

# A FRAMEWORK FOR THE DEVELOPMENT OF UNIVERSAL NETWORKING LANGUAGE E-LEARNING USER INTERFACES

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**Abstract** — *The UNL infrastructure aims to overcome the language barrier on the Internet. At the same time, distance learning (DL) is becoming the best way to promote the knowledge diffusion across countries. However, the distance learning process still presents some obstacles to be overcome. The UNL can help to reduce particularly those problems and to provide a common educational environment across different languages. This paper discuss the development of the UNL version of an existing web platform for distance learning. The overall goal of this project is to create a framework to support the development of UNL user interfaces applied for e-learning platforms.*

## INTRODUCTION

This paper presents part of a research project that aims to build an e-learning platform using Universal Networking Language (UNL) technology.

It involves the prototype development of the UNL version of an existing e-learning platform called VIAS-K (Virtual Institute of Advanced Studies - Knowledge Environment). This platform is provided by the Distance Teaching Laboratory, LED, from the Federal University of Santa Catarina, UFSC, Brazil [15]. It supports a huge group of interactive models composed of actors, contents, management, users support and collaborative tools. In order to full fill each user's specific needs, these models will consider also the variety of users' mother language, based on the UNL system.

Although UNL have been developed with success, it is still a brand-new technology [17]. It is an artificial language that exchanges the knowledge from a natural language to make possible the access of its content through different languages. With the purpose of promoting the development of UNL and the effectiveness of DL, this research proposes a case study that brings UNL into the existing VIAS-K environment.

A framework for UNL user interface design will be established in order to help developers to well represent e-learning contents from diverse linguistic sources and cultural backgrounds. Its research includes the implementation of modules that will allow the visualization of the case study in three natural languages: Portuguese, French and English. Moreover, it may contribute to expand both fields of research, UNL and DL, through its diffusion by an e-

learning application. The project takes in account graphical user interface principles and ergonomics aspects as well as usability ones.

In this prototype, the UNL infrastructure of multilingual functions is being used: 1) to generate a framework for UNL user interfaces applied to e-learning platforms as well as subsidies to build a guideline for UNL interfaces in general; 2) to create new concepts to the UNL KB (new UWs); 3) to provide visualizations of VIAS-K platform in different languages; and 4) to improve what is known in the fields of UNL and DL.

## BACKGROUND

Education in its several modalities has become more and more indispensable to the formation of highly skilled professionals that can really answer the needs of the globalized market. The power of knowledge and principles becomes part of a system of innovations, not a moral or cultural force, but an incubator of new industries in an economy dominated by technology [15].

Higher Education Institutions need to work along with the productive sector in order to satisfy the demands of professional formation and qualification, as a consequence of the following aspects [7][13]: a shift from the model centered on the campus to a model centered on the student; greater flexibility of the teaching institutions for their own survival; a considerable increase of the demand for further education, having as a common cause the continuous teaching and, consequently, generating the need of increasing the number of places to satisfy it; social pressure for knowledge (globalization, productivity, explosion and generation of new knowledge).

The factors abovementioned show that the educational system is not ready to develop in the same pace of the technological changes. Therefore, it is necessary to search for new approaches to the training of learners within a new enterprising vision. Thus, the most reliable way for an infrastructure of education passes through a change in the existing educational model. The adoption of distance educational programs along with the use of other media seems to be a possible solution. In addition to it, it is necessary to improve the development of environments with several languages to reach the maximum of people. A Technology such as UNL combined to the construction of

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friendlier user interfaces will certainly make use of all the Internet potentiality to help in the diffusion of knowledge across the world [4].

It is paramount to insist on continuous, open, personalized and collaborative education that allows individuals to update their knowledge throughout their professional lives, no matter their geographic or temporal settings;

### **E-learning Platforms**

Over the last years, attempts have been made to allow the construction of learning platforms that can make possible the transmission of contents in an efficient and meaningful way by Internet.

According to Rosenberg [11], “Web-based technology is the key to a deep revolution on learning». The challenge is to transmit the information to reach the greatest possible number of users, independently of different features and purposes. In this context, the development of web applications is required to allow the transmission of content in many different ways and to many different kinds of users, leading then through the environment and customizing it to every need and goal.

In VIAS-K's case, many different parameters can be adapted, considering all the different styles of users (actors) that use the platform. Each user category may have an adapted platform in terms of content, navigation bars, and interactive tools.

VIAS-K platform target audience is performed by isolated and geographically dispersed students that are looking for specific kinds of knowledge (knowledge on demand) and by specific institutions interested in promoting web-based closed courses for its collaborators.

Among it we believe that the experience of VIAS-K is a good case to be developed as an UNL application, since it introduces an important issue to the e-learning field: it is a case where the user, developer or administrator have the power to customize the interface. Thus, why not make it really universal, giving the user the possibility to visualize the contents in this/her mother language? The VIAS-K platform is presented as a case study model to diffuse the knowledge across different countries, and contribute to the United Nations initiative of creating a multilingual infrastructure on UNL.

### **UNL and Distance Learning**

The UNL is a multilingual system that involves linguistic aspects besides engineering ones. Although it is still at an early stage of application development, most of the research for establishing it as a valid tool to overcome linguistic divide has already been done, since 1997, by 16 computational linguistics research groups all over the world [18] [19]. The reason why UNL is being adopted in this project is because it is an emerging technology that will be largely used in the Web. To substantiate this fact one can be

aware that the patent of UNL was requested by the UNL secretary general itself.

Although most of the UNL infrastructure and architecture has been already researched and designed, there is still a lot of work to be done. One of the goals to be reached during the UNL application development process is how to represent the distribution of a same textual content in different languages, considering graphical user interface elements and its ergonomic rules. Since it must be adaptive, it is necessary to research and develop techniques that allow making standard user interface principles applicable to them.

In order to assure its functionality and aesthetic, it is needed to situate its special interface issues in the context of HCI-systems (Human Computer Interactions) [1] [2] [3]. The application of usability evaluations of the text content as well as the textual menus and the labels for the navigational task may contribute to provide the desired framework.

Considering the DL context, UNL can be used to increase the use of the technology, since it allows a broad diffusion of the information, extending its range to people outside of a specific place. For instance, the same course directed to people from Swiss could also be taught to people from Egypt or Brazil. If the content of the course is made with UNL, the students who will access the course will be able to understand its content when they get into the learning platform. In other words, people from different countries living far from each other, will be able to share their experiences in the same environment using their own language.

In the VIAS-K application, UNL may be used to represent the text included in the contents. The existing texts will be translated according to the language selected by the user when s/he first accesses the environment. Technically, UNL will represent all the text as UNL sentences. The UWs will be chosen and the UNL sentences will be built. After that, the dictionary entries will be selected to every language that it is going to be able to translate. The last step is to build the set of rules to execute the translation. With the sentences and the language and rules dictionaries, a “proxy” will be built to allow the interpretation of the UNL by a browser.

Even though UNL is not totally developed yet, experiments carried out worldwide have shown that it has a great potential, and that it can be one of the ways to answer the ever-growing demand for education across the world.

### **THE CASE STUDY**

To achieve the HCI case study diagnosis the Shneiderman's taxonomy [12] is established as the basis for the usability evaluations. This approach may guarantee the analysis of usability and HCI rules requirements.

Finally, the framework will be generating based on the evaluation. As a result, it may contribute to the proper design and represent of UNL e-learning user interfaces for a

universal understanding as well as to improve the power of UNL system's communication.

The UNL VIAS-K version being here proposed will be built to allow comparisons with the original one. For validating a new proposition, which will be generated through Shneiderman's taxonomy [12], tests will be applied using both the original VIAS-K version, in Portuguese, and the UNL version, in English and French. In the first case, the tests will take place with Brazilian students at UFSC. In the second one, the tests will happen in Switzerland, with students at UniGE (University of Geneva).



FIGURE 1: TWO DIFFERENT COURSES ON VIAS-K PLATFORM

### The evaluation of VIAS-K UNL version

Although the UNL version of VIAS-K is still at an early stage of development, its construction can be helpful in providing theories for UNL interface design. Therefore, it may be helpful in defining e-learning systems properties and situating its special interface issues in the context of HCI (Human Computer Interaction) field. Nevertheless impressive researches about adaptive approaches to user interface design have been made and analyzed, a few recommendations have been led, in order to give a briefing of its task performance. This topic intends to establish a sort of considerations about VIAS-K UNL version design as a way to point out some criteria for the design of the e-learning user interface.

The prototype is currently being implemented. The first part of the project focuses on designing and prototyping the chose content in there natural languages: English, French and Portuguese. To achieve it, the following UNL elements are being developed:

- UWs related content;
- UNL sentences;
- English, French and Portuguese dictionaries and grammar rules;

After that, the UNL system will be implemented into the VIAS-K platform.

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In order to produce an equivalent UNL for a the original VIAS-K contents, the UNL editor of the appropriate Language Server will be used to start the process called "enconversion". After that, the UNL viewer is used to "deconvert" the UNL text into the user's natural language, by using the UNL viewer of hi/her appropriate Language Server.

### FRAMEWORK FOR THE DESIGN OF UNL E-LEARNING PLATFORMS

According to Shneiderman [12] the user interface designers must: "try to predict subjective satisfaction or emotional reactions". It implies that the user may have control on what he wants to see.

Control is only one of the eight golden rules, presented by Shneiderman [12] based on his user interface studies. It is considered that these are the rules that can assure a successful interface. They are used to formulate the proposed earlier framework, which is presented below. This framework corresponds to the rules that will be applied to evaluate the comparisons between the use of the original platform version and the UNL one. They comprises:

**1) Consistency:** Set standards and keeping the elements of design, specially the navigation and support menus, located in a consistent way from screen to screen, from version to version and from window to window, independently of the labels and text blocks visual mass. According to Shneiderman [12], identical terminology should be used in prompts, in menus and help screens. It means that the UNL system may be planned in order to assure a consistent customization among all the language possibilities that can be displayed. A consistent presentation of menus allows the user access then during the whole interaction, which helps to reduce the disorientation caused by many levels of contents. This concept includes standards qualities of graphic design like: a) Grouping: group elements by connecting the items that are similar, such as content, navigation and support menus on the screen; b) Hierarchy: display established groups, such as navigation menus and hyperlinks, in a logical sequence according to the target audience and the context of tasks to be performed; c) Relationship: reinforce grouping and hierarchy by supplying elements related to each other through the use of colors, image representation, alignments, etc [1] [5] [8] [9];

**2) Shortcuts:** Frequently users prefer carry out then tasks faster, which means a reduction in the interaction processes. Shortcuts can enhance tasks procedures (choosing and performing actions faster). A good adaptation may allow the representation of actions and tools by its initials, which may be dynamically adapt to the different languages that the UNL system can present. Another important thing to be carried out involve the use of icons [6]. The iconic signage for menus, actions and tools has cast doubts. All the people

recognize not all the symbols. In an international interface, the icons must be integrated with words in the same small communication unit, at least by a "tool tip". The native language of the user may also convert this small text unit.

**3) Feedback:** It is important to provide feedback during the whole user navigation as well as while the user access the website. We believe that in the case of an e-learning platform, which uses UNL technology, the system may react promptly on the whole application to avoid subsequent delays.

**4) Closure:** To measure the duties amount (that the user will have to accomplish in the platform) or how long it will take to navigate (searching for tasks or accomplishing some goal) can be stressful and discouraged. Grouping tasks and let the user know how much effort it will take to accomplish assignments and/or how much longer it will take to navigate are important issues to motivate the user. This will also provide us a feedback of the UNL translation, since we can make comparisons between the original and the UNL versions of VIAS-K.

**5) Error:** Either anticipation or handling should be considered for any sort of application. A common error that can occur in a user interface is the bad text position that may be consequence of bad adaptation or can be caused by bad interpretation of the content, menus navigation and labels, as well as dialog boxes texts.

**6) Reversal of actions:** According to Shneiderman [12], the actions should be reversible as much as possible. It has to do with the control and the feedback properties, and all of them together can assure the user satisfaction. An UNL application must keep both the web browser and the navigation menus always present in all pages, so that the actions of going "forward" and "backward" can be made independently of the browser. That's why it is important to assure the good translation of menus and navigational tasks.

**7) Control:** Give to user the power to control his actions rather than make him follow or respond automatic events will promote more involvement and better results throughout the interaction. The purpose of the UNL system is to facilitate the communication rather than creates a negative reaction of the user against the bad control over system's adaptation options. That's why it is important to make as much options available to the user as possible, in an organized way, aiming to help the user on his own decisions about the languages he/she want to receive the information [8] [10].

**8) Reduce short-term memory load:** In order to assure comprehensible text displays, it is essential to consider that information load is quite big to be remembered by the user. It is important to keep the whole interface simple, especially because in the case of the UNL version it may become understandable in any state of customization.

Our future work is the validation of the VIAS-K platform UNL version, based on these rules presented above. The product of the

evaluation may allow us to reformulate the proposed framework, based on its effective results.

## FINAL CONSIDERATIONS

All of the aspects cited above can be considered a challenge for UNL developers. This paper describes the prototype that is being developed as a current project for web-based distance learning. Starting from its development experience, it will be possible to describe a number of issues and techniques that may be considered to help enhance the presented framework for the development of UNL e-learning environments as well as user interfaces for general UNL applications. This classification may help web designers to achieve an effective and harmonic UNL interface, the activeness of usability and assure the 8 golden rules.

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