

## WEB SURVEY SYSTEM TO DISCOVER THE ACTUAL ROLE OF EXPERIENCE IN LEARNING IN HIGHER EDUCATION: A CASE STUDY

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**Abstract** — Adults students (AS) bring to Higher Education (HE) and to the learning process a wide range of life experiences. The use of these can assist academic learning and enable AS to become independent reflective learners. Research is urgent as more adults are returning to HE, because of the push policy for lifelong learning – at national government, European Commission (EC) and Bologna Process levels. The project PRILHE (Promoting Reflective Independent Learning in HE), funded by the EC Socrates-Grundtvig Programme, aims to identify the learning processes which enable AS in HE to become independent reflective learners and how best to support these processes. Within this research, both quantitative and qualitative methods were used to determine how students organise their studies and to discover their learning experiences. This paper describes the design and development of the system for the web survey data collection, taking into account the characteristics of information systems quality models.

**Index Terms** — Information Systems Quality, PRILHE (Promoting Reflective Independent Learning in Higher Education), User-based Design, Web Survey System.

### INTRODUCTION

As a consequence of the policy push for lifelong learning – at national government, European Commission and Bologna Process levels – more adults are taking part in Higher Education (HE). Adults bring with them a wide range of life experiences to the learning process. The use of these experiences, in the HE curriculum can assist academic learning and enable adult students to become independent (autonomous) and reflective learners.

The project PRILHE (Promoting Reflective Independent Learning in HE) funded by the European Commission Socrates Adult Education Programme has as its aims: i) to identify the learning processes which enable adult students in HE to become independent and reflective learners (to include study skills, self management, reflective processes and timings, learning to learn, analysing learning and teaching styles, interaction with lecturers and peers, institutional support and structures); ii) to determine how this process can be better supported, in terms of materials, systems, staff, lecturers, web support, peers, family, friends; and to

examine the interface between learning from experience and academic learning - the overlaps and conjunctions - and how experience may help academic learning and future learning, including in the workplace.

The overall aim is to identify models of good practice in higher education institutions to share across Europe, in order to improve policy and teaching practices in this field. The project is being developed by a consortium of European HE organizations, in seven countries – namely, the Centre for Lifelong Learning, United Kingdom (coordinator); ISEGI, Universidade Nova de Lisboa, Portugal; Centre for Extension Studies, University of Turku, Finland; Georg August Universität Göttingen, Germany; The University of Lower Silesia, Poland; CREA, University of Barcelona, Spain; Department of Education, University of Stockholm, Sweden.

Within this research, both quantitative and qualitative methods were used to determine how students organise their studies and to discover their learning experiences. It was decided that, in order to collect the exploratory data, a Web survey would be carried out. In the ISEGI case, we decided to make available, on line, the questionnaire – common to all countries participating in PRILHE, but translated into Portuguese.

A database was also developed to collect the data and to do the statistical analysis. As studies on Adults in HE in Portugal are a new area of research, the Portuguese team felt that they should be in control of data entering the database. This enabled them to direct PRILHE project promotion and control the issue of questionnaires to those HE institutions that were being expanded and their programmes reorganised to address the needs of adults returning to HE. This paper describes the design and development of the system for the web survey data collection, taking into account the characteristics of information systems quality models.

### THEORETICAL FRAMEWORK

#### Information Systems Quality

We consider three approaches to information systems: the technology-centered approach, the process-centered approach and the approach centered on human and organizational factors [1]. The technology-centered approach focuses on definitions such as that of [2], where an information sys-

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tem is defined as a set of integrated blocks: input, output, models, technologies, data sets and controls.

The process-centered approach concentrates on aspects of information and knowledge processing. This approach includes definitions such as that of [3], which regards a system as a set of elements or components that interact to attain objectives and an information system as a specific type of system, defined as a set of interrelated elements or components that collect (input), manipulate or store and disseminate (process) data or information and provide a response mechanism (output).

The approach centered on human and organizational factors stresses the interests of organizations in the system's product or outcome (response ability) as well as usability and satisfaction of human users. This approach includes information systems definitions such as that of [4], where an information system is regarded as a set of inter-related components seeking to gather, process, store and distribute information in support of decision-making and control within organizations. Also included are definitions such as that of [5], which argues that information systems components include users, product, business processes or objective-oriented processes, stakeholders, information and technology.

The approach centered on human and organizational factors has taken on more importance, in light of the increased use of Internet resources, be it in new business forms and processes or in resources intended for individual users. Thus information technologies are increasingly being regarded as providers that make information systems possible, rather than as critical elements of the information systems.

### Quality Models and Characteristics

As far as this paper is concerned, priority is given to the approach centered on human and organizational factors. This means that information system quality is a consequence of the quality of the software and supporting information technologies as well as the quality of the information system product.

Software quality refers to efficacy, efficiency and accessibility as well as conditions of use by users, considering the intended purposes of the software product. Product quality, in turn, reflects the overall characteristics of that information system that fulfill the implicit and explicit needs of the users.

At first, the quality of a system was regarded as a measure of the quality of the software alone. However, despite the persistence of the 'software quality' designation, the concept has now been expanded to include the quality of the product, together with those factors inherent in Human-Computer Interaction and user satisfaction. We therefore consider four quality-inherent aspects:

- Process quality - relates to the development process of an information system;
- Product quality - quantified by internal and external metrics and characteristics;

- Quality in use - relates to system performance and user satisfaction in a specific context of use;
- Organizational capability - relates to the product's life cycle and to the capability of the organization to develop and implement the system with the intended quality characteristics.

Next, we refer to several software quality models that integrate product quality, including Boehm's Model, Dromey's Model, FURPS Model, McCall's model and the ISO 9126-1 model.

**Bohem Model** – Presented in the late 70's, Boehm's model [6] focuses on the utility of a software product taking into account portability, utility and maintainability. It includes user needs and aspects of hardware characteristics rather than software characteristics alone.

This model considers the following characteristics: testability, efficiency, understandability, reliability, human engineering, maintainability, changeability and portability.

**Dromey Model** – Dromey's model is based on the connection between a software product model and a quality model. The requirements of a quality model for the software product refer to identifying needs from different stakeholders, to the purpose of the supporting applications and to what is necessary to establish quality postulates or expectations from different stakeholders [7].

Depending on the stage of development of a software product, Dromey proposes three models: requirements model, design model and implementation quality model. The latter model considers characteristics related to efficiency, reliability, functionality, process maturity, maintainability, portability and reusability.

**FURPS Model** – The FURPS model was developed by Hewlett-Packard and owes its name to a set of software quality attributes [8]. The attributes are functionality, usability, reliability, performance and supportability, where the latter refers to attributes commonly covered by the term 'maintainability'.

The purpose of this model is to ensure that the above attributes will immediately establish metrics for each stage of the software engineering process. Unlike the other models, this model does not take into account characteristics related to software portability.

**The McCall Model** – In McCall's model [9], the factors that affect software quality are divided in two categories: directly measurable factors and factors not directly quantifiable, as for instance product usability, in which case checklist-based quality indicators apply.

The quality characteristics addressed by McCall's model are testability, correctness, efficiency, reliability, flexibility, integrity, interoperability, maintainability, portability and reusability.

**ISO 9162-1** – According to the ISO 9126-1 standard [10], quality is defined as a set of capabilities and characteristics of a product or service with which the product or service is enabled to fulfill the intended implicit or explicit needs. Reference [11] refer to other quality perspectives related to systems development, namely: user's outlook and understanding of end product quality; outlook of development team; product manager's outlook on end users, as far as marketing requirements are concerned.

System evaluation should be based on or consider IS quality postulates. According to the ISO 9126-1 standard, quality can be regarded as a set of system characteristics that meet the following aspects: functionality, reliability, usability, efficiency, maintainability and portability.

## WEB SURVEY SYSTEM

### System Main Objectives

This section deals with the Web-based system developed for the PRILHE Web survey. The description of the system follows the theoretical framework outlined in the previous section. The system incorporates several modules: online questionnaires; interactive database and email sender service. The system objectives were:

- To facilitate the project dissemination and to promote, in the period allocated for data collection, the highest number of responses from the target-population (adult students in HE and their lecturers);
- To make the questionnaire completion task as user-friendly as possible, with the data being entered automatically into the database in real time, or in printed format, according to users' needs;
- To reduce the costs – both time and effort – associated with questionnaire completion, as respondents could review their answers online before submitting them electronically;
- To increase data storage and downstream processing efficiency in the database supporting the system – this contributes to a reduction in errors and other problems traditionally associated with manual data introduction;
- To make available an automatic procedure, alerting the introduction of new questionnaire answers in the system, through the automatic sending of email messages to the system and project managers; this protects data base integrity in real time.

### System Description

User access to the system is in the form of a common Webpage with a text description of the project, its aims and a request for participation by completion of the relevant questionnaire, for students or lecturers. This is illustrated in Fig. 1.

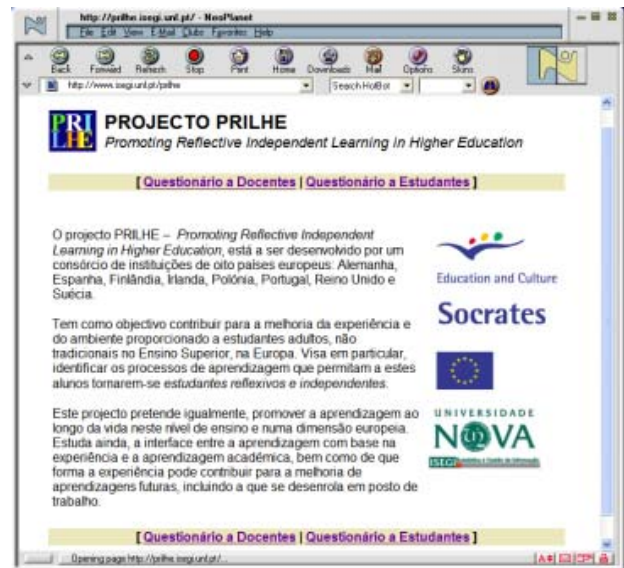


FIGURE. 1  
USER VIEW OF THE INITIAL ACCESS TO THE SYSTEM

Taking into account the user profile (student or lecturer) the system redirects the user to a page containing more information concerning the project and the ways in which the user can make a useful contribution. The questionnaire can be completed and submitted online or downloaded and sent back by email or post. Fig. 2 illustrates a user view of the student's questionnaire, which is similar to the lecturer's, save for questionnaire format and content.

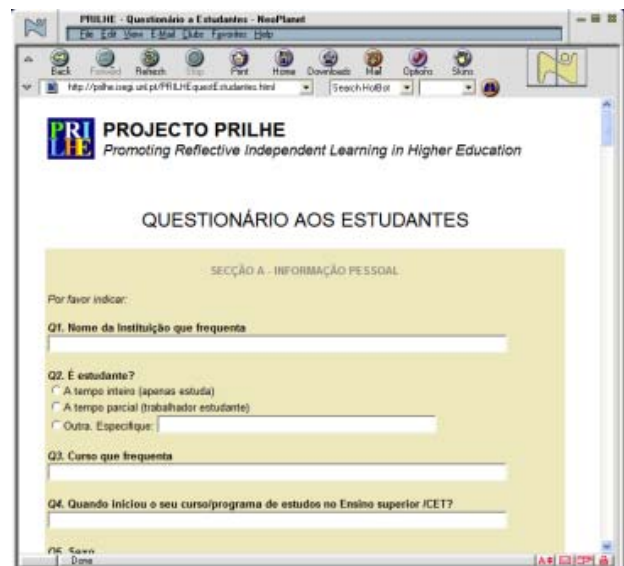


FIGURE. 2  
USER VIEW OF STUDENTS QUESTIONNAIRE ONLINE

Completion of the questionnaire online is as follows:

- The data is sent to the database and processed so that it is automatically allocated a unique identification number;
- The system then stores the data and sends it simultaneously to two email addresses: one for the PRILHE project manager and the other to the system administrator.

These processes guarantee the immediate detection of possible anomalies in the storage and processing of information, during the phase of questionnaire responses, while at the same time facilitating system administration.

### System's Characteristics

Despite variations in designations, aggregations or nomenclatures, all system quality models apply – directly or indirectly - quality characteristics analogous to those which the ISO 9126-1 standard considers. In the following paragraphs those characteristics are described and each is analysed in line with the characteristics that PRILHE Web survey system possesses.

**Functionality** – capability to provide an efficient response to the system's intended objectives. The sub-characteristics of functionality are: suitability for the intended functions, response accuracy, interoperability with other systems and equipment, security and compatibility with systems, equipment, procedures as well as data and information models required for functioning.

- *The system has addressed the requisites and objectives for which it was developed.* It facilitated the project dissemination. It enabled an efficient collection of data required for the project. It facilitated the filling of the questionnaires in real time. It contributed to reduce resources and time costs spent in data collection. Data storage in the database was efficient. It enabled the detection, in real time, of anomalous filling of questionnaires and maintained database integrity. The system was integrated in the computer network of the host organization, and thus benefited from the existing security resources.

**Reliability** – capability to maintain performance in different scenarios. The sub-characteristics of reliability are: system maturity, fault and error-tolerance, recoverability, compatibility with procedures and equipment that are potential substitutes in case of failure.

- *Contingency plans and several options for maintenance viability were analysed.* Initially it was thought that the system could be installed to include the other Portuguese project partner. However, the need for information collection and analysis from the different types of adult/mature students prevented this. The submission of completed questionnaires was always possible, by email, even if the database became non-operational.

**Usability** – ability of users to understand the functions of a system and capability of the system to provide a friendly environment. The sub-characteristics of usability are: perception, understandability, operability by the user and compatibility with other processes and procedures normally used by the users.

- *Due to the characteristics of the interface, the system works in a friendly way both for experienced and new users.* The way the interface appears facilitates, through its similarity with printed questionnaires, the answers to the questions asked. Moreover, there are areas of information available to respondents about the project's aims and objectives.

**Efficiency** – capability to deliver suitable and continuous performance, regardless of the number of users simultaneously interacting with the system. The sub-characteristics of efficiency are: time behavior, behavior in resource utilization, compatibility with system resources, e.g. data formats.

- *The system performance is not altered by the number of users accessing the web-survey system simultaneously.* This is a consequence of the system sending to each user their own copy of the questionnaire. In this way, the processing effort is divided between the client machines of the during the reply session. The forwarding of responses is ordered during access to the system server, a process which is not apparent to the user. Faults, as a consequence of a high number of simultaneous accesses, are only possible if the number of simultaneous accesses were well above the set of all potential respondents..

**Maintainability** – capability to allow maintenance procedures, updates or alterations. The sub-characteristics of maintainability relate to the system being: analyzable, changeable or improvable, stable, testable and compatible with maintenance procedures.

- *Updating the database does not require updates of the integration environment..* Actually, the database can be updated at any time, without requiring any restructuring of the system architecture.. Moreover, the registers can be added, eliminated or modified, by the application managers, without needing to introduce any alteration in the interface or in any other detail of the system. This is an interesting characteristic, because it enables the acceptance of questionnaires, completed in print format, by the database.

**Portability** – capability to deliver performance in different platform environments or architectures. The sub-characteristics of portability are: adaptability, installability, peaceful co-existence with other systems, procedures, processes and equipment, replaceability and compatibility with different systems and equipment.

- *The system functions effectively in several hardware and software environments.* Independently of the computational resources of the user, the portability characteristics of the system, because it is integrated on the Web, allow the user to access and interact with the system. In this context, it does not matter which browser is used or the Web environment available to the user.

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## CONCLUSION

The Web survey system development enabled the collection in real time of the required information, by facilitating the collection of exploratory data within the time constraints of the PRILHE project.

It was demonstrated that the system would present the required quality characteristics to assure that it would be a valuable tool for the PRILHE project. To achieve this quality, models were reviewed and the characteristics included within the ISO 9126-1 standard were selected and adopted within PRILHE Web-based survey system.

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