The initial research motivation can be stated as (Borges Gouveia, 1999):

- find better ways to facilitate education, learning and training support, taking advantage of existent widespread technologies;
- allowing to transform information and knowledge into skill;
- innovate in the learning process, by letting the user learn by doing;
- allowing system application to multiple knowledge areas;
- allowing content access, communication and broadcasting in multimedia format;
- fostering the development of skill networks.

The motivation for a content management support to organise access and use of educational materials was also based in the assumption that it is possible to extend current Web use. Current Web use is more focused in following a digital library paradigm and add remote facilities for information access as discussed in (Gouveia, 1998a). An alternative is to take advantage of the Web to rethink the education and learning process (Gouveia, 1998).

EFT*Web* model

Here follows a brief description of the EFT*Web* model as presented in (Gouveia, 1999). The model approach, technology support and mechanisms are introduced.

Model approach

The EFT*Web* user can be an individual or a group of individuals like a class.

The idea for support maximum flexibility in accessing content is to give total permission to use available resources and facilities by assign a particular profile to each user that defines what it can use. 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!). 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.

Technology support

The EFT*Web* model is implemented with available technology. To support content distribution, the 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. Web access is possible with a personal computer and its cost is acceptable. Other Internet services can be of interest and the model proposed its implementation using the Web interface (an example is *Webmail*).

To support content, the database technology was selected. 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. It also provides proven means for search and dynamic maintenance of contents and model data structures.

To support structure, where relations between contents are of importance, thesaurus technology was selected. 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.

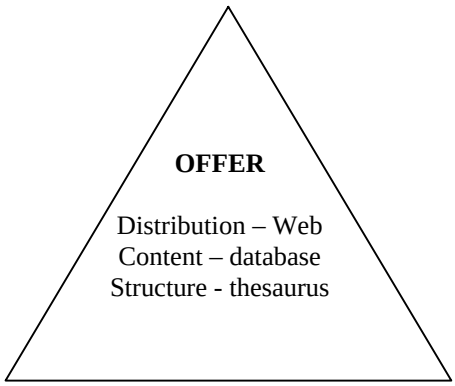

Figure 1. The offer in the EFT*Web* model

The combined use of Web, databases and thesaurus technologies are designed as the support for the system offer - distribution plus content plus structure - and constitutes the system core added value. Figure 1 represents the model offer.

One of the more relevant features of this model is the use of thesaurus technology to structure content. 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 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.

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 use also allows integration with Internet and Intranet existent facilities.

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 EFT*Web* 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.

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 and 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;

- billing: allow the necessary arrangements to use the system in a commercial way, where different types of promotions, paying programs, and fees can be applied.

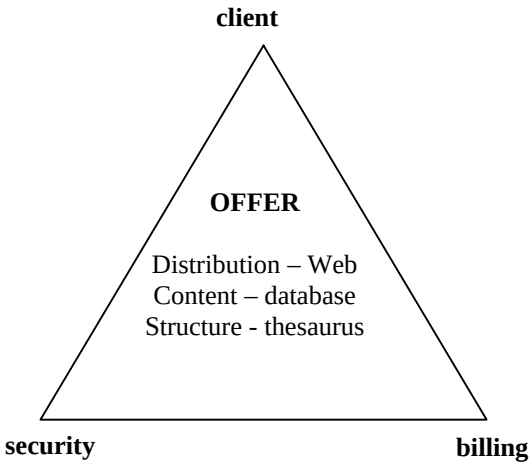

Figure 2. The entities in the EFT*Web* model

Model mechanisms

The model mechanisms are used to interface the offer with the entities 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.

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 system offer.

The model mechanisms (figure 3) are 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. In order a client access content about a given theme, credits must 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. The credits mechanism interact with the billing by allowing a internal unifying cost usage and commercial independent pricing, once the same credits can have different costs for different types of user or users enrolled in different programs.

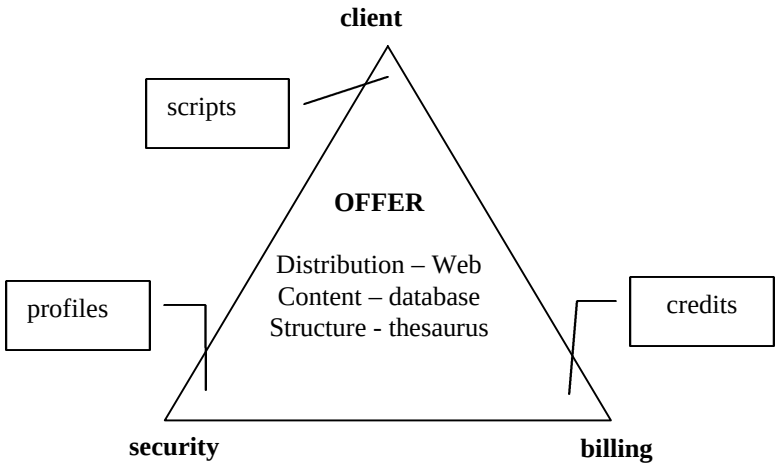

Figure 3. The mechanisms in the EFT*Web* model

EFT*Web* services

With the offer, entities and mechanisms the *EFTWeb* model define the relation between the client, the support and the offer. The system core deals with the use of Web, database and thesaurus technologies, it is necessary to support a number of services that can treat the relation between the offer and the client according to given processes.

Three types of users where 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 multiple thesaurus.

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 current implemented services - for the normal user - were described in detail in (Borges Gouveia, 2000). They are:

- mail: each client must have access to its own mail address to send/receive messages;
- dialog: allow client chat in real time. The service is organised in rooms that group users with the same topic interest;
- personal area: works as the system portal, proposing to the client a link collection;
- personal folder: it’s the place where the client place his documents with the option to share them;
- search engine: available in two modes - textual search and thesaurus (by directory);
- guides: this facility defines the content sequence - "knowledge road" - to be used. It groups other guides, units, and content.

EFT*Web* prototype technology

A working EFT*Web* prototype can be tested in the following *url*: *http://194.79.88.252/Contacto* (you must ask for a password to access the system). The EFT*Web* prototype was developed using the following software development platform:

- web engine: Microsoft Information Server IIS 4.0;
- database engine: Microsoft SQL Server 7;
- programming language: HTML 4.0, CSS for web page styles, Microsoft ASP (server), and JavaScript (client).

SYSTEM NOVELTY

The system was designed to support innovation in giving lectures and training. The authors propose a flexible system, already in use, Web based and fully operational to support the following goals:

- provide teacher / students communication using actual Internet facilities, integrated in a same, consistent Web interface (thus minimising system impact to newcomers – usability issues);
- allow the separation between content production, content certification, assessment and lecturing as independent activities in the learning process;
- support for continuity in the use of produced contents (both by teachers and students);
- allow an easy interface to administrative support for teacher material reuse;
- augment the students involvement in content rating by supporting rating and comments / annotations about each particular content in the system;
- support students usage monitoring based on a credits scheme that allows selling and buying contents (making each user a potential producer/consumer);
- support content classification based on a thesaurus system that allows more abstraction and flexibility in the contents search;
- provides a framework to include high level services that use the system, as automatic assessment and 3D interactive visual interfaces.

Impact in education settings

We can consider four types of activities involved in the process of education, learning and training, we can enumerate (Gouveia, 1999):

- 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.

In (Gouveia, 1999) we also propose three main education types based on current education, learning and training activities:

- 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 available resources in a flexible way - specially the ones concerned with content. Second, allow combining types and education activities for extending and describe resources as contents and contexts in the EFT*Web* perspective.

EFT*Web* proposes a model to 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 also with semantic support given by using thesaurus technology.

Considering the activities versus the education types we found that each education type focus on a different set of most important activities. Thus, supporting both activities as separate functionality can lead to a more flexible adaptation of the EFT*Web* system to each of the education types. This allows for a single system the possibility to integrate all the three education types as showed in table I, by supporting the more related activities.

	Lecturing	**Training**	**Instruction**
Lecturing			
Certifying			
Evaluating			
Production			

Table I: education type versus activities in the process of education, learning and training

CONCLUSIONS

Current efforts focused on testing and further developing the existent system. In particular, three work areas are proposed:

- assess the system use in various educational contexts, regarding lecture support, training and instruction activities;
- research for best practices in EFT*Web* use;
- develop other system services to take advantage EFT*Web* core system.

These directions allows for content classification, processes, use methodologies and technology enhancement which can lead EFT*Web* to be considered as a valid and mature ICT product for educational use. Offering EFT*Web* as a means for delivering Education, Training and Learning regarding three main goals:

- flexible: concerning the production process. The production includes contents, thesaurus and guides;
- diversification: by means of reusing existent content in new guides (contexts) and upgrading them with new contents or improving the existent contents;
- differentiation at the product level, by offering content and guides for satisfying each client needs.

These can be considered as core characteristics to support operations management taking EFT*Web* as a transfer function for an information base supply channel.

The authors defend that already available features of the EFT*Web* system can be used for both presence and distance education (Borges Gouveia, 2000a) as well to satisfy the described three education types.

EFT*Web* can be of help in the emerging of new approaches to the education business not only by supporting but also for packaging contents and facilitate its management.

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