

*Analysis, design, implementation and pilot testing of the Information Systems based on the Teaching Management Portfolio from the Facultad Regional Multidisciplinaria de Carazo Professors, for decision making (UNAN-Managua)*

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## ABSTRACT

This research work resulted in the creation of a support system for decision making in order to improve management and control of the Teaching Portfolio, which is a fundamental practice in higher education institutions and also contribute to the management of organizational knowledge. The research was developed for the Facultad Regional Multidisciplinaria de Carazo (FAREM-Carazo). It brings the processes improvement about registration and management of experiences, evidences and teaching practices. The final results of the study were: the choice of an alternative technology development, analysis, design, implementation of a system with solidly structured components, based on the theoretical elements of the Teaching Portfolio and the validation of its use through tests of usability that allowed to measure the level of acceptance by the teachers who were trained in the use of the tool. This system makes the management of organizational knowledge and the right decision making possible and serves as an aid tool for the insertion of young teachers, thus allowing, to a large extent contribute to the automation of institutional academic processes.

## INTRODUCTION

Nowadays, Information Systems facilitate the recording and management of large volumes of data that can be easily processed in a matter of seconds, and that give as output, relevant information to make right decisions in the different areas in which these systems are used. In the context of higher education institutions, decision-making systems are of great importance in order to carry out the management of organizational knowledge, which is one of the most important, but the main asset that is handled in this Type of institutions, intensive in knowledge.

In order to carry out the above, it is necessary that this knowledge could be evident and recorded in some way by the people who generate it, in this case, University Professors, and for this, instruments are needed to enable registration of the experiences and evidences of the

activities of their daily work. In the case of the present study, this instrument is the Electronic Teaching Portfolio, whose purpose, according to Cano (2006), although presented as a formative instrument, is a resource to evaluate the teaching process, while the teacher is also documenting it. For Zubizarreta (2004), the purpose of the Electronic Teaching Portfolio, among other things, is to document and evaluate what has been learned in the teaching-learning process; This as a way of knowing the weaknesses and strengths in the work of teaching.

The concept of the Electronic Teaching Portfolio has been formally introduced at UNAN-Managua through the “Initial and Permanent Training Program in University Teaching Strategies of UNAN-Managua Teachers”, carried out in 2012, with the support of the Universidad Autónoma de Barcelona (UAB) and the financing of the Agencia Española de Cooperación Internacional para el Desarrollo (AECID).

Among the topics addressed by the above-mentioned program, special emphasis was placed on the Electronic Teaching Portfolio, on which a series of trainings were carried out and then replicated by the participants in their corresponding academic units. Subsequently, as part of the follow-up to the program, some very basic computer works related to this concept were developed by students of the Information Systems Engineering Major from FAREM-Carazo and under the guidance of some teachers of this faculty.

The application of the concept of the Electronic Teaching Portfolio, although not as recent, has been gaining momentum in many important universities in the world, as a space oriented to the management of information and knowledge of teachers, based on a reflection and an analysis of the teacher and their superiors, that facilitates the decision making on different processes of the academic management of the institution. The Teaching Portfolio motivates teachers to reflect on their performance as a facilitator of knowledge development, so that they evaluate themselves during the process of their teaching. That is why efforts have been made to develop information systems that register the performance of the teacher from their work within the institution, allowing this information to be kept in an orderly and structured manner, facilitating its sharing with other teachers.

In this sense, the “Management Information System for Decision Making, based on the management of the Teaching Portfolio of the faculty of Facultad Regional Multidisciplinaria de Carazo (FAREM-Carazo), Universidad Nacional Autónoma de Nicaragua, Managua (UNAN-Managua)” Is cataloged as a research and development work, framed in the line of technology applied to organizational management. Both dimensions, research and development, are manifested in parallel throughout the work, since the initial process of analysis and design of the system involved the collection and processing of relevant information, obtained from key informants, which allowed the definition of reference terms of the system. Likewise, once the system was developed, different groups of teachers were trained, and a new instrument, validated by experts, was used to collect information on aspects related to usability, standardization, friendliness and content. After which various elements of the system were improved, until obtaining the version that is currently presented.

## **MATERIALS AND METHODS**

For the study, different methodologies were applied, which helped in the different phases of the research process. Since the interviews with authorities and experts to obtain information that once

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processed allowed the definition of the requirements, the scope and limitations of the application till the use of specific methodologies to the analysis, design and implementation of the system to generate a reliable product that meets the methodology requirements that the OOHDM (Object-Oriented Hypermedia Design Method) defines for Web environments (Pineda, 2008).

Processes are detailed as follows:

Interviews were conducted with key stakeholders who make decisions about how to conduct teacher evaluations and provide information about the variables of the study object. These interviews were carried out to those teachers who had the position of department directors.

In addition to the interview with the department directors, an expert was interviewed on the subject of the Teaching Portfolio, to provide the necessary information about how the portfolio should be structured. An interview was also carried out with coordinator of the Methodological Unit of FAREM-Carazo, considering its dominion over the theory related to the Teaching Portfolio, having as purpose, to know how these concepts can be translated into requirements for an information system, and also to ask about the teacher evaluation indicators.

Within the computer methods, Microsoft Project 2013 was used to elaborate the schedules of activities carried out, both in the information gathering phase and in the analysis, design and programming stage of the application. For the correct documentation of the analysis and design of the application, the Object Orientation Paradigm was taken into account, using the Unified Model Language (UML).

CASE tool, Enterprise Architec, was used to elaborate the different diagrams that the UML paradigm requires to graphically represent the different processes that the application performs during its operation. The Visual Studio 2013 development environment and the SQL Server 2008 Database Manager were used for the design of interfaces and information storage.

After the development stage, an instrument was applied to measure the level of usability of the application. Questions were asked to measure usability, standardization, inclusion of theoretical elements in the system, interaction of the system, feedback and support on decisions made, organization of information, recovery of historical data, among others, in order to make an analysis about the operation, visualization, standardization and relevance of the system.

## RESULTS

One of the results of the study was to select the most appropriate platform for system development, taking into account the time required for development, the level of knowledge in the proposed development platforms, the time invested in the analysis of the application and investment in equipment for the development and hosting of the application once completed. The alternatives were the following:

### Alternative 1: Platform .Net, Manager of BBSqlj Framework Js

FREE SOFTWARE FOR THE DEVELOPMENT OF THE APPLICATION (ALTERNATIVE I)	
Development of IDE	Visual Studio Community 2013
Graphic Design Software	Gimp
Diagramming Software UML	ARGO UML 3.4

Server Lenguaje Framework	C-Sharp (C#)
Client Lenguaje Framework	JQuery 1.11.2 y AngularJS 1.3.11
Office Software	Open Office 4.1
Development Environment	IIS Express

Table 1. Alternative No. 1

**Alternative 2: Platform Php, MySQL Framework Js**

FREE SOFTWARE FOR THE DEVELOPMENT OF THE APPLICATION (ALTERNATIVE II)	
Development of IDE	Lavarel
Graphic Design Software	Gimp
Diagramming Software UML	ARGO UML 3.4
Server Lenguaje Framework	PHP
Client Lenguaje Framework	JQuery 1.11.2 y AngularJS 1.3.11
Office Software	Open Office 4.1
Development Environment	XAMP

Table 2: Alternative No. 2

From the interviews made to the university academic authorities and to the expert in theory of the Teaching Portfolio, the necessary information was obtained to elaborate the requirements of the application. As part of object-oriented development proposed by the methodology (OOHDM) and engineering requirements, they were elaborated with the help of the CASE tool, Enterprise Architect, which is very useful to optimize the work and Generate the documentation. The following is a general outline of the requirements developed for the system development:

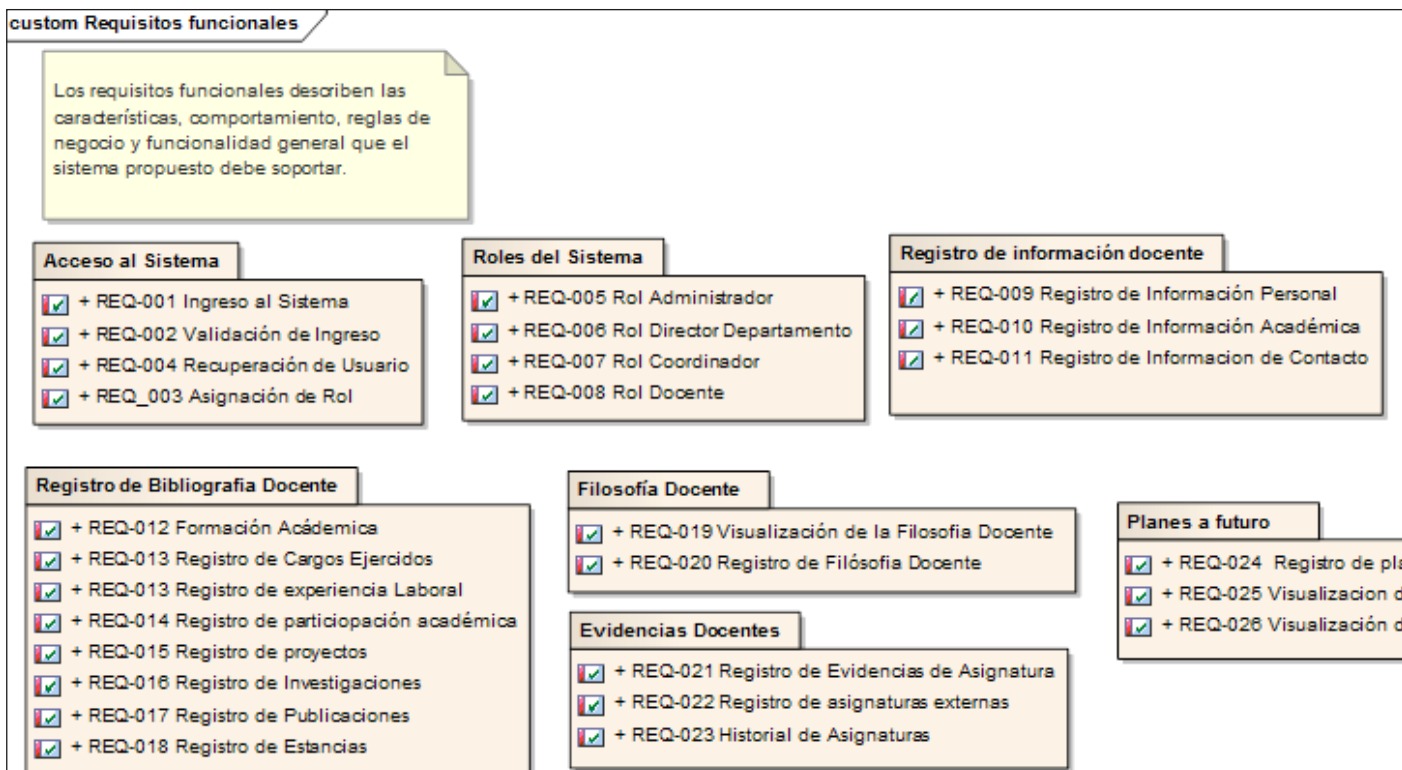


Figure 1: General scheme of functional requirements

After realizing the conceptual components of the application, we proceeded to the creation of modules, which allowed the operation in a Web environment. The main application interfaces that are part of the study result are shown below.

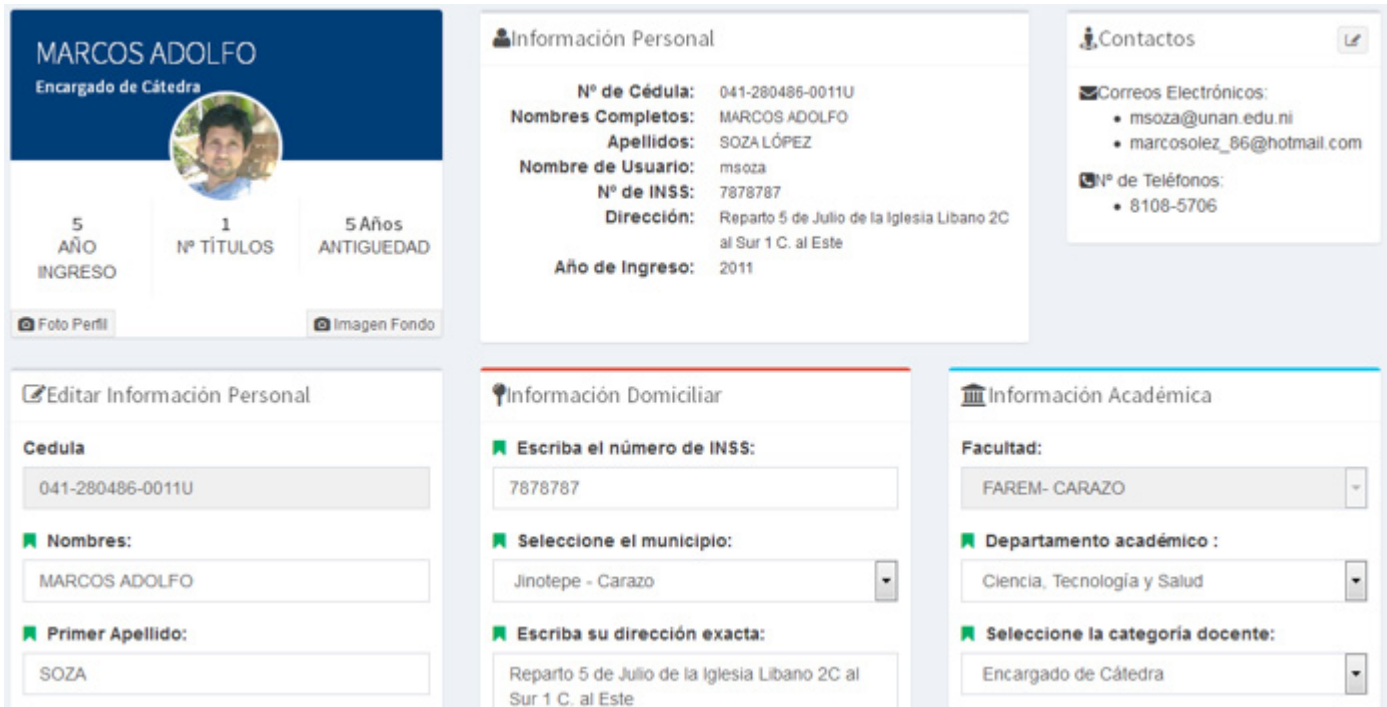


Figure 2: Information editing screen

Once the system was implemented and piloted, the usability of the system was validated. In order to do this general analysis, the average of the ten variables was analyzed and the variable "Average Score" was generated, which was constituted by ranges of values from 1 to 5. Defined as follows 1 - 2: Strongly disagree; 2 - 3: Disagree; 3 - 4: Agree; 4 - 5: Strongly Agree.

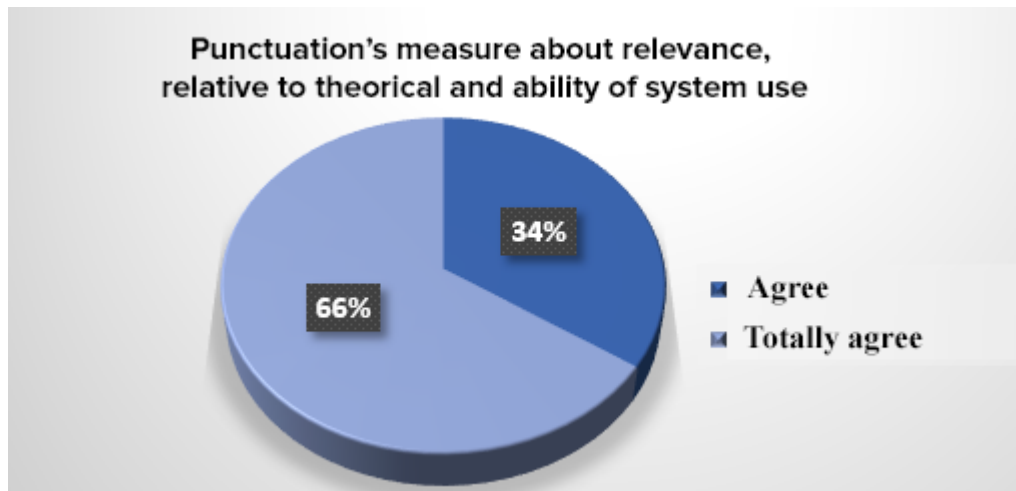


Figure 3: Acceptance Graph of Users

## RESULTS DISCUSSION

From the results presented in the previous chapter, we have as a starting point the collection of the necessary information to define the scope and limitations of the system, taking as a reference the theory set out in the theoretical framework about the requirements presented by Robertson and Robertson (2005), in which the requirements are established as a process to discover elements before starting to write codes. For this, the interviews with authorities and experts were giving shape to these requirements and were categorized into functional and non-functional, as explained by Sommerville (2005).

From the data obtained, we proceeded to the analysis and design of the application, for which we had as a starting point the theory related to the Teaching Portfolio. The structure used, was obtained in the proposal elaborated by Rodríguez and Marcenaro (2012), who based on what they learned from UAB's expert teachers, divided the teaching portfolio into four fundamental pillars, which are: Biography of Teachers, Philosophy of Teachers, Evidence and Plans to the Future. This structure was the best to be adapted to the type of technology used by the system.

In light of the above, the definition of the software technology and the methodology to be used was defined, and for this, as explained by Escalona and Koch (2002), one that best adapts to the nature of the application is the OOHDM, which focuses on navigation diagrams, which gives users different views according to their role in the application. For the use of this methodology the UML diagram was used, which represented the entities and relations and interactions between them.

In order to evaluate the feasibility of the software development, the established by Oliveros, Danyans and Mastropietro (2014) was taken into account, in which Web applications are defined as technology that requires special methods and tools for their use, as well as technical and scientific knowledge for their development, taking into account this information, two development proposals were developed, which are free to use and both have the necessary characteristics for the creation of the application, having chosen the first proposal, having as an argument for their choice the accumulated experience in development of this technology, the hardware and software equipment with which the university counts and the time established for its completion.

As may be seen, the development of the system - taking into account the methodological steps, of design and implementation - yields satisfactory results, since qualitative research techniques were used for data collection and survey for validation, resulting in a tool for the centralization of information and improvement of processes of the teaching portfolio.

The Web System of teaching portfolio in its first version has been widely accepted by the teachers of FAREM-Carazo, UNAN-Managua, which can be corroborated in the piloting processes that have been carried out with different groups of teachers of the institution in which 76.67% of these rated that they agreed with all the positive aspects that were raised about the application.

Most of the teachers participating in these tests have considered that, from a computerized point of view, the system is clear, friendly, intuitive and easy to use; in addition, this group of teachers consider that, from the content aspect, the application is coherent with the theory of the teaching portfolio and contemplates the indicated about its structure, with the added value of the interaction flexibility and great processing and storage capacity that computers allow.



In addition to the above, the system works on the Web, thus enhancing the communication processes that make this application an important technological innovation, based on the principles of knowledge creation and management. On the one hand, through the registration of evidence, the process of explaining the tacit knowledge of teachers is carried out, showing the most representative of their good practices, lessons learned, know-how and accumulated experience. On the other hand, the system allows a general appreciation of the knowledge map of the institution, indicating who owns which knowledge and where these people are located. In this way, the application facilitates the contact with other teachers, based on the particular professional interests in order to share the material of the portfolio, and in this way, empower communities of practice, networks of experts and research groups, as well as contribute to the professional development of new teachers through pedagogic accompaniment processes.

## **CONCLUSIONS**

After having interviewed the expert in Teacher Portfolio and Department Directors, in which how the system modules, inputs and outputs should be structured and should be obtained and displayed respectively was discussed. The main results were the definition of the scopes and limitations of the system, which was taken as a starting point to start with the definition of the application requirements.

In accordance with the above and following the definition of the specific objectives, the feasibility study was carried out with the presentation of two Web development alternatives, which led to a process of analysis and the decision by the alternative number 1. This decision was taken, taking into account the experience in technical personnel, the provision of the necessary technological equipment and the time the development of the application would take, in order to be able to validate its feasibility in a reasonable time for its subsequent analysis.

With the information gathered and the chosen development platform, the analysis and design of the Web System of Teaching Portfolio was continued, for which, diagramming using the UML paradigm and the OOHDM methodology for the design was used, taking into account the conceptual, navigational and interfaces aspects, in order to create an intuitive and very useful product.

After the development of the system, the feasibility and pertinence of the system was measured, with the application of a survey to a non-probabilistic sample. This showed, in a general assessment, how the application was accepted from the point of view of operation, design and relevance of the information.

The results obtained demonstrate that the Web System of Teaching Portfolio is an important tool for the registration of information, experiences, reflections and teaching practices, and an effective tool for decision making, with a strong focus oriented to the management of organizational knowledge.

## REFERENCES

- Cano, E. (2006). *La Carpeta Docente como instrumento Formativo*. Barcelona: Universitat de Barcelona.
- Caplan, M. (1998). *The Teaching Portafolio. CRLT The Center for Research on Learning an Teaching*.
- Facultad de Informática, Electrónica y Comunicación. (2010). *Centro de Investigaciones en Tecnologías de la Información y Comunicación (CITIC)*. Panamá: Facultad de Informática, Electrónica y Comunicación.
- Galvan Fernández, C., Rubio Hurtado, M. J. & Rodríguez Illera, J. L. (2013). Propuesta didáctica para el uso de Portafolios Digitales en Educación Superior. *UDETIC*.
- Gutiérrez Marcenaro, H. R. (2014). *Unidad de Investigación y Desarrollo Tecnológico*. Jinotepe. FAREM-Carazo.
- Instituto Nacional de Tecnología y Comunicación. (2009). *Ingeniería del software: metodologías y ciclos de vida*. Madrid: Inteco.
- Kendall, K. E. & Kendall, J. E. (2005). *Análisis y Diseño de Sistemas*. México: Pearson, Printice Hall.
- Oliveros, A. F. (2014). Prácticas de Ingeniería de Requerimientos en el desarrollo de aplicaciones Web. *Facultad de Ingeniería y Ciencias Exactas, UADE. Ciudad Autónoma de Buenos Aires*.
- Rodríguez Gómez, D. (2015). *Gestión del conocimiento y mejora de las organizaciones educativas*. Madrid: La Muralla, S.A.
- Rodríguez Lara, J. & Gutiérrez Marcenaro, H. R. (2012). *Carpeta Docente. Torreón Universtario*.
- Rodriguez Pullido, J. (1998). La Carpeta Docente y la Reflexión. *Revista de Currículum y Formación*.
- Zubizarreta, J. (2004). *The Learning Portafolio: Reflective Practice for Improving student Learning*. New York: Jossey Bass.