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"A methodology for continuous usability assessment in educational content portals."

Autor: David Martín Moncunill

Director: Dr. Salvador Sánchez Alonso

Tribunal:

Presidente: ……

Vocal 1: ……

Vocal 2: ……

CALIFICACIÓN:……

FECHA: …… de …… de ……

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The cartoons have been made by the author using http://www.stripgenerator.com on-line tool.

Convertirme en el primer ingeniero de la familia siempre fue un reto, de la cual toda ella quiso hacerse partícipe y terminó resultando una pequeña presión. A pesar de todo ☺ quiero dedicarle esta obra a mi familia: padres, hermana, abuelos, tíos y primos; los cuales me hacen constar constantemente su alegría por mis progresos académicos y me animan a seguir trabajando.

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Resumen

La Comisión Europea ha mostrado un gran interés en promover portales con contenido educativo en diversas áreas de conocimiento. Este tipo de proyectos están claramente destinados a que el usuario final pueda emplear el portal de forma útil para su educación. En este sentido, la metodología de trabajo que debería seguirse para este tipo de proyectos debería estar centrada en el usuario, esto es, debería desarrollarse conforme a los principios de lo que es conocido como "User Centered Design". Sin embargo, este no es el caso de los proyectos analizados, donde se han detectado varios problemas comunes relativos a como se realizan las pruebas y experimentos con usuarios. El propósito de este trabajo es desarrollar una metodología de evaluación continua de la usabilidad para portales de contenido educativo, mostrando que esta metodología es aplicable en el contexto de este tipo de proyectos europeos y los posibles beneficios que traería su implantación.

Palabras Clave: **"usabilidad", "portales de contenido educativo", "e-learning", "proyectos europeos", "User Centered Design"**

Abstract

The European Commission has shown a great interest in promoting educational content portals in different areas of knowledge. These projects are clearly intended to allow end users to use said portals in useful ways for education purposes. In this sense, the methodology that should be followed for this type of projects should be centered on the user, that is, they should be developed according to the principles of what is known as "User Centered Design". However, this is not always the case of the analyzed projects, in which several common problems related to the way in which they deal with tests and experiments with users have been detected. The purpose of this work is to develop a methodology for the continuous assessment of usability for educational content portals, showing that this methodology is applicable in the context of this kind of European projects, as well as the potential benefits that its implementation would bring.

Keywords: **"usability", "educational content portals", "e-learning", "European Projects", "User Centered Design"**

Introduction

This dissertation has been made in the context of several European projects related to the development of educational and research portals which retrieve their information from semantic repositories. The most important case studies for this work are the Organic–Edunet[1], VOA3R[2] and Organic.Lingua[3] projects, in which the author of this thesis has been and currently is actively collaborating.

During his work in these projects, the author has noticed that the way in which they were being tested could be significantly improved in order to obtain more and better feedback about the usability issues they might have. A quick research about this topic in other related projects such as Europeana[4] showed up that there were similar problems to overcome it this kind of EU funded projects.

1. Objectives and Contribution

The main purpose of this project is to expose the need to improve the way in which trials and experiments with users are carried out in the context of EU funded projects related to educational content portals and to provide an approach to deal with the identified problems.

The specific objectives will be:

a) List the most common problems found in the studied projects regarding the way trials are done from the usability point of view.
b) Find a solution for each problem described.
c) Provide guidelines to establish a methodology which will cover usability along all the project lifecycle. This means that the usability of every part of the project will be continuously assessed.

[1] http://www.organic-edunet.eu : A Multilingual Federation of Learning Repositories with Quality Content for the Awareness and Education of European Youth about Organic Agriculture and Agroecology (2007 - 2010). Funded by the eContentplus Programme.
[2] http://www.voa3r.eu : Virtual Open Access Agriculture & Aquaculture Repository (2010 - 2013). Funded by the ICT Policy Support Programme (ICT PSP).
[3] http://www.organic-lingua.eu : Demonstrating the potential of a multilingual Web portal for Sustainable Agricultural (2011 - 2014) Funded by the Competitiveness and Innovation Framework Programme (CIP), Policy Support Programme (PSP).
[4] http://www.europeana.eu/ : Europeana and the projects contributing content to Europeana.eu have been funded by the European Commission under eContentplus, the Information and Communications Technologies Policy Support Programme (ICT PSP) and similar programmes.

The final contribution of this dissertation will be to provide best practices regarding usability in any kind of trials involving users for future similar projects.

2. Research Methodology

The research process will proceed along the following 4 steps:

1. State of the art analysis:
   This will describe how educational content portals in the context of EU funding projects deal with usability and trials involving users.

2. Identification of common problems:
   A deeper look about how trials are planned, carried out and summarised. The results will show up a list of common problems to be solved.

3. Find a solution for each problem:
   In this stage an individual solution for each problem will be provided. It's important to notice that each problem will be taken as a singular problem. When several problems concur, solving one doesn't have to necessarily mean an improvement – a bigger problem might exist that makes useless all the efforts to solve the other problems.

4. Development of an ad-hoc methodology:
   All the information will be analysed as a whole to develop a methodology for the continuous usability assessment in educational content portals, covering the whole project lifecycle.

I. State of the Art

ISO/IEC 9241, defines usability as *"The effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments."*

- Effectiveness: the accuracy and completeness with which specified users can achieve specified goals in particular environments
- Efficiency: the resources expended in relation to the accuracy and completeness of goals achieved
- Satisfaction: the comfort and acceptability of the work system to its users and other people affected by its use.

In the context of ISO/IEC 9126 for software projects, usability is defined as *"The capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions."* This seems to be little more than the application of the first definition in the context of software development.

It should be noted that a software can be viewed from different devices, by people with different abilities, among other factors, so that's what we talk about specific conditions of use. When trying to "universalize" these terms of use, i.e. making software usable for everyone, regardless of their physical, mental or intellectual characteristics, or of their environment, we talk about "accessibility". Although in many cases the degree of accessibility increases when the usability does, this does not always happen.

In the last years developers have aware of the importance of usability in software engineering. Usability has gone from being something that was made just before implementing the interface – when performed –, to be considered at all stages of the software life cycle, having a life cycle of its own, where the prototypes loom large importance.

If usability is an important factor in the success of any product, when talking about educational products we can say it's definitively a key factor. That's why a User Centered Design approach should be considered for this kind of projects.

1. UCD &Usability in Software Development Lifecycle

Making products that are more usable and accessible is part of the larger discipline of User Centered Design (UCD). UCD is a design philosophy where the end–user's needs, wants and limitations are taken into consideration at all stages within the design process and development lifecycle.

Products developed using the UCD methodology are optimized for end–users and an emphasis is placed on how the end–users need or want to use a product instead of forcing the end user to change his behaviour to use the product [NormanDraper86].

User Centered Design is a common process in software development where typical UCD activities are broken down into four phases in the development lifecycle: analysis, design, implementation and deployment [NormanDraper86].

According to the international standard ISO 13407, human–centered design process provides the basis for UCD. This standard defines a process throughout a development lifecycle, but does not specify the exact methods used for user–centered design.

The most important basic principles of user–centered design are:

d) Iterated design (from a "learn as you go" perspective)
e) Early focus on users and their tasks
f) Evaluation and measurement of product usage.

User Centered Design rolls up into an even larger, more holistic concept called experience design. Experience design takes care of the whole relation with the customer, which includes answering questions such as [UTesting08]:

g) What happens when the product is delivered, maintained, serviced and possibly returned?
h) What does the organization do to support the research and decision–making process leading up to the purchase?

Companies developing technology–based products have product lifecycles that should include some type of usability engineering/human factors process, especially if the product is related to areas such as education. In [UTesting08] Jeffrey Rubin, Dana Chisnell and Jared Spool identify some questions that could arise in that process, suggesting methods to provide answers to said questions

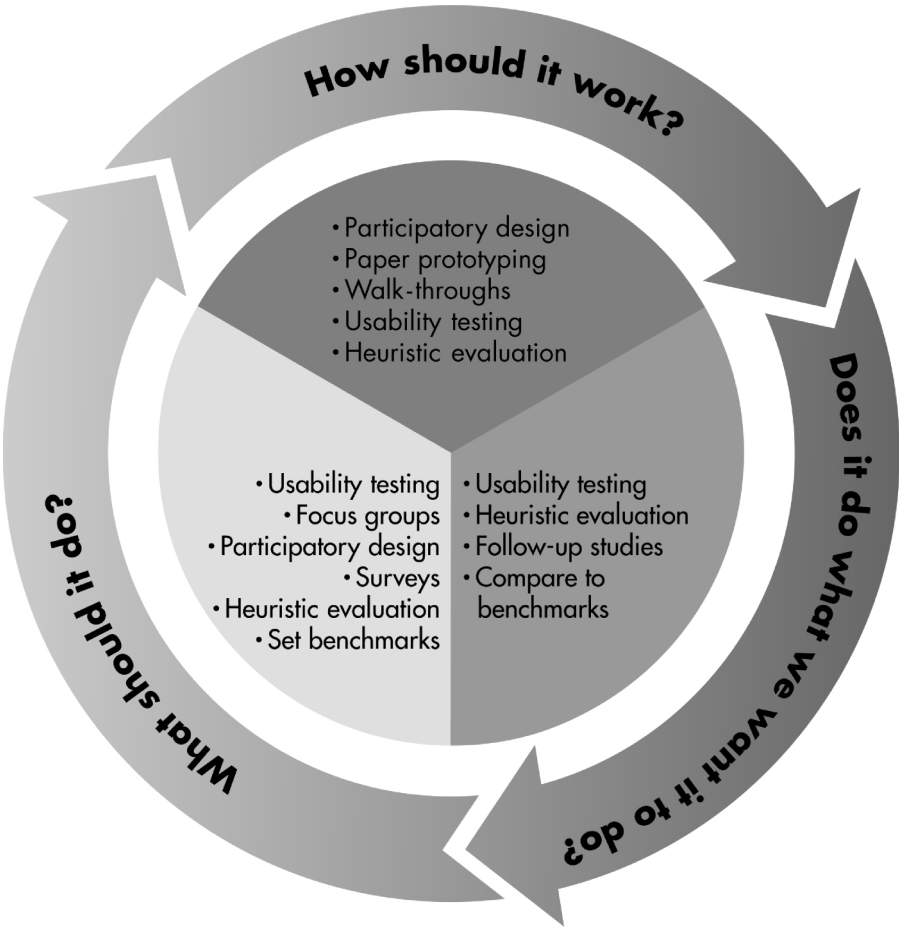

Figure 1*: Questions and methods for answering them. Extracted from [UTesting08]*

What figure 1 illustrates is that usability can cover the whole lifecycle of a product. Within each product lifecycle phase there are a variety of usability engineering activities that could take place in order to evaluate and optimize the product, from the usability point of view.

This example shows an iterative lifecycle, based on receiving user feedback during each phase, before moving to the next phase. This can involve several techniques, most of them require the participation of real users, and it has to be carried out only by usability experts and the multidisciplinary teams working in the project.

The multidisciplinary approach is a must in usability. There are multiple instances in which collaboration is required among various team members, since there are too many factors to consider when designing very complex products for less technical end users. UCD requires a variety of skills, know-how and, most important, information about the intended user and the usage s/he will do.

2. Usability in educational content portals in the context of EU funding projects

In the last years, the European Union Commission has funded a number of projects related to education and, more specifically, to educational content portals in different topics such as agriculture, human rights, ecology or art, among others. [CORDISFP7]

The main purpose of an educational portal is clear: providing access to educational contents to its intended users. The success of an educational portal will depend mainly on two factors:

a) The number and quality of the resources that the portal links.
b) The way in which the portal can facilitate the location and access to these resources.

The number and quality of the resources lies in the content providers and is out of the scope of this work, as it focuses in the second point, the development of the portal itself.

An educational portal should provide the location and allow the access to **useful and relevant** educational resources according to the user needs and his characteristics, such as age, language, educational context, etc.

Making an analogy with the usability definition, the main purpose of an educational content portal should be:

"*The effectiveness, efficiency and satisfaction with which specified users* ***– with different personal characteristics and educational interests –*** *achieve specified goals* ***– i.e. locating useful educational content for them –*** *in particular environments* ***– on–line, in the context of the European Union –***"

This perfectly fits with the usability definition, thus making the UCD approach as the best for the implementation of this kind of portals, in which the user is clearly the center of the portal purpose.

Nevertheless, the projects analyzed in this work don't follow this approach but a more usual one in the context of European projects, in which most – or all – of the interaction with users is carried out in the framework of a "Work Package", which includes all the product trials.

The following section, (2.1), describes how the work is organized in European Projects belonging to the Framework Programmes (FPs), providing further information about "Work Packages.

2.1. Work Organization in European Projects

All projects analyzed in this work belong to the European Framework Programmes (FP), which depend from the European Commission [CORDISFP7]. Any project submitted to these programmes and expecting funding from them should meet the guidelines and templates provided by the European Commission.

Among these templates is the one for the "Description of Work" [DoW]. The Description of Work, commonly referred to as DoW, contains the details of how the implementation of the project must be done, including work packages, deliverables, milestones, resources and costs of the beneficiaries – organized in a tabular form – as well as a detailed narrative description of the work.

It consists of two parts:

1. **"Part A"** contains the cover page, the project summary, the list of participants and the budget breakdown, as well as 8 Workplan Tables, which provide the details on how the project will be implemented. These tables are:
    a. WT1 List of work packages
    b. WT2 List of deliverables
    c. WT3 Work package descriptions
    d. WT4 List of milestones
    e. WT5 Tentative schedule of project reviews
    f. WT6 Project effort by beneficiaries and work package
    g. WT7 Project effort by activity type per beneficiary
    h. WT8 Project efforts and costs

Project Number [1]	250525	Project Acronym [2]	VOA3R

LIST OF WORK PACKAGES (WP)

WP Number [53]	WP Title	Lead beneficiary number [55]	Person-months [56]	Start month [57]	End month [58]
WP 1	Management and coordination	1	74.80	1	36
WP 2	Setting up the stage	17	89.70	1	6
WP 3	Modeling the scientific/scholarly lifecycle	3	75.60	4	36
WP 4	Platform design and integration	1	125.80	4	36
WP 5	Content integration and population	5	106.90	7	36
WP 6	Experimentation, pilot trials, and evaluation	3	76.30	7	36
WP 7	Dissemination and exploitation	13	86.20	1	36
		Total	635.30		

Table 1 *: List of Work Packages of VOA3R project.* [VOA3R DoW]

Work packages represent a major sub–division of the project and have verifiable end–points such as deliverables or important milestones in the overall project. Each work package should have an associated precise, clear and quantified description.

Work package number [53]	WP6
Work package title	Experimentation, pilot trials, and evaluation
Start month	7
End month	36
Lead beneficiary number [55]	3

Objectives
The aim of the work package is to provide the evaluation framework for the VOA3R developments and services to make agricultural and aquacultural contents more accessible, usable, and exploitable as well as to realize a series of pilot trials that will take place in order to evaluate and validate the project results. More specifically, the objectives of this WP are the following: a) To design the pilot evaluation and validation activities of VOA3R, also supporting them with the necessary evaluation guidelines and materials. b) To coordinate the implementation of a series of pilot trials as well as collecting and analyzing the evaluation and validation results, including summarizing final recommendations. The evaluation and validation will consist of (1) controlled experiments on the new services for the publication and reviewing life cycles including alternative peer review systems and for semantic search services, rendering, and querying (task 6.2), of (2) pilot trials on the virtual federation of repositories and content integration (task 6.3), and of (3) validation trials with also external user communities on connecting external repositories and on publishing and exchanging diverse contents (task 6.4). By this, the evaluation and validation will also follow the three phases of the development: The tasks 6.2 and 6.3 are related to the phases 1 and 2 with the internal partners, and the task 6.4 is covering phase 3 involving also external partners.

Description of work and role of partners
This workpackage will be implemented through the following tasks: T6.1 'Evaluation plan' This task develops the evaluation plan for all planned controlled experiments, pilot trials and validation trials. The evaluation plan will be based on and compliant with the ISO quality standard RFDQ (ISO/IEC 19796-1) that is applicable for the whole life cycle of any digital content and learning object covering the planning, design, production, realization, and evaluation processes (responsible partner: UDE).

Table 2 *: Work Package 6 "Experimentation, pilot trials and evaluation" description for VOA3R project – partially extracted* – **[VOA3R DoW].**

2. **"Part B"** is the narrative part of the DoW, based on the structured information from Part A of the proposal. This is the part in which –among other aspects– the project concept, objectives, methodology, work plan and implementation are fully described.

In the end, every project presented along these lines will have a number of work packages – summarized as tables in part A – with different links and relations between them – described in part B –.

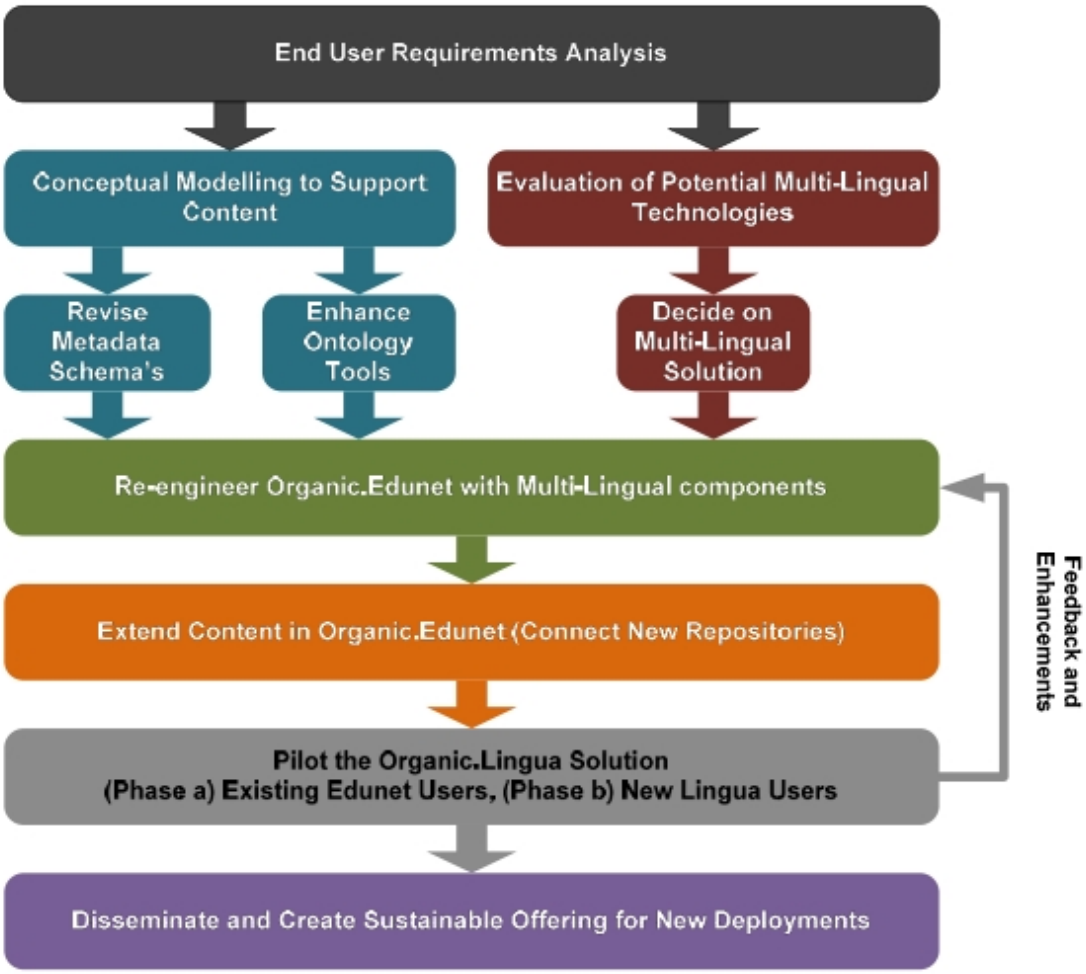

Figure 2*: Structure and Organization of Workplan, Organic.Lingua project. [ORGANIC DoW]*

Analyzing the work packages of different European projects in this context, it's evident that some of them appear in most:

- WP related to management.
- WP related to requirement analysis / setting up the stage.
- WP related to trials / experiments.
- WP related to dissemination & exploitation

These work packages have been previously seen in table 1 for VOA3R project and can be seen again in the following table for the Organic.Lingua project.

Project Number [1]	270999	Project Acronym [2]	Organic.Lingua

LIST OF WORK PACKAGES (WP)

WP Number [53]	WP Title	Lead beneficiary number [55]	Person-months [56]	Start month [57]	End month [58]
WP 1	Management & Coordination	1	65.60	1	36
WP 2	Requirements Analysis	7	82.10	1	36
WP 3	Conceptual Modelling Framework	4	102.50	1	36
WP 4	Language resources and modules development	5	95.10	1	36
WP 5	Online Service Re-engineering & Extension	1	90.10	1	36
WP 6	Extending Content Coverage	11	85.10	10	36
WP 7	Pilot Operation & Validation	7	93.70	7	36
WP 8	Dissemination & Exploitation	8	65.80	1	36
		Total	680.00		

Table 3 *: List of Work Packages of Organic.Lingua project.* [ORGANIC DoW]

Table 4 shows the relation between Organic.Lingua and VOA3R projects with the above mentioned common work packages.

WP Topic	VOA3R WP	Organic.Lingua WP
Related to management	1	1
Related to requirement analysis / setting up the stage	2	2
Related to trials / experiments	6	7
Related to dissemination & exploitation	7	8

Table 4 *: Relation of Organic.Lingua and VOA3R work packages.*

2.2. Trials and user-oriented research

As just seen, all the trials, experiments and user oriented research is often gathered in a work package related to this topic. The work package is coordinated by one of the consortium partners, but usually most of the partners participate in it, trying to get a bigger and better sample of the results, making trials in different locations with different user profiles. This is indeed a very good approach, but as it will be seen later, several problems could arise due to the lack of expertise of the partners conducting this kind of trials.

Figure 3 shows an abstraction of the typical work packages workflow in the context of this work.

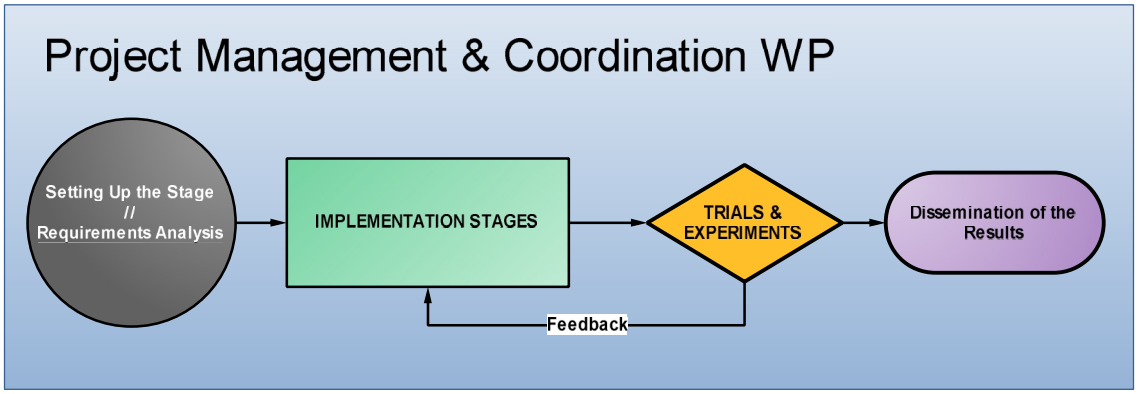

Figure 3*: Abstraction of the typical work packages workflow in analyzed EU projects*

As it can be seen, after an initial stage in which everything is set up, including the requirements analysis, the implementation stages start. By conducting different trials and experiments, the consortium gets useful feedback to prepare the different implementation stages and disseminate the results.

The activities in this work package could and are usually classified in three mayor groups, namely "Pilot Trials", "Validation Trials" and "Experiments". Next paragraphs will detail the meaning and objectives of these concepts in the context of this work.

Pilot Trials

The "Pilot Trials" are tests of the suitability of the services or processes for the objectives of the project, carried out in the first stages of the project for initial testing. These trials are formative and their main objective is to help refine the final version of the service or product.

Validation Trials

The "Validation Trials" are summative tests used for final testing and conducted after the pilot trials, in order to validate the results of the former pilot trials. They are usually conceived as an external evaluation of the project.

Controlled Experiments

Controlled experiments are designed to try specific aspects of the project due to their relevance. In a controlled experiment, the setup is designed to test hypotheses. It has one or more conditions (independent variables), and measures (dependent variables).

Controlled experiments are carried out under controlled conditions, not necessarily in a real context, but in a "laboratory" or "experimental" setting, controlled by the researchers. In the analyzed projects, the “usability work” is enclosed in this category.

3. Case Studies

During the current work, several EU funded projects have been analyzed. In the following chapter we will provide a more detailed introduction to the most relevant ones. Among these, the three main case studies are Organic.Edunet, VOA3R and Organic.Lingua.

The reason for this is that in these three projects the UAH, and more specifically, the author of this work, have had a direct implication in the development of the usability tasks. Furthermore, UAH has coordinated VOA3R project and is currently coordinating Organic.Lingua.

Other relevant projects that have been analyzed are “Europeana”[5], “Open Discovery Space”[6], and “Explore and Act for Human Rights”[7]

3.1. Organic.Edunet

Organic.Edunet is a multilingual federation of learning repositories whose mission is to raise awareness and forward the education of European youth in Organic Agriculture and Agroecology, providing quality content. It facilitates access to learning materials on organic agriculture and agroecology from all over the world [Manouselis et al.]. Organic.Edunet uses Agrovoc thesaurus (Agrovoc), as a knowledge representation scheme [Sánchez–Alonso & Sicilia]. The first version of Organic.Edunet website was launched in 2010.

[5] http://www.europeana.eu/
[6] http://www.opendiscoveryspace.eu/
[7] http://explorehumanrights.coe.int/

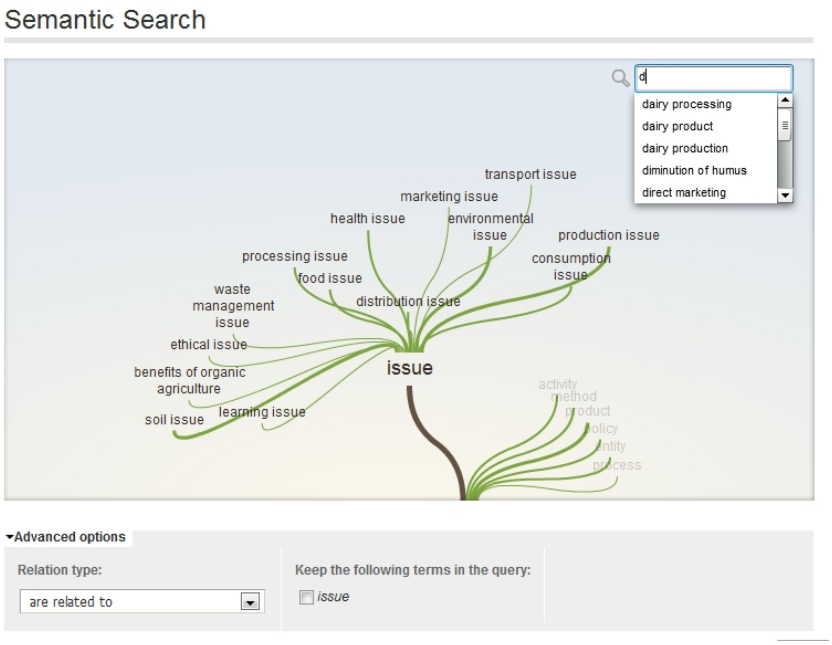

Figure 4: Organic.Edunet innovative Semantic Search Interface.

Organic.Edunet project also worked in the development of innovative search interfaces, which has a lot to do with the usability field. One of the search interfaces that this portal offers is called "Semantic Search". This interface integrates Organic.Lingua's resource classification scheme by using a tree diagram.

This interface was analysed and compared (making use of benchmarks), with the rest of search interfaces offered in the portal by means of an in depth usability study carried out during the fall semester of 2011 [Martin–Moncunill].

3.2. VOA3R

"Virtual Open Access Agriculture & Aquaculture Repository" (VOA3R) is a 3–year project that was launched in June 2010, funded by the European Commission under the CIP PSP programme. It brings together 14 organizations from 10 European countries aiming to facilitate the open sharing of scientific and scholarly research publications and outcomes related to agriculture, food and environment [Goovaerts].

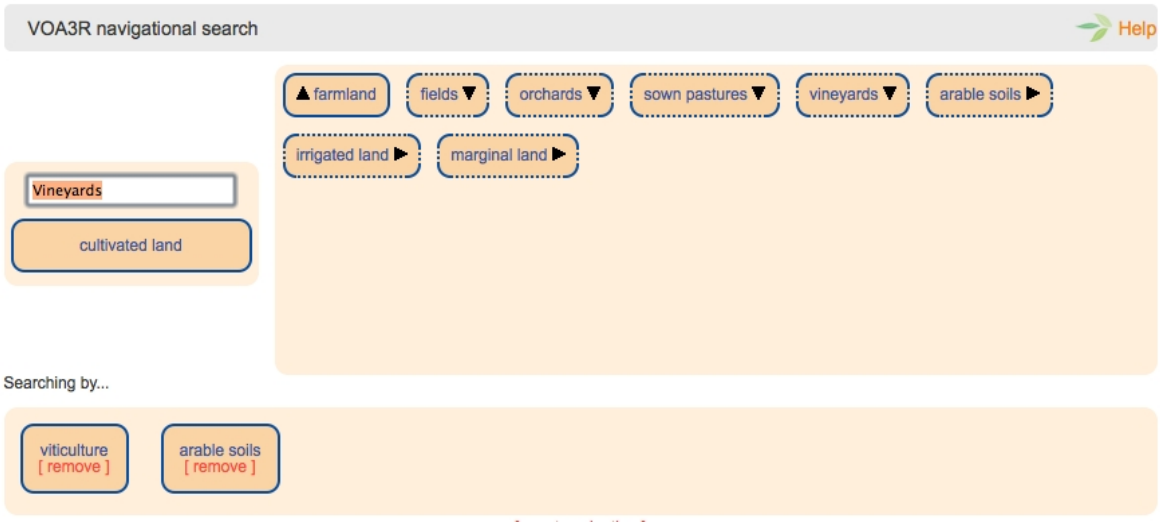

Figure 5: VOA3R Navigational Search Interface.

As seen in figure 5, the VOA3R initiative also delivered effort into implementing innovative interfaces to navigate through Agrovoc thesaurus terminology and show results linked to VOA3R resources.

At the beginning of the project there were not specific usability tasks planned for VOA3R. The consortium noticed this lack, as well as other problems, during the trials and so a new strategy regarding usability for the project was proposed in May 2012.

The Usability research in VOA3R project includes all the information gathered from the VOA3R pilot trials as well as that gathered by executing usability techniques such as thinking aloud, interviews or cognitive walkthroughs. These results were described and published as part of the project deliverables [VOA3R deliverables].

3.3. Organic.Lingua

Organic.Lingua aims to enhance the existing Organic.Edunet portal with advanced language services such as multi–lingual facilities that will further support the uptake of the portal from its targeted audiences, facilitate the multilingual features of the portal and further extend its geographical and linguistic coverage [Dimitropoulos et al.].

Although Organic.Lingua project does not follow the UCD model for its development, the focus and effort expended in usability aspects is noticeable in its DoW and deliverables, being much higher compared to Organic–Edunet project.

Results from the Organic.Edunet project and the above mentioned usability studies were taken as a starting point for developing the new version of the portal. Also, some usability related work was made during the gathering of new requirements [ORGANIC deliverables].

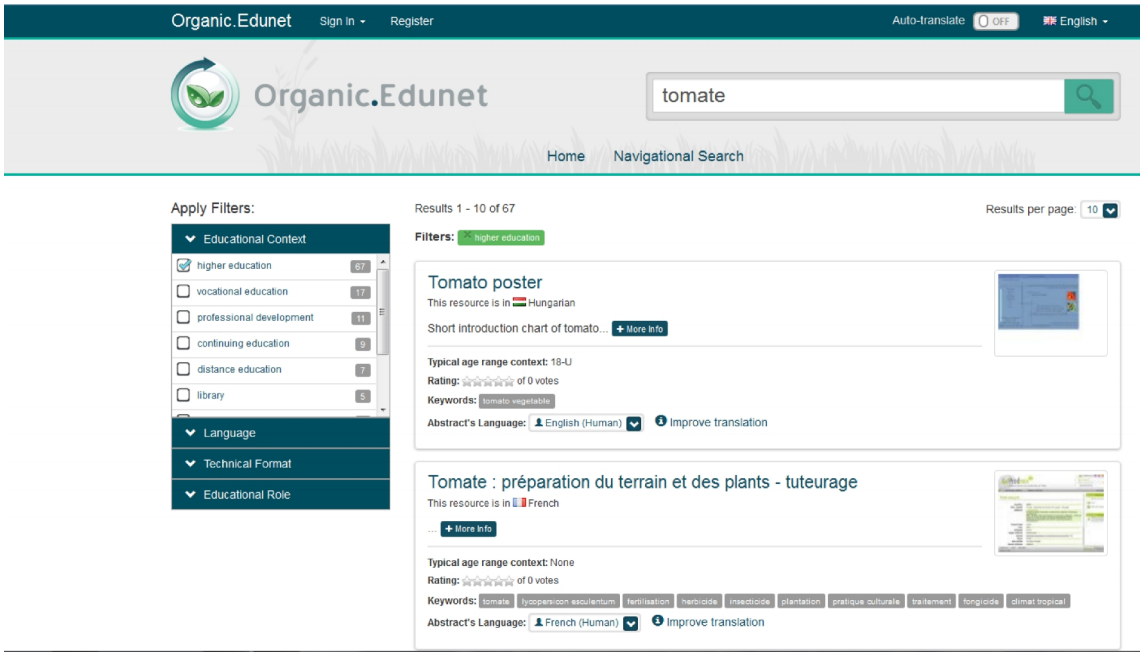

Figure 6*: The Organic.Lingua Project*

Preliminary tests with users for Organic.Lingua project started in January 2013. All users were members of SEAE – Spanish Society for Ecological Agriculture, as users with expertise in Organic Agriculture and Agroecology were required. Five more user trials took place in the next 6 months in France, UK, Latvia, Estonia and Greece involving users with profiles related to education, organic agriculture, agroecology or/and students.

3.4. Other projects

As mentioned at the beginning of this chapter, Organic.Edunet, VOA3R and Organic.Lingua have been the 3 main case studies for this work. These have been the projects in which the analysis has been deeper, due to the greater implication of the author of this work.

Other relevant projects analysed for this work have been:

Europeana

Europeana.eu is an Internet portal that acts as an interface to millions of books, paintings, films, museum pieces and archival records that have been digitalized throughout Europe. More than 2,000 institutions across Europe have contributed to Europeana. The author of this work has co–authored two papers about usability related to Europeana [Martín–Moncunill et. al] [Gaona P. et al.] .

Open Discovery Space (ODS)

"Open Discovery Space: A socially–powered and multilingual open learning infrastructure to boost the adoption of eLearning resources" addresses various challenges that face the eLearning environment in the European context. ODS will fulfill three principal objectives:

- Firstly, it will empower stakeholders through a single, integrated access point for eLearning resources from dispersed educational repositories.
- Secondly, it engages stakeholders in the production of meaningful educational activities by using a social–network style multilingual portal, offering eLearning resources as well as services for the production of educational activities.
- Thirdly, it will assess the impact of the new educational activities, which could serve as a prototype to be adopted by stakeholders in school education.

Thanks to its experience in previous educational projects, the Information Engineering research unit from University of Alcalá was asked to join the ODS consortium. UAH's major contribution is in the development of the Open Learning Content (WP7), Social Learning Data (WP8) and Socially Empowered Open Discovery Space Portal (WP9). UAH is leading task T7.3 Open Learning Content Alignment & Integration, and supporting Training Academies (WP6) on technology topics. [ODS DoW]

Explore and Act for Human Rights (EAHR)

EAHR's main objective is to achieve implementation and enforcement of the human rights in the education sector through a better understanding of the principles of the European system of protection of human rights and the functioning of its mechanisms.

This project initially intended to enable European secondary school students to become familiar with the key principles of European law regarding human rights and to understand how the European Court of Human Rights and other important CoE monitoring bodies. Secondly, this project aims to develop the teachers' role and responsibilities as key actors in ensuring an effective implementation of the principles of the European human rights system.

The Information Engineering research unit from University of Alcalá is developing the portal which will give access to the educational resources provided by this project.

II. Common Problems of Existing Approaches and Recommendations

The following sections will describe the most relevant among the common problems detected during the realization of this work and proposes recommendations to deal with them.

The first five problems described are general – global – problems regarding the overall usability approach. After them, we will proceed with those related to the way in which the trials are done and how to optimize them to extract more valuable and precise information.

It is important to notice that when several problems concur, solving just one doesn't necessarily mean an improvement – as a bigger problem could exist, making useless all the efforts to solve them.

So, after looking at these problems one by one, all the information will be analysed as a whole – in Part III – to develop a methodology for the continuous usability assessment in educational content portals, covering the whole project lifecycle.

1. Global problems regarding the overall usability approach

1.1. A Partial Vision of Usability

All the analyzed projects mention usability in their DoWs as a very important aspect, but at the end of the day their approach is far away from what it is required.

In these projects usability does not cover the whole lifecycle of the project and, in most cases, it is limited to some experimental tasks inside a work package. This, in real life, means not much more than some usability testing during the different implementation stages. This approach highly limits the usefulness of the usability effort.

Recommendations

As explained in chapter one, usability can and should cover the whole project lifecycle by the employment of different techniques and experiments. Also, best option for this kind of projects should be the UCD approach, since users are truly the *Raison d'être* of educational portals.

A methodology covering the whole project lifecycle, proposing different techniques and experiments for the different phases, should be developed. The full description of this methodology is described in Part III of this work as abovementioned.

1.2. Weak relation with Dissemination Work Package

Dissemination events gather people interested in the project, which means real potential users – the main usability information source. Even more, they usually gather experts with a lot of knowledge in the field that could provide their experience at zero cost.

Figure 7*: Panoramic view of VOA3R session during 2013 LINQ Conference (Rome).*

Unfortunately, most of the time these events are just promotional actions and the opportunity to gather feedback from users is completely lost. Loosing this kind of opportunities means losing a lot of information, time and money that could have been earned if the event had been prepared taking the "usability point of view" into account.

Recommendations

Dissemination activities should be prepared with the usability team, in order to try to extract as much feedback from users as possible. Some examples could be:

- Recruit users for future usability trials or even volunteers that will provide periodic usability feedback and help to disseminate the project.
- Prepare "focus groups" about relevant topics.
- Run small testing activities (e.g. try the registration process, look for a resource they could be interested in)
- Make walkthroughs and ask users for their subjective impressions through the use of questionnaires.

- When making brochure or flyers, ask the users to try all or some aspect of the project and complete a questionnaire / send feedback.
- Or employ any other usability technique that fits in the context.

1.3. There's no usability assessment in the early stages of the project

Not taking usability into consideration in the early stages of the project could bring terrible consequences, especially when the development cycle of the project is not iterative or the iterations are too long.

Usability should be present during the capture of requirements, analysis and design phases. If it's not done this way and a major usability problem – i.e., related to an error in the capture of requirements phase – is detected during usability testing, it could be too late or too expensive to make the needed modifications.

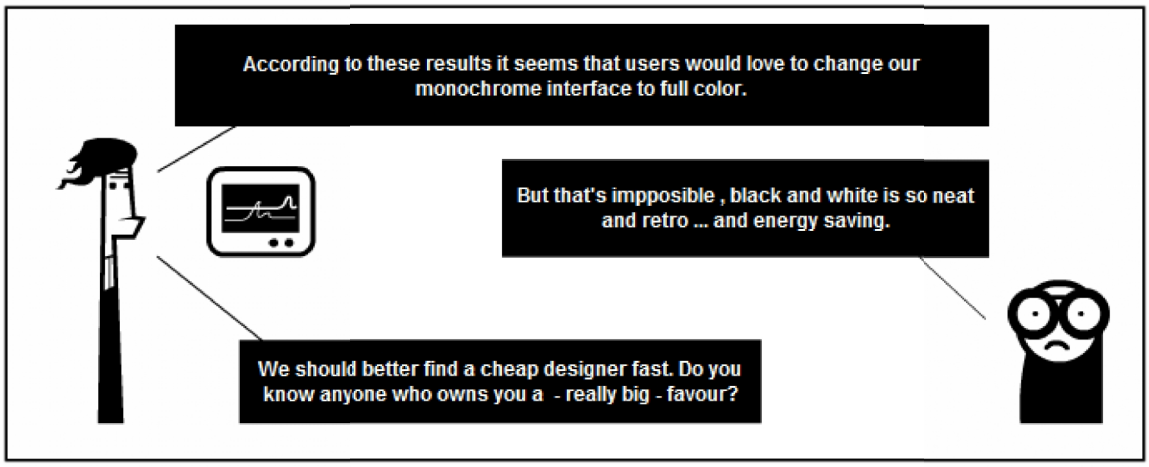

Figure 8*: There's no usability assessment in the early stages of the project – Cartoon.*

Recommendations

Include usability tasks during these phases of the project. There are several techniques that could be employed, just to mention some of them:

- Cognitive and pluralistic walkthroughs.
- Heuristic evaluation.
- Paper prototyping.
- Participatory design.

Some of these techniques will be explained in Part III, during the definition of the methodology, any case is really easy to find information about them in the web.

1.4. Not all the consortiums members are involved in Usability tasks

Usability makes users to use the products, thus making the effort of the whole team noticeable. Not matter what their role in the project is, all the consortium members must care about usability.

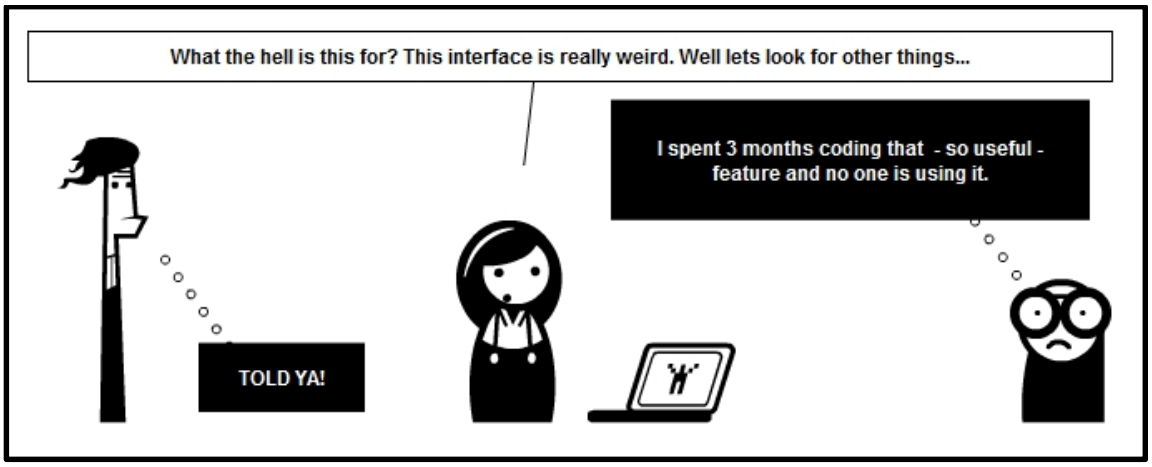

Figure 9*: Not all the consortiums members are involved in usability tasks – Cartoon.*

Recommendations

All partners should know about the relevance of usability in the project and help improving it as much as they can. The idea is to involve the whole consortium in the usability improvement. This could be as easy as just "using the project" periodically or asking colleagues to do so.

Usability feedback must not come only from external users but also from the members of the consortium. The Usability team constantly needs the collaboration of other consortium members, since there are too many factors to consider when designing very complex products for less technical end users and they have their point of view about who the intended user will be and his usage of their work.

1.5. Participants' needs are not included in the budget.

The budget for usability and trials seems to be not enough and it is destined almost exclusively to pay salaries. In most of the analyzed projects there was no budget to compensate users for their participation in trials or even to make them feel comfortable enough – which means among other aspects that:

- Drinks, coffee or something to eat must be offered to the users participating in the trials.
- The room must have an adequate temperature, furniture, etc.
- The place must have adequate Internet access (when needed).
- Users don't have to be forced to bring their own computers.
- Users should not to participate just after/before they should go to work.

This means that a good number of people participating in the trials and experiments would be people that feel somehow obliged to do so – colleagues, students, friends – and the people coming because they are interested in them may not find themselves comfortable, which can dramatically affect the quantitative and qualitative information.

Recommendations

When the budget is estimated, the consortium should take into account the needs of the users that will participate in the trials and experiments. An important amount of money can be earned taking advantage of the participation in other events – such as dissemination, as just seen – to prepare some usability activities.

Once more, partners should know about the relevance of usability in the project thus making them happy to spend some more money on it.

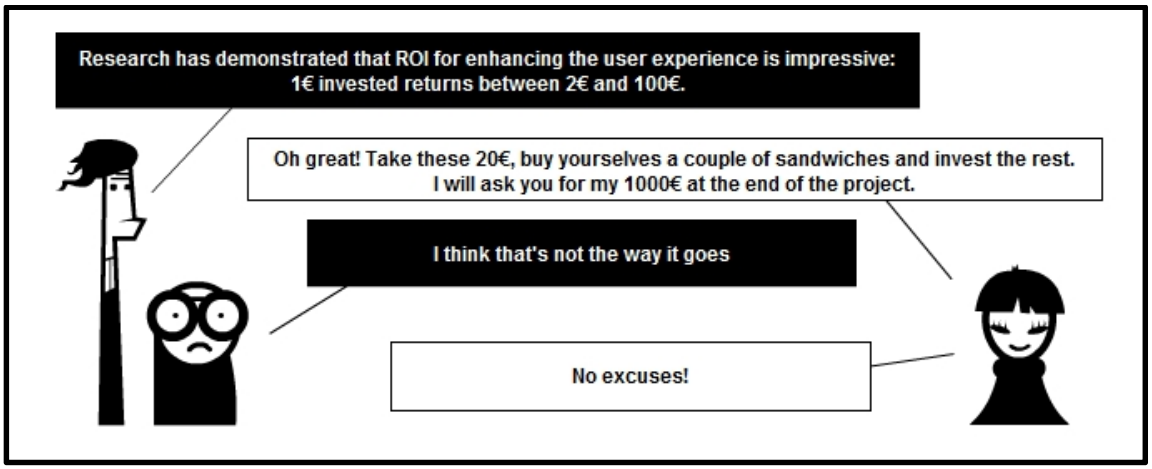

Figure 10*: Usability ROI – Cartoon.*

Leading companies like IBM, Microsoft, Apple, Google, Whirlpool, and Procter & Gamble have invested heavily in usability, which has yielded significant returns on investment (ROI). These companies spend M$ in usability before launching any product.

In any case, what it is sure is that any functionality implemented could be made worthless if users don't understand how to use it, don't like to use it or even think it's flawed. If the project's functionalities are not understood by users they will simply not use it, and all the effort in other areas will be also worthless.

2. Specific problems related to the way in which trials are done.

2.1. Lack of knowledge of the people moderating the trials

A European funded project involves partners from different countries, and for this reason the trials should include users from all over the EU, which means making trials at least in all the partners' countries.

Having a usability expert in every partner's team is something that will not likely happen. Also, it is possible that the main usability expert may not have the knowledge about the language, culture, etc., of all the countries taking part in the project, making impossible for him to moderate all the trials.

To deal with this handicap the partner responsible of the "trials work package" must provide some guidelines about how to moderate trials. Moderating the trials is not an easy task – especially when the moderator has no previous experience – and having some written guidelines about how to do so is simply not enough.

When this happens, two things can happen:

- In the best case, the unexperienced partner gathers much less useful information than expected.
- In the worst case, the unexperienced partner gathers spurious information which will contaminate the results.

The worst case can put the usability team in serious troubles when trying to analyze the results, even leading them to incorrect conclusions, which could lead to the waste of efforts and budget, or even decrease the usability of the portal.

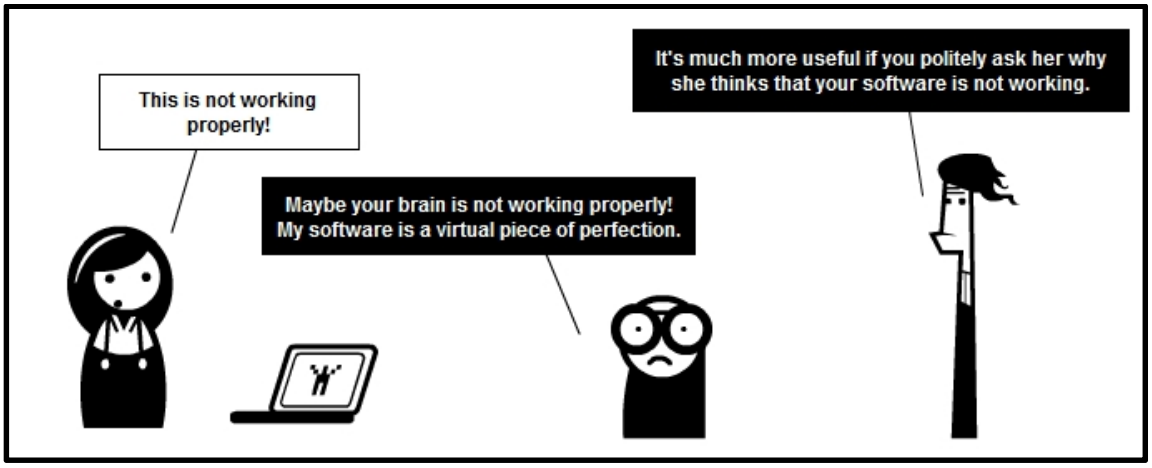

Figure 11*: Lack of knowledge of people moderating the trials – Cartoon.*

Recommendations

Guidelines are a really good tool, but some practical training is also needed.

Usability experts should prepare training sessions with real users, so the rest of the partners can learn and practice how to moderate the kind of trials planned for them.

Consortium partners can use the kick-off and the periodic meetings for these training sessions.

If there is budget for it, a good idea is to send the usability experts to help with the trials, fully realizing about the context and gather as much useful information as possible.

2.2. Inadequate elaboration of user profiles.

Trials are too generic and don't take the opportunity of gathering more specific information from users which could provide it, according to their background. This opportunity really exists, since the different partners have different organizational profiles and it is easier for them to access to different kinds of users, including experts in different areas.

In most occasions profile questionnaires are too generic and the usability team cannot put the results in context and evaluate them properly, since they don't have information about the notable characteristics of the user that are influencing the results. This includes the motivation of the user to participate in the trials. In the worst cases there is not even a profile questionnaire.

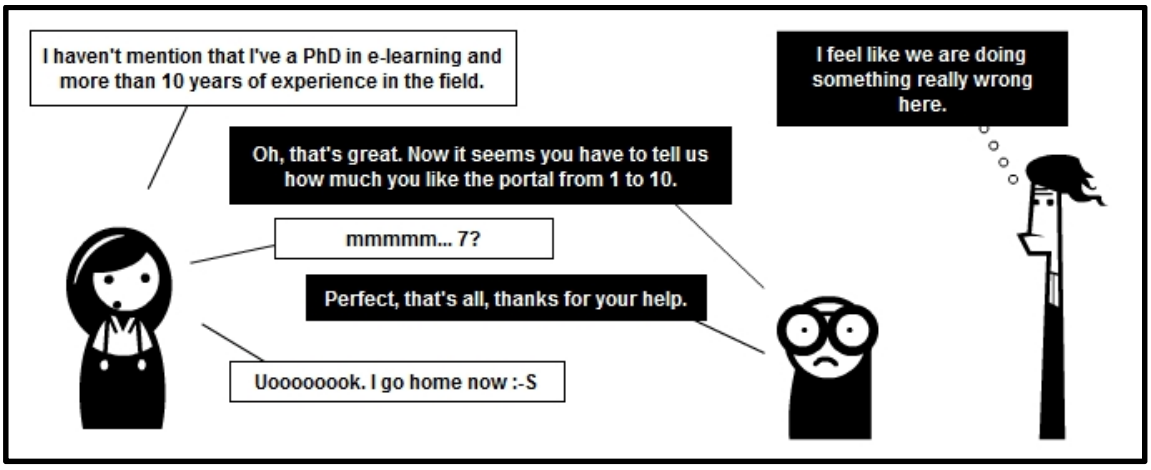

Figure 12*: Inadequate elaboration of user profiles – Cartoon.*

Recommendations

Trials must be adjusted to the user profiles that partners could reach. Small changes as making different questions or just knowing the concrete expertise of the users could provide very useful information for the usability team.

Proper tools to extract this information about the users should exist. Questionnaires are a good method, but sometimes more than one generic questionnaire is needed. Short interviews are also very useful.

2.3. User profile questionnaires are filled as part of the trial session

The problem when users fill the user profile questionnaire at the trial session is that the trial's hosts do not really know how many users according to a determinate user profile will participate. Also they will not have enough time to verify if the information provided by the user is correct.

It is usual for people to have problems to define their experience or amount of knowledge in a given area, and it is also common that they could misunderstand any given question or forget providing relevant information about their profile.

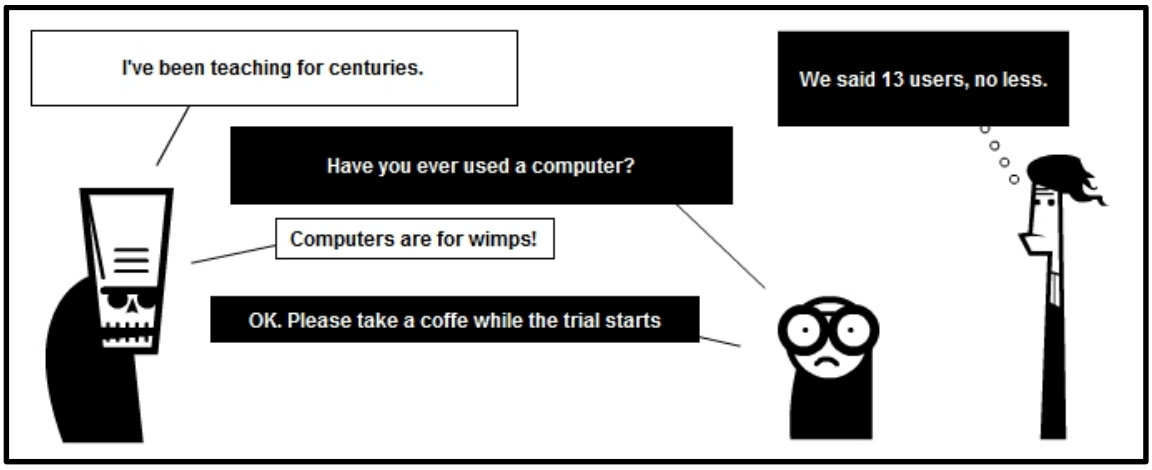

Figure 13*: User profile questionnaires are filled as part of the trial session – Cartoon.*

As figure 12 shows, in the worst case, that the hosts could have invited some users who do not match the required user profile, something that is out of the scope of the project.

Recommendations

This could be not so relevant in completely generic pilot trials, which look for a big amount of quantitative and subjective data, although it is really important from a usability perspective.

Asking the users – or at least some of them – to fill and send the user profile questionnaires before the trial day is a small effort which could provide a big return, since this will make feasible to prepare the trials to extract as much information as possible.

In some cases is also a good idea to have short interviews with some users in order to verify the information or to clarify some aspects that could be relevant for usability purposes.

The most important benefits of this approach are:

a) It makes relatively simple to extract qualitative data. For instance, the team will be able to identify experts and ask them for more information, an interview, participate in a focus group session, etc.
b) The prevention of gathering spurious data due to out of the scope users.
c) Making sure that enough users for each user profile are available.
d) Users could be classified into different groups at the beginning of the trial and make different trials according to their profile.

2.4. Users have personal relationships with the trial's hosts

It's extremely frequent that the users invited to the trials have some kind of personal relationship – co-workers, students, etc. – with the hosts. This should not be a problem as long as every user taking part in the trials does not feel pressured or persuaded to provide specific results influenced by personal feelings or interests.

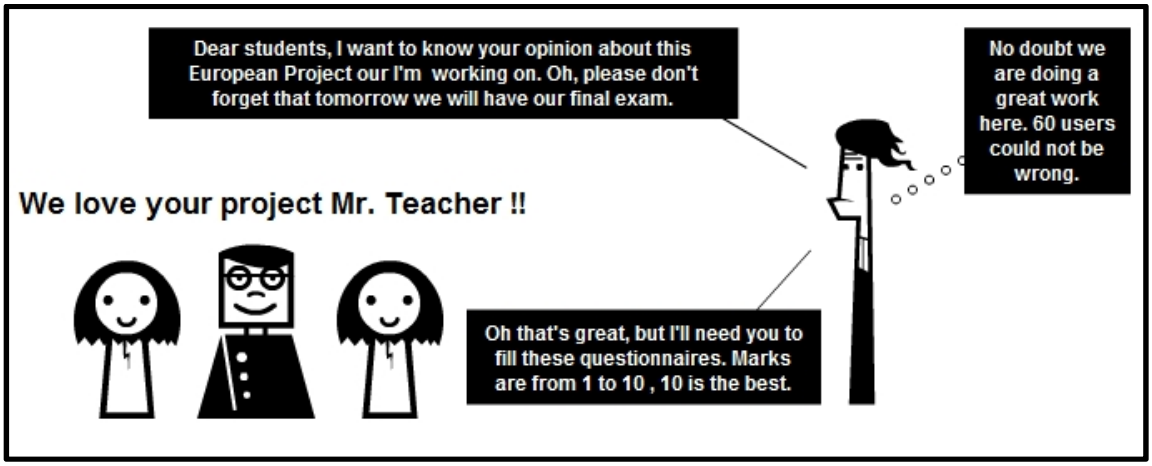

Figure 14*: Users have personal relations with the trial's host – Cartoon.*

Recommendations

Using colleagues, students, friends or people with any kind of personal relation is risky, but in some cases it can even be a good idea:

- Users with some kind of relation with the trial's moderator / host, could feel more comfortable to express their real feelings and opinions – than they will do to a stranger.
- Hosts will have a deeper knowledge of the user profile, his background and professional experience. They will not have the need to verify any information or make a short interview before the trial.

On the other hand, users should not be afraid or feel bad about criticizing the project due to personal feelings or 'destroying' it because any other kind of interests.

To avoid the inclusion of personal feelings and interests in the conclusions, some effective measures are:

- Giving a speech before the trials are conducted, in order to point out that criticism of their project is welcomed, since it is the best way they have to improve it.
- Completely anonymize the data. At this point the hosts should take into account that this will make further contact with the users impossible.

2.5. Users are not informed about the portal version – development status.

As well as moderators will not be able to properly analyze the trial results without having enough information about the user profile, users will not be able to properly evaluate the portal if they have no idea about its current development status.

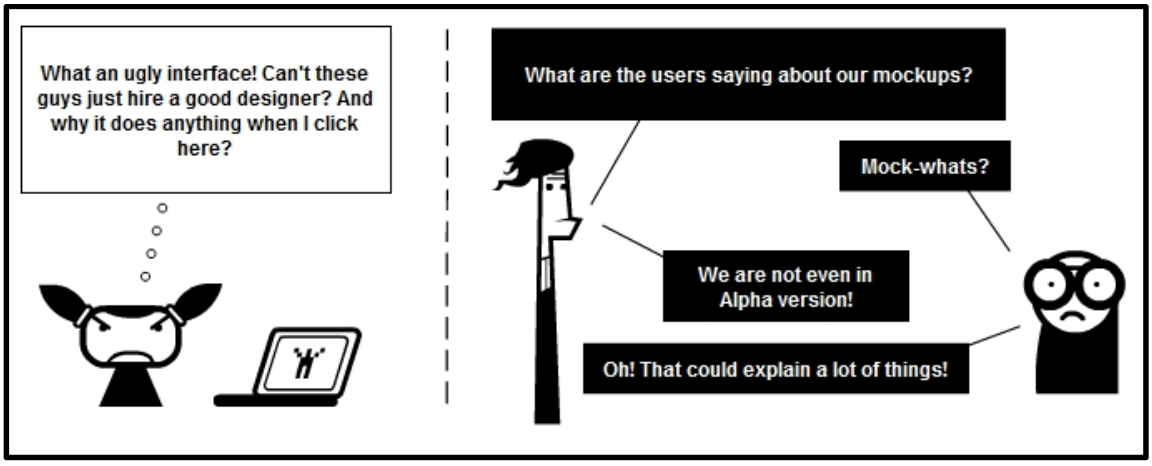

Figure 15*: Users* are not informed about the portal version – development status – *Cartoon.*

When trying a product, most users tend to think that they are trying a final version of the product. If this is not the case and the user does not know about this, the trial's results will not only be useless but also will contaminate the results.

Recommendations

The 'Welcome Speech' should include information regarding the development status of the portal and the purpose of the trial. This will help users to focus on the most important things the consortium is willing them to evaluate and 'do not panic' if some functionality is missing.

Users must be completely informed about:

a) If the interfaces are definitive, just mock–ups or willing to be improved.
b) Which functionalities are fully operative and which are experimental.
c) If there are any problems in which the consortium is currently working on, e.g. the system could be working to slow or getting disconnected from time to time.
d) Any other known issue that will influence the user experience.

2.6. Users try functionalities which are not working correctly

This problem is similar than 2.5., but in this case it refers to whether the users are trying functionalities which are not working well and if the hosts have informed about this.

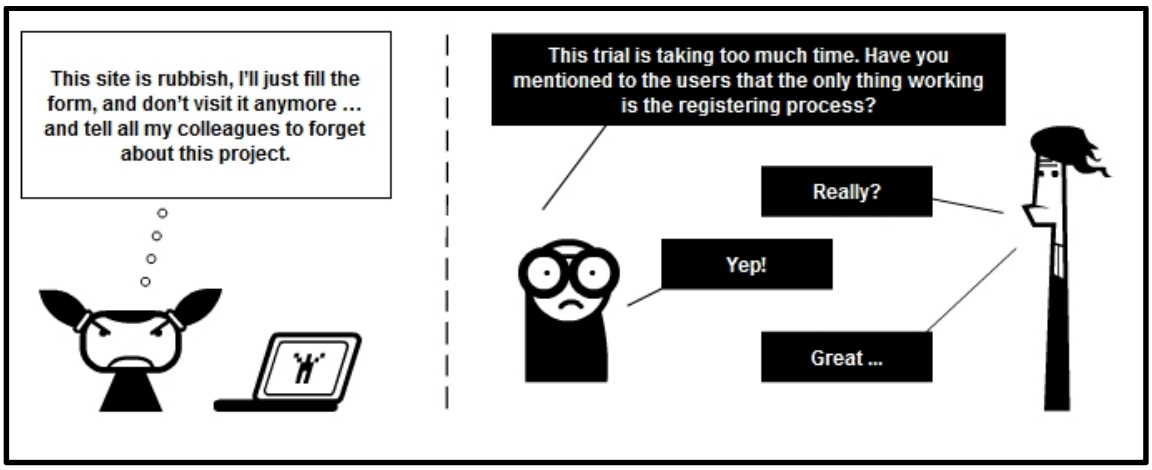

Figure 16*: Users try functionalities which are not working correctly – Cartoon.*

This situation could appear when:

- The development team has not notified about the portal status for the trials.
- The trial's hosts have not paid attention to development team information.
- The trial's hosts have not informed the development team about the date of the trial, and the development team is making changes or technical tests at the same time.
- A non–expected technical problem arises.

Recommendations

The communication between the development & technical team with the trial's hosts must be fluent and precise. Both should work together to make sure that everything will be prepared:

- A set up environment – server – should be ready for the trial.
- The technical & development team(s) should test the server and portal before the trial, guaranteeing that the latest stable version of the portal is provided.
- Any maintenance or non-trials relayed work on this server should be scheduled for another day.
- Team leaders should be completely sure that all the staff knows about the trials and:
  - Will not work with the server during their duration.
  - Will be ready if an unexpected technical problem arises in order to fix it and avoid cancelling the trials.
- Make sure that the trial's host is completely aware of the portal status and that only finished functionalities are going to be tested.

2.7. Every user tries all the functionalities

Users must only try the functionalities that they will use in real life. If users are forced to try functionalities that they will never use when the platform goes live, the results will not be valid, as the context of use will not be realistic.

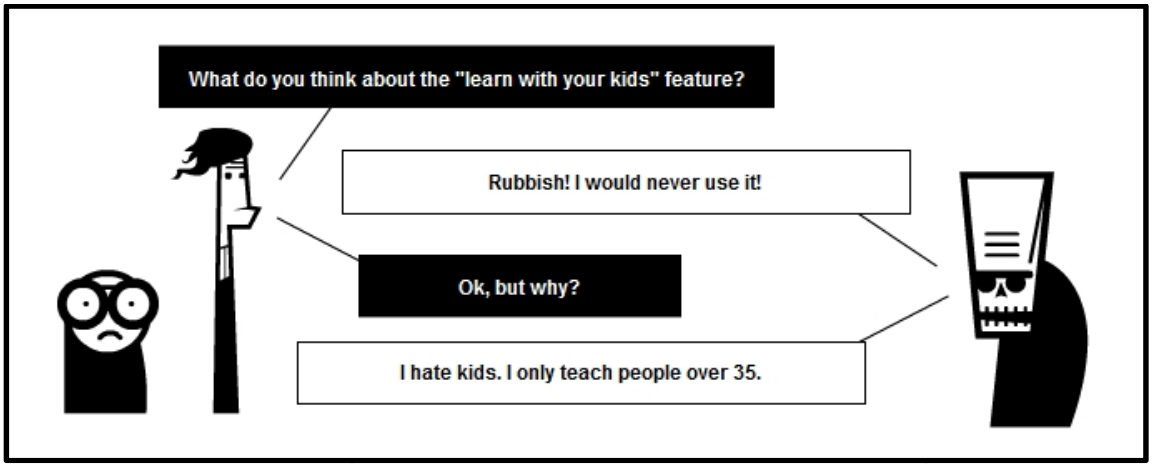

Figure 17*: Every user tries all the functionalities – Cartoon.*

Recommendations

Trials should be adapted to the different user profiles. In order to do this properly, it is necessary to follow the recommendations described in problems 2.2. 'Inadequate elaboration of user profiles' and 2.3. 'User profile questionnaires are filled as part of the trial session'.

2.8. Lack of well–defined scenarios and tasks

In most of the analyzed cases, trials were completely generic and did not have well–defined scenarios or even some specific tasks that the user must try to accomplish.

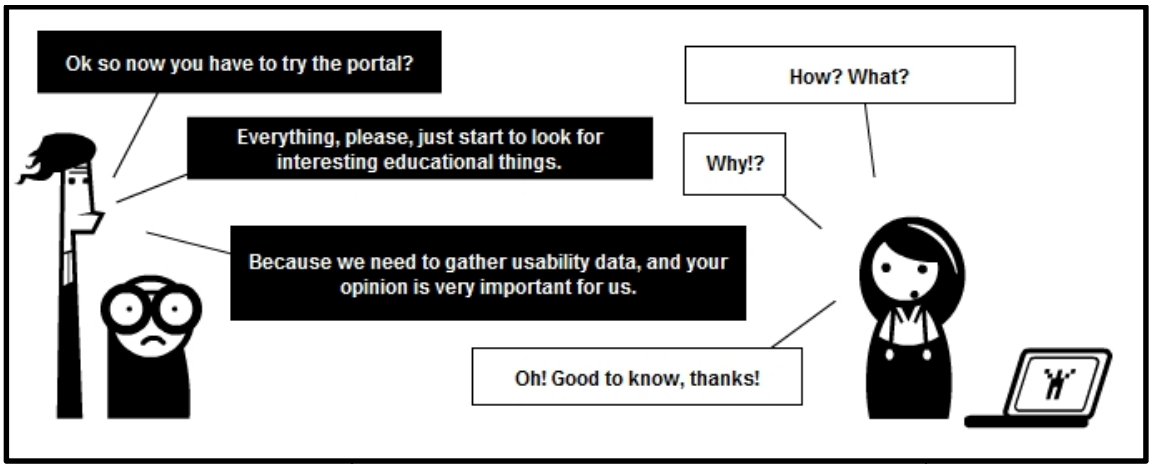

Figure 18*: No well–defined scenarios and tasks – Cartoon.*

Going back to the usability definition:

> *"The effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments."*

Since in this case there is not a particular environment – or context of use –, neither specific goals, the data gathered in this way will mostly be useless for analyzing the usability of the portal.

Recommendations

Completely generic trials in which users try everything without predefined tasks in the context of a scenario are mostly useless for usability purposes. The only information that could be extracted from this kind of trials is the subjective overall impression of the users through satisfaction questionnaires and some users' comments if they feel in the mood to do so.

A scenario should be designed for every test, with specific tasks according to the information that the usability team is needing to clarify all the usability issues which could not be solved by the use of heuristic techniques / expert's analysis.

2.9. The relation with the user ends when the trial ends

The users who participate in the trials should be potential real users, which means people interested into the project. Trials usually gather experts among other important stakeholders which could be helpful in many other ways apart from testing issues.

It is easy to see that trial events are a great opportunity for dissemination purposes, as well as dissemination events are a great opportunity to gather useful feedback as explained in problem 1.2.

But as described in problem 1.2. , this aspect is not taken into account during the preparation of the trials, losing a great opportunity to take advantage of the situation.

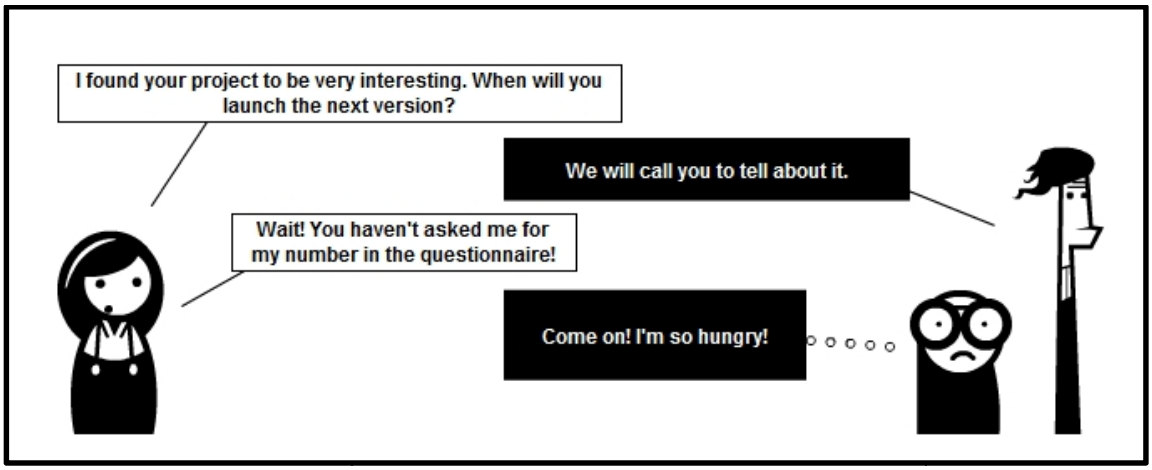

Figure 19*: The relation with the user ends when the trial ends – Cartoon.*

Recommendations

The consortium must take advantage of the opportunities that appear during the celebration of trials, where end–users, experts and other stakeholders meet.

The objective is to establish permanent relations with the users that will facilitate things like:

- Recruit beta-testers.
- Recruit leads for dissemination porpoises.
- Recruit researches willing to collaborate in any scientific aspect.
- Prepare dissemination events in other institutions.
- Keep users active informing them about project's advances, deployment of new functionalities, etc.

2.10. Extremely long tests

In many occasions the duration of the trials is too long and there are no pauses. Long trials not only make almost impossible to recruit users, but can also contaminate the results, since the ones participating get tired and the trials gets completely distorted.

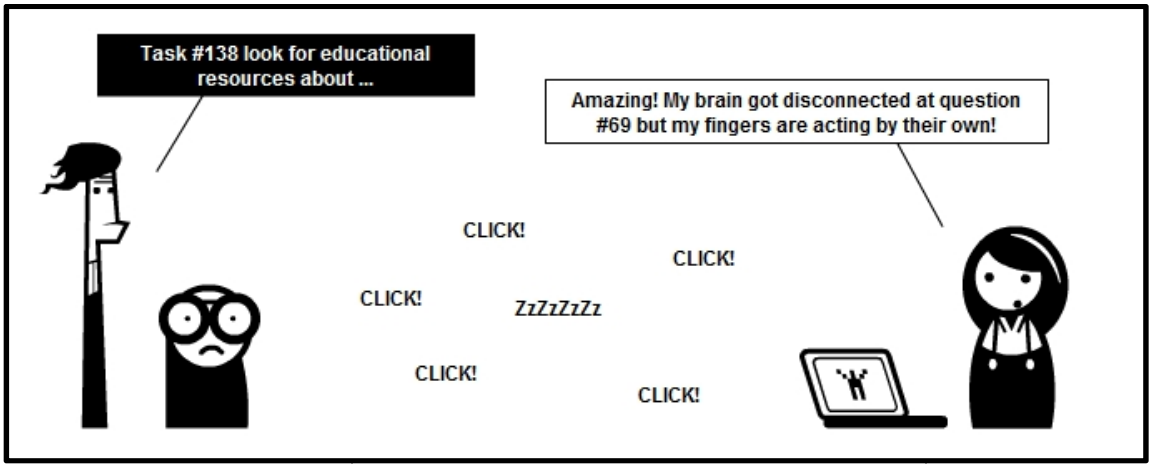

Figure 20*: Extremely long tests – Cartoon.*

Recommendations

The 'time costs' for the users should be reduced to the minimum. If the trial is going to be too long, the hosts should plan coffee breaks to help the users to relax. This coffee breaks could also be useful to try to extract more information for users in a relaxed context or for dissemination – networking – issues.

2.11. Questionnaires are asked to be filled at the end of the trial.

Ask the users to test something and then give them questionnaires / surveys to gather their impressions is the usual way in which trials are done. It is evident that the user should try the portal before giving his opinion, but trials' hosts should take care of some aspects if they want to gather valid data.

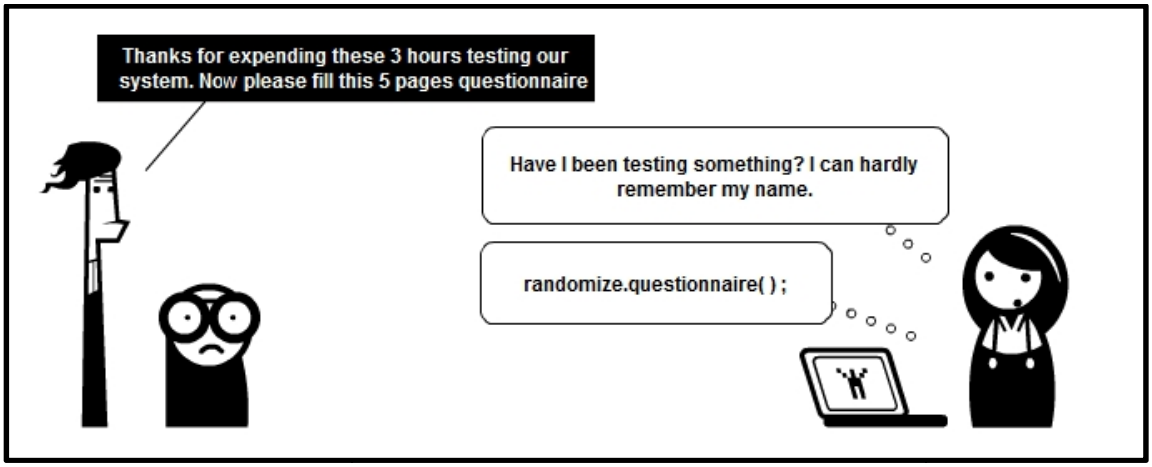

Figure 21*: Questionnaires are asked to be filled at the end of the trial – Cartoon.*

During trials users usually have to try several functionalities, which tends to take a lot of time – sometimes too much, as described in problem 2.10.

It is understandable that after all that testing users would:

- Be tired and willing to 'get back to home'.
- Have forgotten lots of details about the functionalities tried at the beginning of the trials.

Thus, users will not be in the best conditions to fill any kind of questionnaire, especially if it is an extremely long questionnaire – which will surely happen, since hosts would like to gather information about all tried features. This situation will lead to the following problems:

- A high number of random replies.
- A high number of not replied or "neutral" replies.
- Almost none qualitative – detailed – information would be gathered.

Recommendations

If the described situation happens, trial's hosts will not be able to ensure the validity of the gathered information. To avoid this happening hosts should:

- Divide the trial in short testing sessions about specific topics.
- Provide different questionnaires for each session.
- Make rehearsals / coffee breaks as explained in problem 2.10.

Questions asking about overall portal aspects such as colors, logos, fonts, etc. could be given at the end of the trial session.

2.12. Not enough qualitative neither objective information is gathered

Questionnaires are usually employed to extract quantitative data about users' subjective impressions and they are really good tools for that.

Nevertheless if the usability team has not enough qualitative information complementing this quantitative data, they will probably not be able to adequately face the detected problems. Most of the information gathered in analyzed questionnaires are just subjective overall impressions, which are not be very helpful for usability purposes.

The usability team can detect that there is a problem with functionality 'X' if there are lots of users saying that they 'do not like' that feature. But it could be an impossible task to guess what the problem is about if there is no more information or – even worst – if the team has contradictory results from another trial.

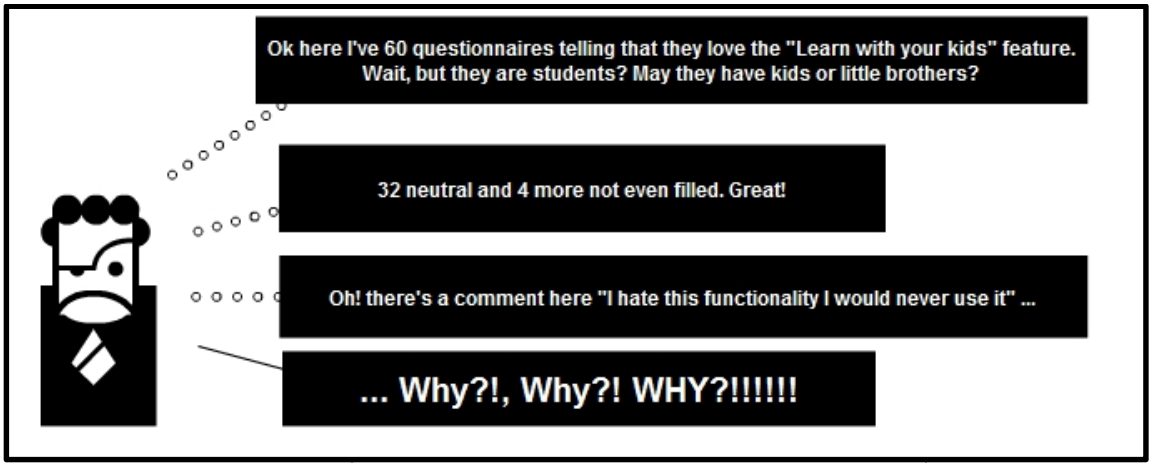

Figure 22*: Not enough qualitative information is gathered – Cartoon.*

It is also important to notice that all the information gathered will be **subjective** so the data must be carefully analyzed and also contrasted with some objective data.

Recommendations

Hosts should try to gather as much qualitative information as possible, making possible to precisely identify the problem and allow them to make an idea about how to solve it.

First step to achieve this is to ensure that the problem described in 2.11 is solved. Then some open questions as *'Please tell us why …'* could be included in the questionnaires. Of course, using other tools apart of questionnaires will be very helpful.

How to obtain objective quantitative data

The following example details a way to extract some objective data without breaking the structure and format of pilot and validation trials.

Usability testing techniques such as 'Thinking Aloud Protocol' are the main tools to extract objective data from users. The setup of this kind of techniques is one user testing and at least one moderator playing exclusive attention to the user.

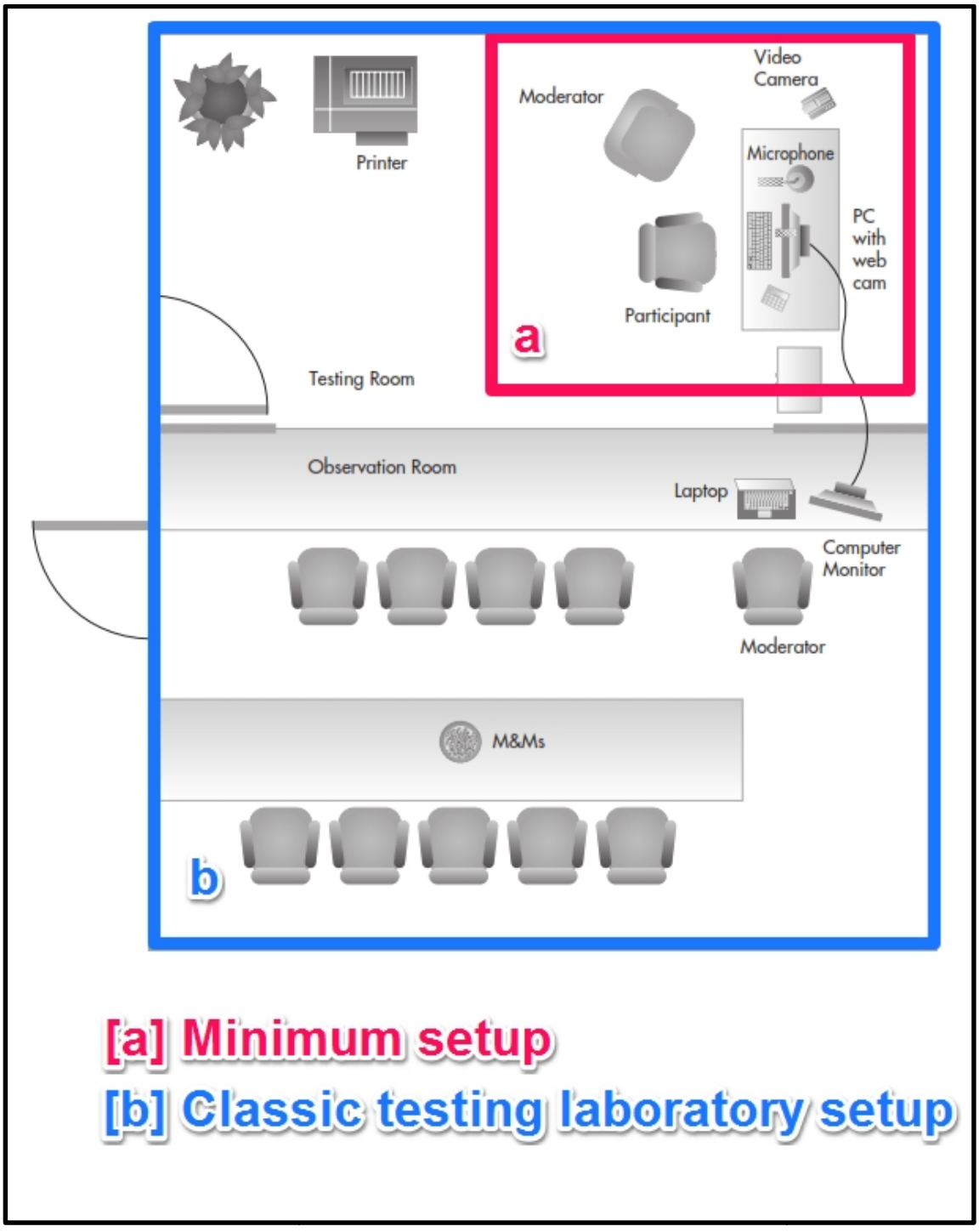

Figure 23*: Classic testing laboratory setup and minimum setup for most usability testing techniques. [UTesting08]*

As it can be seen in figure 22, several people can be paying attention to just one user and the minimum necessary will be 1 moderator for 1 user. This also means that every user is invited to participate independently, each one with his own time schedule.

It is easy to see that this kind of experiments will completely break the structure and format of pilot and validation trials, but there are other ways based in these techniques to extract some objective data.

VOA3R Trials	
USER ID	

SESSION 2 – SOCIAL FEATURES (R)

1. Setting Up the Stage

	Time	Dif
1.1. Change website's visualization according to your profile.		
1.2. Change your status, just express yourself ☺		

2. Making Friends

	Time	Dif
2.1. Look for "David Martin" and add him as a friend.		
2.2. Send a message to him saying "Hi friend!"		
2.3. Look for 2 more friends that are researchers in the same field as you (IT) using the advanced social search and add them as friends. You can add more criteria if you want.		

3. User Communities / Groups

	Time	Dif
3.1. Look for "IT in Agriculture" user community and join.		
3.2. Tell everyone you like this group. (Thumbs up)		
3.3. Open the "VOA3R Usability Issues" discussion in a new window/tab.		
3.4. Say that you are participating in VOA3R pilot trials and you'll provide feedback soon.		

☺ Thanks for your help ☺

Figure 24: *VOA3R testing form to gather objective data during pilot trials.*

The form showed in figure 23 was designed for VOA3R project last stage of pilot trials. The objective of this form was to gather some objective data – time and complexity – about certain common and important tasks.

The user had to try to complete the tasks as listed and fill the form according to these instructions:

> ***"Time"**: The time it takes to you to complete the task: A=Immediate |B= up to 3 minutes | C= more than 3 minutes. Please don't spend more than 5 minutes trying to complete a task with time.*
>
> ***"Difficulty":** How hard is the task to be completed: A=No problem | B= some minor problems | C= Severe problems to complete the task | D= You gave up or you couldn't complete the task.*
>
> ***Use the back of this paper to annotate anything that you find interesting, bugs to fix, questions and whatever you would like to bring to our attention.***

With this technique the usability team will not have as accurate results as other ones coming from – for instance – a benchmark test, but this level of detail is not needed in most cases.

VOA3R and Organic.Lingua experiences have showed up that very useful information can be obtained in a very easy way using this technique.

Several forms like the one showed in figure 23 where made to evaluate different features according to the different user profiles. In this case, the form was designed to evaluate basic social features and oriented to researchers – that is why it says "Social Features (R)".

Using this technique avoids the following problems:

a) *2.7. Every user tries all the functionalities* → There are different forms with different tasks for each user profile.

b) *2.8. No well–defined scenarios and tasks* → The user has to complete perfectly defined tasks in concrete scenarios.

c) *2.10. Extremely long tests* → The maximum for this test is 35 minutes (no more than 5 minutes should be expended for any task) the average was less than 20.

d) *2.11. Questionnaires are asked to be filled at the end of the trial* → The information is gathered as soon as the user completes the task. Also the user is asked to use the back of the form to annotate anything that he find interesting, bugs to fix, questions and whatever he would like to bring to trial's hosts attention.

e) *2.12. Not enough qualitative neither objective information is gathered* → The user is asked for objective quantitative data by filling the time and difficulty gaps and for subjective qualitative information by writing comments, as just explained.

f) *2.15. No one cares about motivating the users* → The form was also designed to be as friendly and usable as possible. There are a couple of small details which try to help in this subject:

   a. The user only has to write down his ID number, not any other kind of personal information. This ID number is assigned by the trial's hosts when the user gives them his user profile questionnaire.
   b. The form 'tries to be nice' with the user. It is easy to understand and thanks the user for his help.

2.13. Results are analyzed too far away in time and distance from the trials

The typical information contained in a trial report describes generalities about how the trial was hosted – number of users, time schedule, etc. – and the raw results.

It is a common problem that trials' hosts take too much time to report and do not provide enough details or even a brief analysis explaining their point of view.

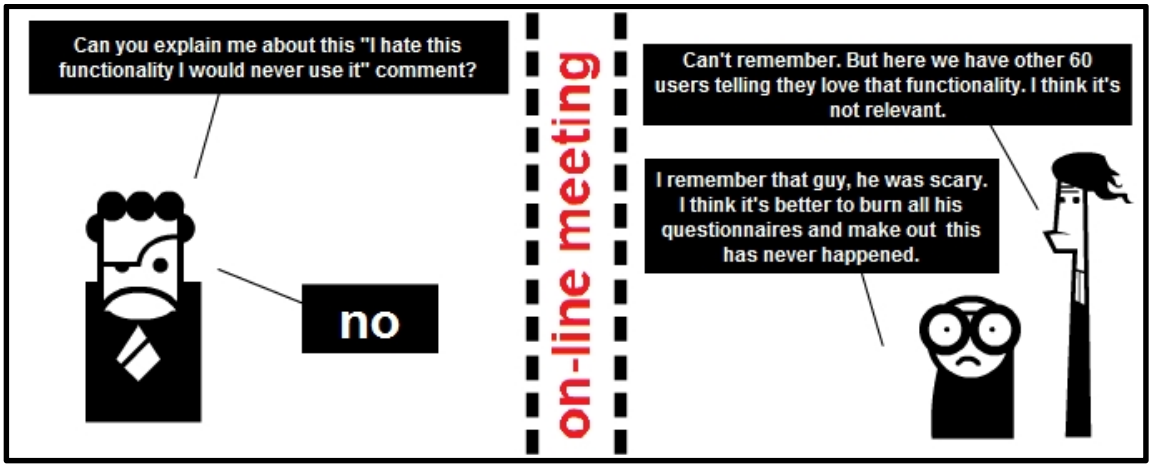

Figure 25*: Results are analyzed too far away in time and distance from the trials – Cartoon.*

In addition of not having enough information about the context and other particularities, people analyzing the results would most probably be from another country. This means, different cultures and ways of thinking, which will make the analysis even harder.

Recommendations

Partners participating in trials may not only host events and report results but help to analyze them with the usability team.

They should also try to report as soon as possible and make annotations about all the relevant particularities which occurred during the trial.

2.14. Users can't be / are not contacted to clarify or further analyze their trials

The usability team may need to contact some users to look for additional information. For instance, the usability team would like to clarify some comments or ask for feedback about desirable changes from the user point of view.

This will surely happen if problems as the ones just described – 2.13, 2.12, 2.11, 2.10, etc. – exist.

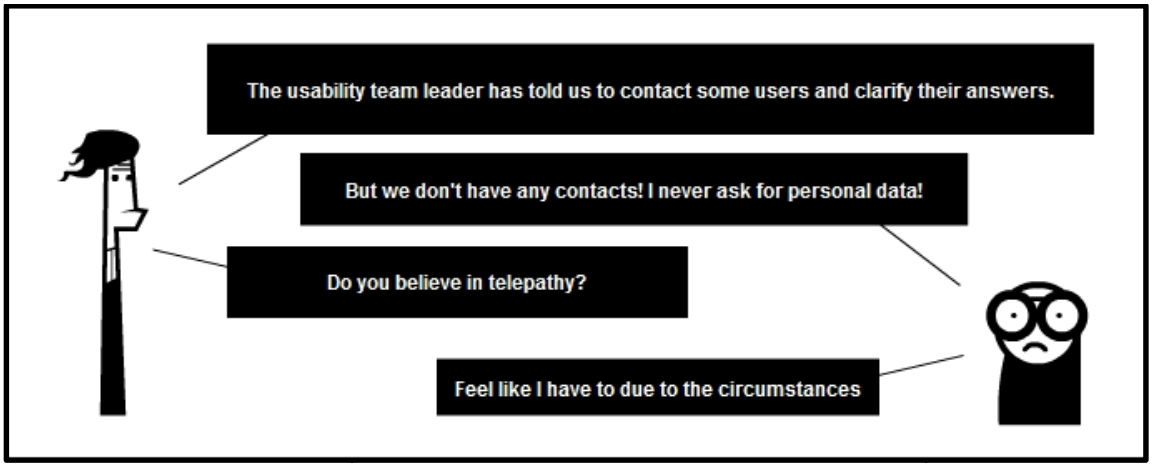

Figure 26*: Users are not contacted to clarify or further analyze their trials – Cartoon.*

Recommendations

A way for contacting the user should be recorded during the trials. Data protection policies should be considered for this subject. The following example deals with this problem and shows a template for a profile questionnaire which solves this and other previously described problems.

How to prepare a user profile questionnaire

This chapter has described several problems that could arise due to insufficient or wrong information regarding the user profile.

a) *2.2. Inadequate elaboration of user profiles* → Different user profiles should be defined and trials must be adjusted to the user profiles that partners could reach. There must be a tool to identify the users and assign them to the different conceived groups.

b) *2.3. User profile questionnaires are filled as part of the trial session* → It is better to have this information several days before the trial takes place. Methods to validate the received information may be considered in some cases.

c) *2.7. Every user tries all the functionalities* → To avoid this problem different users group should be established, and again, there must be a tool to identify the users and assign them to the different groups.

d) *2.8. Unclearly–defined scenarios and tasks* → Well-defined scenarios and tasks should be conceived according to the different user profiles.

e) *2.9. The relation with the user ends when the trial ends* → The user profile questionnaire should help to make the consortium realize if they would be able to establish a deeper relationship with any user.

f) *2.14. Users can't be / are not contacted to clarify or further analyze their trials* → There must be a way to gather some contact data so the consortium would be able to contact the user after the trials ends.

g) *2.15. No one cares about motivating the users* → A good way to motivate the user is knowing what the user motivation for participating in the trials is. The user profile questionnaire could include some question regarding this topic.

Also a short pre-test interview or colloquium could be useful to gather this information. Another way to achieve this – useful for small / medium groups – is to make everyone to present their selves, e.g. - "Please tell everyone your name, and why you are interested in the project".

organic lingua	**USER ID: _____**				
Name:					
Country:					
Email:					
How would you best describe yourself? Please indicate your occupation.	❑ School teacher ❑ Librarian ❑ Student at school ❑ College/ University teacher ❑ Technology developer	❑ Researcher ❑ Student at college / university ❑ Adult learner ❑ OA / AE Practitioner ❑ Other:_____			
What is your native language?					
Do you speak any other languages? If yes, which?					
	Never	Rarely	Sometimes	Often	Always
1. Have you ever used an educational portal/repository?	❑	❑	❑	❑	❑
2. Have you ever uploaded educational resources to an educational portal/repository?	❑	❑	❑	❑	❑
3. Have you ever described an educational resource using metadata?	❑	❑	❑	❑	❑
4. Have you ever used Organic.Edunet?	❑	❑	❑	❑	❑
5. Have you ever used automatic translation services?	❑	❑	❑	❑	❑
Use this text area to provide us additional information regarding your profile, background in the educational sector and experience. Please tell us why you are interested in the project.					
❑ I would like to be kept informed about portal updates and project news. (Data protection policies should be included here)					

Figure 27: *A version of Organic.Lingua user profile questionnaire.*

The user profile questionnaire showed in figure 26 ask for the information needed to solve the abovementioned list of problems:

- Name, country and other personal data (highlighted in red) could be asked if needed. People usually do not like to provide this kind of information – e.g. some women consider very impolite to ask them about their age. It is better to avoid asking for this kind of information.

- The email (highlighted in blue) will provide a way to contact the user after the test if needed. Other ways to contact the user could be asked, but it is fundamental to make him feel safe and know that he will not be disturbed with spam.

- The green highlighted fields are related to the user's specific experience and knowledge, which will mostly define the user group he belongs to.

- The text area highlighted in yellow asks the user about additional information regarding his profile, background in the sector, experience and his motivation to participate in the trials. All this is related to problems 2.9 and 2.15.

- Finally the user should be asked if he is interested in receiving notifications about the project progress. All the DPP issues should be also written here, according to the legislation of the country where trials are hosted.

After the user fills this questionnaire the trial's hosts should provide him his user ID. This is useful to:

a) Don't make the user to put his name and other personal data once and again in every questionnaire or form he should fill.
b) Partially anonymize the information provided by the participants.

2.15. No one cares about motivating the users

It is much easier to make users collaborate during the trials when they are motivated. This will lead to obtain more information and avoid spurious data, since users will be more interest to provide a detailed reply.

If users are not motivated – bored, nervous or even angry – just the opposite will happen. It could also lend to situations like the ones described in problems 2.10 or 2.11.

A motivated user could participate in a 3 hours long trial and finish it with a smile on his face. A user participating in a trial feeling forced to do so (see problem 2.4) will not stand the situation after 20 minutes.

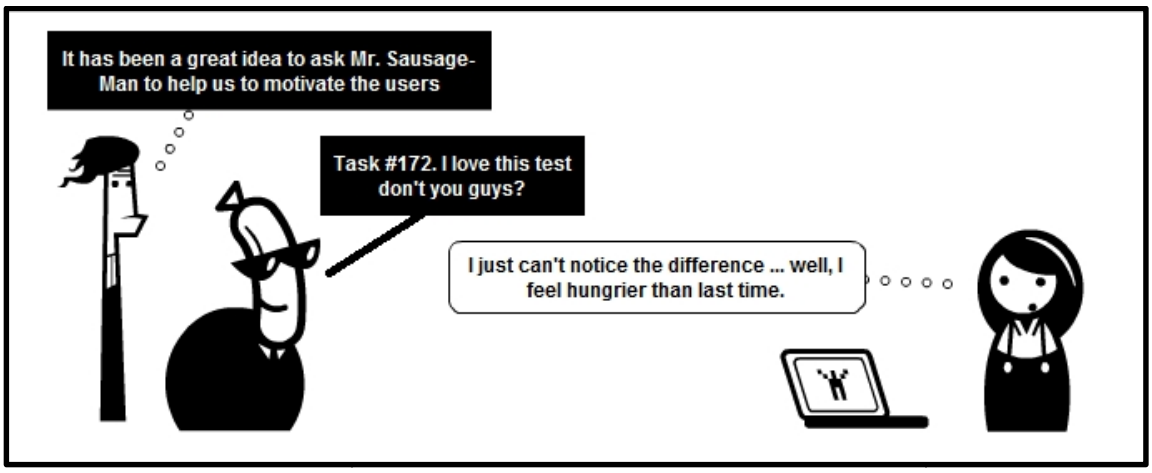

Figure 28*: No one cares about motivating the users – Cartoon.*

Recommendations

There are many ways to motivate users, some of them have already been described in the "recommendations" section of the previous problems.

Which is clear is that all the partners hosting trials should know about the relevance of this topic and do their best to motivate the users – which is directly related to problem 2.1 "Lack of knowledge of the people moderating the trials".

Is also extremely important to keep in mind that the first step to motivate users is to know their motivations regarding the project, which starts with and adequate way of gathering user profile information.

Books as [UTesting08] or [CBarnum11] have very detailed information with several chapters describing how to motivate users and deal with the whole testing moderation process.

III. Proposed Methodology

The objective of this part is to detail a methodology in which usability covers the whole project's lifecycle, according to the abstraction of the typical work packages workflow detailed in Unit I.

Different usability techniques and tools for each project's phase will be presented. The use of these techniques should follow all the recommendations explained during Unit II.

Usability testing techniques will be the main tools during the implementation stage. A detailed description of how to manage usability during these stages will be provided, including guidelines and templates in order to make easier the testing tasks and to assure the extraction of high quality, reliable and reusable results.

1. A Work Packages Workflow based on User Centered Design

The "typical work packages workflow" which was explained in part I, showed up that the implementation stages start just after an initial stage to set the project up. Then results were obtained by performing different trials and experiments, which led to their dissemination.

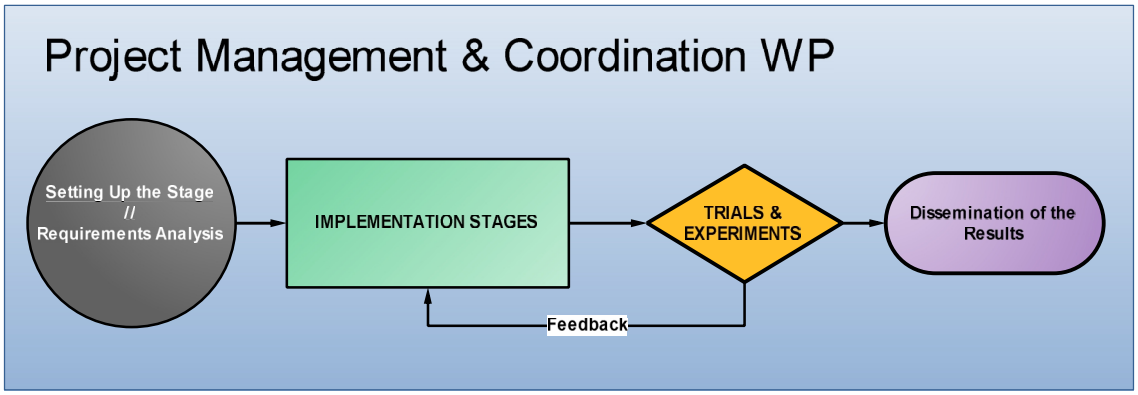

Figure 29*: Abstraction of the typical work packages workflow in analyzed EU projects*

This vision 'locks up' usability to the “trials & experiments” work package, and more precisely to the controlled experiments tasks. It is clear that this approach completely breaks the centered user design one, which will probably be the best option for the development of educational portals – as it was also explained in Part I.

The following figure shows a possible solution for this where usability covers all the project’s lifecycle, since it is being present in all project’s work packages.

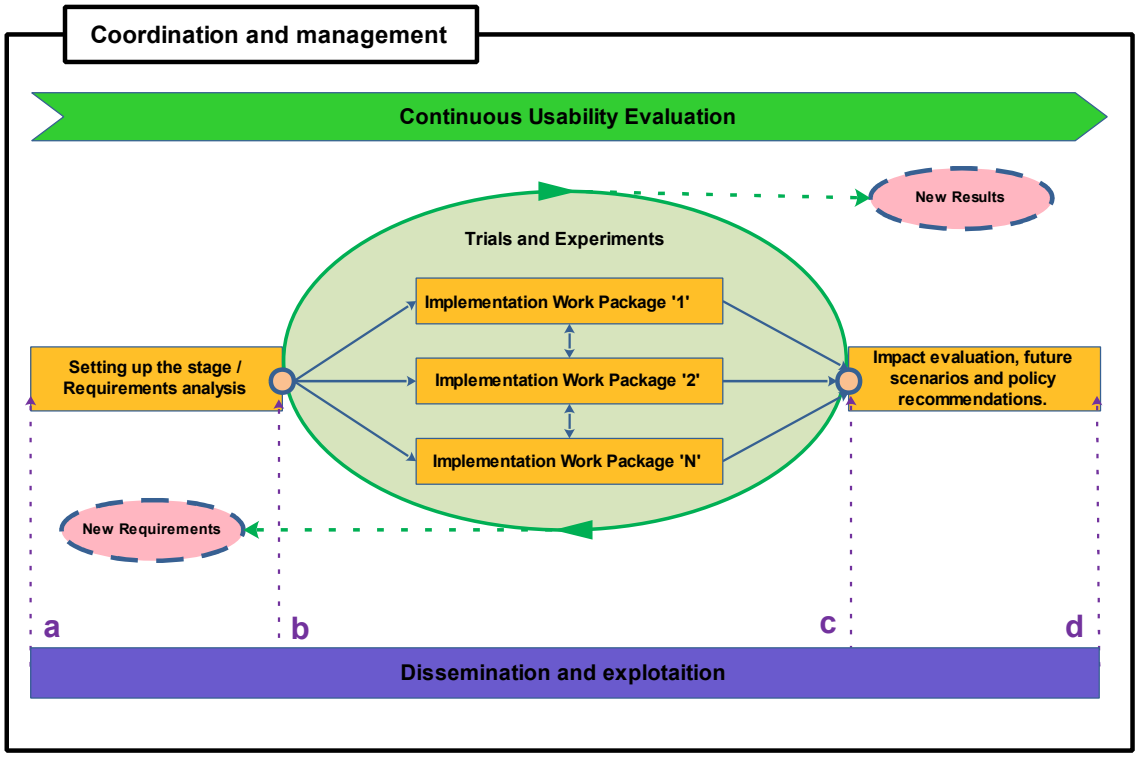

Figure 30*: Proposed Work Packages Workflow*

‘Coordination and Management’ Work Package

The objective of this WP is to covers all the management and the scientific and technical coordination aspects of the project. Continuously monitoring of the project could be made effective by regular reports and physical and on-line meetings.

‘Dissemination and Exploitation’ Work Package

This WP should aim to promote the project to interested stakeholders as well as to set up a network structure for achieving its future sustainability. It should run from the beginning to the end of the project, in parallel to the rest of the WPs.

This concept – running in parallel during the entire project – was introduced in part II, when describing problems as 2.1 or 2.14. Dissemination opportunities could occur at any moment – e.g. during a trial – so having dissemination activities, as seen in figure 3, is not only not optimum but also not realistic.

Of course, there are some key moments during the project in which the dissemination activity should be especially intense. These points – showed in figure 29 – are:

a) At the very beginning of the project, to announce that the project has been accepted and look for any possible support: volunteers, new partners, etc.
b) When a new implementation lifecycle is going to start, to inform about the next project's steps.
c) At the end of an implementation lifecycle, to disseminate the results.
d) At the end of the project itself, for obvious sustainability reasons and to disseminate the overall results.

'Implementation' and 'Trials & Experiments' Work Packages

Any project will have one or more work packages dealing with implementation tasks, for instance:

- To implement the portal itself.
- To implement new educational contents.
- To implement metadata schemas.
- To implement new ontologies.

As explained before, these implementation work packages should run in an iterative context, where usability is always present.

Taking the abovementioned work packages as an example, it is important to notice that the usability of the portal, of the educational contents, schemas and ontologies can and should be measured – and it will be the same for any other implementation work package.

Usability testing techniques will be the main tool to evaluate usability during implementation work packages. Chapter four will provide a full description about how to manage usability during these stages, including guidelines and templates in order to making the testing tasks easier and to assure the extraction of high quality, reliable and reusable results.

The 'Trials and Experiments' work package will establish continuous trials to evaluate and validate the development, aiming to optimize the platform, making it as much useful, usable and exploitable as possible.

It is also important to notice that during these 'development stages or cycles' new results will arise, which could lead to new requirements for the portal. The implementation of these new requirements doesn't necessarily have to wait to the next cycle, as it will be seen in chapter 4.

'Impact Evaluation, Future Scenarios and Policy Recommendations' Work Package

The idea behind this 'new' work package is that it will be useful to measure the impact that the project is having in the topics addressed by the call and to research about future scenarios to tackle societal challenges in the educational context by the use of the project.

This will require a thorough and permanent analysis of the project and of its environment, delivering a report at the end of each of the project's development stage, which will be useful to prepare the next one.

'Continuous Usability Evaluation' Work Package

The only work package missing at this point is the 'Continuous Usability Evaluation' work package. As it can be seen in figure 20, this work package covers all the other work packages during all the project's lifecycle.

Next chapters will describe how this should be done:

- Chapter 2 for the 'Setting Up the Stage / Requirements Analysis' work package.
- Chapter 3 for the 'Impact Evaluation, Future Scenarios and Policy Recommendations' work package
- Chapter4 for the 'Implementation' and 'Trials and Experiments' work packages.
- The relationship between usability and "Dissemination" work packages was explained in part II.

2. Usability in 'Setting Up the Stage / Requirements Analysis' work package

Poorly specified user requirements are one of the most important factors behind a project failure. At this stage of the project, the consortium should answer these questions:

- What is the portal going to do? → Features
- How will people use the portal?
- Why will people use the portal (instead of other existing solutions)?
- Which will be the most relevant functionalities are most central?
- How should this functionalities be structured?

Usability methods, techniques and tools aim to answer all these questions, thus providing a clear understanding of the requirements as an early input to the project. The objective of this

chapter is to briefly present the most relevant – useful – ones for the tasks that usually involve the 'Setting Up the Stage / Requirements Analysis' work package.

Achieving success requires a proper understanding of both user and organizational requirements, avoiding over-reliance on internally generated requirements, as opposed to data from end-user requirements studies; a good way to do so is by using usability techniques, tools and methods.

Furthermore, as it has been explained, possible new requirements can be detected during the implementation lifecycle. These usability techniques will also be useful to analyze the practicability of the new requirements. For the same reason, these techniques could be useful at the beginning of every implementation cycle.

Heuristic Evaluation

Usability consultant Jakob Nielsen [Nielsen 93] developed this method on the basis of several years of experience in teaching and consulting about usability engineering.

Heuristic evaluations are one of the most informal methods of usability inspection, there are many sets of usability design heuristics; they are not mutually exclusive and cover many of the same aspects of user interface design.

In heuristic evaluation, experts use their experience, using these usability heuristics to provide usability feedback. Heuristic evaluation requires only one expert, reducing the complexity and time spent in evaluation.

The simplicity of heuristic evaluation is beneficial in the early stages of design, but it could be used at any stage of the project. In fact, having continuous heuristic supervision can be a helpful tool. Also, using heuristic evaluation prior to user testing will reduce the number and severity of design errors discovered by users.

As any other expert-based evaluation results are highly influenced by the knowledge of the expert reviewers, which is something to be taken in to account.

Formulate usability goals, set benchmarks and overall design criteria

Setting goals is the first step and the only way to achieve them. The Consortium should formulate goals and set concrete quantitative benchmarks in case it is possible. This will help to focus and steer the design process, supporting the evaluation of early concepts, prototypes and final designs.

Participatory Design

This approach to design attempts to actively involve all stakeholders in the design process in order to help ensure the product designed meets their needs and is usable.

In the context of this work, the most relevant stakeholders would be:

- End Users.
- Employees.
- Researchers in the educational field.
- Educational institutions.
- Partners.
- European citizens.

Participants from these groups are invited to cooperate with designers, researchers and developers during one or several stages of an innovation process. In the context of this work package participants could help with the initial exploration and problem definition both to help define the problem and to focus ideas for solution. At the beginning of every new implementation cycle they could help evaluating the proposed solutions – new requirements.

Surveys / Questionnaires and Interviews

All these are well known tools to gather information, which nowadays could be conducted face-to-face, by email, videoconference, over the telephone, etc.

The most important aspect to mention here is the possibility of not only gathering information about requirements analysis aspects, but to gather data about users which could participate in focus groups, testing, participatory design, trials, etc.

As it has been seen in part II, the recruiting process is an extremely sensible task and the usability team should take every opportunity that could be helpful in this process.

Paper Prototyping

Paper prototyping is a widely used method in the user-centered design process, which involves creating rough, even hand-sketched, drawings of an interface to use as prototypes, or models, of a design.

This method saves time and money by enabling developers to test possible portal interfaces before the start of its implementation. Existing designs could be modified in an easy and inexpensive way, which makes this method useful in the early phases of the project.

Paper prototyping allows the entire creative team to be involved in the process, which eliminates the chance of someone with key information not being involved in the design

process. Another benefit of paper prototyping is that users feel more comfortable being critical of the mock up because it doesn't have a polished look [Klee2000].

Focus Groups

Whilst being poorly suited to evaluating a product, focus groups are useful for discussing possible user requirements and brainstorming ideas. As such, they are really useful during the early stages of the project.

Field Studies & Evaluation of Existing Solutions

Observing the end-user situation and the environment in which a new product or system will be used – including other existing solutions – is a must for understanding user needs.

These methods provide a range of useful information aiming to reveal and clarify the key aspects of current solutions and what users are still missing.

User Personas, Usage Scenarios and Task Analysis

These techniques are used to obtain concrete and illustrative data about typical users, their characteristics, usage situation, tasks and goals, which is particularly useful in supporting early user interface design work.

This deeper analysis of the users that work with a system is needed to know how user's work tasks should be supported by functionality in a system. Personas, scenarios and tasks should always be analysed prior to usability testing. This is needed to ensure that there will be real users trying to do realistic tasks in a realistic context of use (scenario) participating in the tests.

Card Sorting

In card sorting techniques a group of subjects – either final users or experts in the field that is going to be analyzed – are guided to generate a category tree or folksonomy. It is a useful approach for designing information architecture, workflows, menu structure, web site navigation paths or even metadata schemas. Groups may either be organized as collaborative groups (focus groups) or as repeated individual sorts.

The process is really simple, inexpensive:

a) Identify the concepts.

b) Write them onto index cards or Post-it notes.
c) Participants arrange these to represent the groups or structures they are familiar with.
d) This process is repeated across a population of test subjects.
e) The results are analyzed to reveal patterns.

There are several tools to help make these experiments on-line. The way in which users arrange these cards leads to different varieties of card sorting experiments, some of them are:

- Closed Card Sort: participants are provided with a predetermined set of category names – evaluative approach.
- Open Card Sort: participants create their own names for the categories – generative approach.
- Reverse card sort: an existing structure of categories and sub-categories is tested. Users are given tasks and are asked to complete them navigating a collection of cards. Useful to know whether a predetermined hierarchy provides a good way to find information.

Cognitive and Pluralistic Walkthroughs

Walkthroughs involve one or a group of evaluators inspecting a user interface by going through a set of tasks. This means that evaluators should first determine the interface to be used and its representative users, the tasks, etc.

At the initial stages of the project, the user interface is often presented in the form of a paper mock-up, and as the project advances, the evaluators will work with an operative prototype and then with a fully developed interface. This technique is best used in the design stage of development but it can also be applied during the code, test, and deployment stages.

The main difference between 'Cognitive' and 'Pluralistic' walkthroughs is that in the first one usability related experts are the only participants, while the second one should involve multiple groups, including the users – that is why it is called 'pluralistic'.

In Cognitive Walkthroughs user experience experts try to experience the interface from the user point of view, since no real users are participating in the experiment. In fact one of this walkthrough goals is to tell a believable 'story' of how the user could behave, which will be helpful not only for identifying issues, but for identifying user profile related aspects.

3. Usability in 'Impact Evaluation, Future Scenarios and Policy Recommendations' work package

As it has been explained, the objective of this 'new' work package is to measure the impact that the project is having in the topics addressed by the call and research about future scenarios to tackle societal challenges in the educational context by the use of the project.

To achieve this, a permanent analysis of the project and its environment is required, so the usability techniques at this point should be the ones that could help with this analysis.

Heuristic Evaluation

Heuristic evaluation can be used at this stage to check out if 'the portal is doing what it was supposed to do' and in case it is not, propose changes to deal with the situation.

Surveys, Questionnaires and Interviews

Ask to interested stakeholders about the status of the project is a really good way to measure the impact. The team should gather as much feedback as possible to ensure the validity of the results. Surveys and questionnaires are great tools for this.

Interviews should be arranged with selected users who have previously completed the questionnaires / surveys and could provide more useful qualitative feedback.

Focus Groups

The objective would be the same described for interviews, but meeting several users / experts, which will actively collaborate to provide further insights.

Compare To Benchmarks

In the usability context, benchmarking measures how well users perform key tasks. The focus is on quantitative and objective data, not in subjective impressions.

Benchmark is a usability testing technique that needs a higher number of participants than others like thinking aloud protocol. The number will depend on the level of statistical confidence required, from as few as 20 to several hundred.

Benchmarking does not require to be moderated, but rigor is a must in order to ensure reliable, unbiased results.

This technique quantifies the user experience so decisions can be based on data rather than on the opinions of stakeholders, designers, or developers.

The quantitative and objective approach coming from benchmarking, plus the qualitative information gathered from conducting other usability trials and experiments will be the key for reaching realistic conclusions about usability issues.

As it has been explained in part II, having only the information from one side will usually not be enough to properly determine how to deal with a usability issue.

The data that Benchmarking tests usually collect is:

- Success and failure rate completing tasks.
- Time to complete a task.
- Number of errors to complete a task.
- Clicks to complete a task.
- Number of times in which the user asked for or looked for help.
- Which were the most frequent reasons of failure and the most frequent user errors.

When planning the benchmark testing session, the team could take the opportunity to prepare it in such a way that the portal's time of response and other technical aspects could also be measured.

In the context of this work package, benchmarking will be useful in two ways:

a) To internally compare the real results with the expected ones, which were set up in 'Requirements Analysis' work package.
b) To externally compare the results with other existing solutions.

Follow-up Studies

A follow-up study analyses data collected from surveys, interviews, observations, comments and any other kind of interesting feedback about a finished (version of a) product.

Structured follow-up studies are probably the truest and most accurate appraisals of usability, because the actual user, product, and environment are all in place and interacting with each other [UTesting08].

Learning what has happened to a product, its strengths and weaknesses, etc. is a very valuable information, and not only from the usability point of view but for sustainability (really important!) and other project areas.

Making a follow-up study for the project could be useful for this work package, but it will be even more useful to make it for other related projects. In this way, the consortium could extract a lot of useful information to avoid repeating errors and re-use positive experiences and best practices.

If there is an existing follow-up study from another project or experience that could be used, the consortium should be very careful, as it should check that the results are not contaminated in any way, or they would be led to wrong decisions.

4. Usability in 'Implementation and Trials & Experiments' work packages: Usability Testing

Usability evaluation methods could be divided into three groups:

Inquiring Methods

By the use of these methods usability evaluators obtain information about users by talking to them, letting them answer questions verbally or in written form or observing them using the system in real work.

The following are inquiring methods that have been seen in chapters 1, 2 and 3 of this part.

- Interviews.
- Questionnaires / Surveys.
- Focus Groups.
- Interviews.
- Field Studies.
- Card Sorting.

Inspection Methods

Usability inspection is the name for a set of methods where an evaluator inspects a user interface. This is in contrast to usability testing where the usability of the interface is evaluated by testing it on real users. [Nielsen94]

These methods are usually cheaper to implement than testing on users. Usability inspections can generally be used early in the development process by evaluating prototypes or specifications for the system that can't be tested on users.

The following are inspection methods that have been seen in chapters 1, 2 and 3 of this part.

- Cognitive Walkthrough.
- Heuristic Evaluation.
- Pluralistic Walkthrough.

Usability Testing

Usability testing refers to a group of usability methods in which people as testing participants who are representative of the target audience evaluate the degree to which a product meets specific usability criteria. [UTesting08]

Usability testing has its roots in classical experimental methodology, but there are several different ways of testing which go from true classical experiments with large sample sizes and complex test designs (e.g. Benchmarking), to very informal qualitative studies with only a small group of participants (e.g. Thinking Aloud Protocol). Each testing approach has different objectives, as well as different time and resource requirements.

Some relevant usability testing methods are:

- **Thinking Aloud Protocol:** Participants in testing express their thoughts thinking aloud while executing a set of tasks on the application. [Nielsen92]
- **Benchmarking** – explained in chapter 3.
- **Remote testing:** The experimenter does not directly observe the users while they use the application, though activity may be recorded for subsequent viewing
- **Coaching Method:** Participants are allowed to ask any system-related questions of an expert coach who will answer to the best of his or her ability [Nielsen93]. The tester or an expert user could serve as the coach.
- **Retrospective Testing:** Participants watch recorded tests from themselves or other users and are asked about the behavior. Some authors consider this as an inquiring technique, but obviously it requires some previous testing.
- **Co-Discovery Testing:** During a usability test, two test users attempt to perform tasks together while being observed. They are to help each other in the same manner as they would if they were working together to accomplish a common goal using the product. [UTest08]
- **Teaching Method:** Participants are asked to interact with the system first, so that they get familiar with it and acquire some expertise in accomplishing tasks using the

system. Then introduce a naive user to each test user. The novice users are briefed by the tester in order to limit their active participation, and thus not becoming an active problem-solver. Each test user is asked to explain to the novice how the system works and demonstrate to him/her a set of pre-determined tasks.

- **Pre-Trained Testing:** Users are asked to participate in a training session before testing the product. Results are usually compared to other group which has not received training.

As it can be seen that there are a lot of testing methods and it is frequent that researchers combine techniques, made slight modifications or introduce new elements in order to extract the information they are looking for.

The purpose of this work is not to provide the details about all these methods – which would take a whole book – but to provide a general methodology for testing, in which any of these methods could be used.

4.1. Methodology Overview

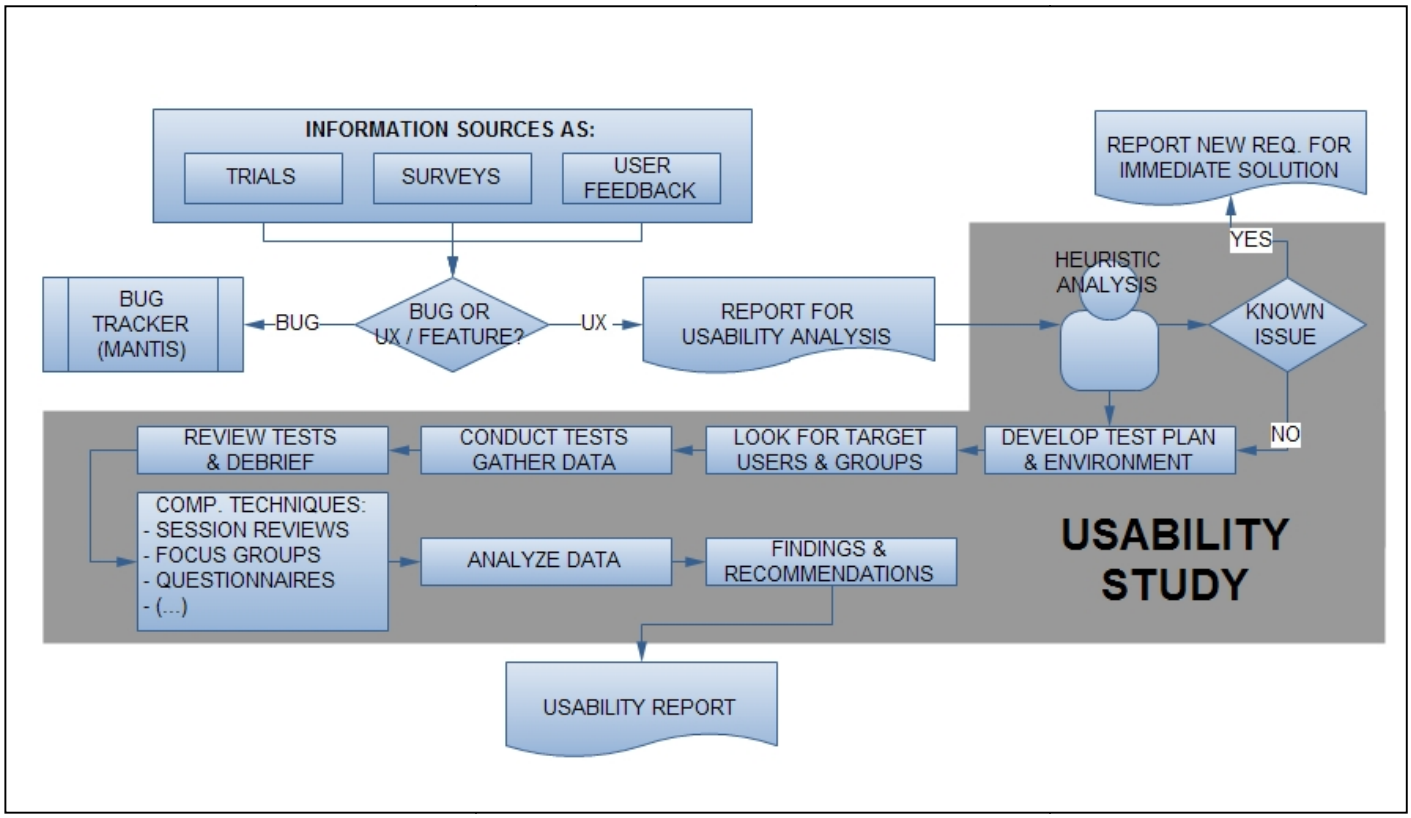

Figure 31*: Methodology Overview*

1. Information about usability issues in the portal will come from different sources and using different techniques to gather it, such as pilot trials or feedback from the experts participating in the project.

   These techniques should be designed and conducted in such a way that reliable information, useful to find issues that could involve new requirements or bugs to be fixed could be gathered.

   A guideline about how to design and conduct these techniques and how to avoid usual problems has already been detailed.

2. Detected issues should be classified, then:

   2.1. Bugs have to be reported in order for them to be fixed as soon as possible using a bug tracker service.
   2.2. Usability issues should be reported for further analysis and verification.

3. The usability team will receive all the usability-related issues. Through heuristic analysis the team will decide as follows:

   3.1. If there is a known solution for the issue, it will be immediately reported to the development team.

   3.2. If not, the issue will be annotated for a deeper usability study with real users and concrete scenarios and tasks, in order to find an appropriate response by the use of empirical methods.

4. At the end of the process a usability report will show findings and recommendations, based in the analysis of collected data following the process showed in figure 30.

   These findings should be taken in consideration by the project leader to establish new requisites and plan their implementation regarding:

   - The severity of the usability problems – known through the analysis of the statistical data gathered during the study.
   - The occurrence of the usability problems – known through the analysis of the statistical data gathered during the study.
   - All the implementation's costs (time and effort), estimated by the project leader.

4.2. How to develop a Test Plan & Environment

Step1: 'Define WHAT is going to be tested'

Defining what is going to be tested is the first step of planning. Usually it's better to test only some website's areas such as "social functionalities" or "search methods" in different sessions, than testing the whole website. All concrete website's aspects that have to be taken in to consideration for usability study should be found out when planning the trial.

The following table lists the main aspects to be tested in VOA3R project.

SOCIAL FEATURES	SEARCHING METHODS
1. Find out if users notice about features that make VOA3R more interesting than other social platforms. 2. Profile creation & registration process. 3. Finding and making "friends" → colleagues. 4. "Your researchers". 5. Participating in user communities.	1. Find out if users understand the use of the different searching methods? 2. Measure utility (user's perspective) & usability of the following interfaces: a. Textual search. b. Tag based search. c. Navigational search. d. Browse e. Author search.
1. Interactions from search results to social features (starting discussions, sharing, etc.). 2. Adaptation of users' profiles, new functionalities for practitioners and students.	

Table 5 : Main aspects to be tested in VOA3R project.

Step 2: 'Determine WHO is going to participate in the tests'

This step is about the determination of the audience and the user groups according to some remarkable characteristics, forming different groups according to this. In VOA3R project 3 different user profiles (researchers, students and practitioners) were identified at its beginning. The following notable characteristics were also taken into account for this case:

A → User's knowledge about searching methods.

B → User's experience in social media networks.

Social Media \ Searching Methods	YES	NO
YES	AB	B
NO	A	C

Table 6 *:* Users' notable characteristics in VOA3R project

HOW we are going to test (and WHY).

Once "what to try" is determined, next step is discerning how to do so, establishing:

- The processes of the trial.
- The Techniques that will be employed during that processes: interview, remote testing, questionnaires, focus groups, walkthrough, etc.

For a better understanding, the reasons about **why** doing things in the planned way should be reported. Continuing with the VOA3R example, next tables show a test plan, with specific tasks and objectives. These tables could be used as templates for any other project.

Test 1: VOA3R Main Social Functionalities *(Reminds what you're trying)*		
Object: Search for missing and unnecessary social media functionalities in VOA3R and review the interfaces of those implemented. *(Object briefing → WHY)*		
Users: *	**Groups:** All (Researchers, Students, Practitioners)	**Subgroups:** All (A, B, AB, C)
Technique: Thinking Aloud Session		
Tasks Briefing: ***(*** *Tasks & Steps → HOW****)*** 1. Spend 5 minutes (max.) navigating through the web and tell the benefits of VOA3R between other social media platforms. 2. Register as a user and complete your profile. 3. Change website's visualization according to your profile. 4. Change your status to "Participating in VOA3R usability tests". 5. Look for "Moderator's Name". Add him as a friend. Send a message to him saying something. 6. Look for another person with similar interests and add him as a friend. 7. Look for 2 more friends that are researchers in the same field as you using the advanced social search and add them as friends. You can add more criteria if you want. 8. Look for "VOA3R trials" user community and join. 9. Tell everyone you like this group. (Thumbs up) 10. Open the "VOA3R usability testing" discussion in a new window/tab. Post / reply some comment about usability in VOA3R portal.		
Complementary techniques: *(More techniques and when to apply → HOW)* 1. Questionnaire (after session). 2. Review of the session – Focus Group.		
Main questions: *(Issues you want to clarify with this trial → WHY)* • Does the user miss some social functionality or thinks some other is useless? • Is registration process easy? Does the user profile contain adequate information for finding interesting people? Is it easy to find people with similar interests? • Are VOA3R user communities a good place to discuss about different topics from a researcher/ practitioner point of view? Is it easy to participate in them?		

Table 7 : Test plan template 1. ***Main Social functionalities in VOA3R project.***

Test 2-A: Searching publications in VOA3R and sharing in the social network.		
Object: Measure the utility of the different searching interfaces from user's perspective and their usability. Find out if users understand the utility of the different searching interfaces and when to use one instead other.		
Users: >5	**Groups:** Researchers and students with this profile.	**Subgroups:** All (A, B, AB, C)
Methodology: Interview Session (Similar to Thinking Aloud, but doing questions to the user)		
Tasks Briefing: 1. You want to get a general idea about the publications in VOA3R, languages, collections and so on. Find a place to do so. *(Optimal solution: Browse)* 2. You're looking for information about weed control using techniques that don't involve the use of chemical products such as mechanical or biological methods. Find 3 publications and take a look to their records. *(Optimal solutions: Text search or navigational search)* 3. You want to know how many publications are categorized as "Weed control" in VOA3R and the different techniques to gather their classification. *(Optimal solution: Navigational)* 4. Find out which are the most tackled topics in VOA3R publications. (Optimal solution: Tag search) 5. Spend some time experimenting with "Your researches" interface. Notice how suggestions about people and resources appear while you specify your research. *(5' max time)* 6. Specify something you're researching about (or would like to research), and share it. How would you ask for help to the VOA3R community in your research?		
Complementary techniques 1. Questionnaire (after session). 2. Review of the session – Focus Group.		
Main questions: • Does the user understand the different searching interfaces? • What usability problems have been detected in the searching interfaces? • Is any searching interface considered useless for the user? Is the user missing some searching feature?. • Is "Your researchers" feature a useful feature for researchers? Is well implemented? Usability problems detected.		

Table 8: Test plan template 2. *Searching for resources in VOA3R project, for researchers.*

<table>
<tr><th colspan="3">Test 2-B: Searching publications in VOA3R and sharing in the social network.</th></tr>
<tr><td colspan="3">Object: Measure the utility of the different search interfaces from user's perspective and their usability. Find out if users understand the utility of the different search interfaces and when to use one instead other.</td></tr>
<tr><td>Users: >5</td><td>Groups: Practitioners and students with this profile.</td><td>Subgroups: All (A, B, AB, C)</td></tr>
<tr><td colspan="3">Methodology: Interview Session (Similar to Thinking Aloud, but doing questions to the user)</td></tr>
<tr><td colspan="3">Tasks Briefing:

1. You want to make yourself a general idea about the publications in VOA3R, languages, collections and so on. Find a place to do so. (Optimal solution: Browse)
2. You're looking for information about weed control using techniques that don't involve the use of chemical products such as mechanical or biological methods. Find 3 publications and take a look to their records. (Optimal solutions: Text search or navigational search)
3. You want to know how many publications are categorized as "Weed control" in VOA3R and the different techniques gather on its classification. (Optimal solution: Navigational)
4. Find out which are the most tackled topics in VOA3R publications. (Optimal solution: Tag search)
5. Use any search functionality to look for a resource that talks about some topic you're interested in.
6. Access to resource's record and start a discussion about it in "VOA3R trials" user community.</td></tr>
<tr><td colspan="3">Complementary techniques

1. Questionnaire (after session).
2. Review of the session – Focus Group.</td></tr>
<tr><td colspan="3">Main questions:

• Does the user understand the different searching interfaces?
• What usability problems have been detected in the searching interfaces?
• Is any searching interface considered useless for the user? Is the user missing some searching feature?
• Find out features for practitioners, or to improve communication between researchers and practitioners.</td></tr>
</table>

Table 9: Test plan template 3. *Searching for resources in VOA3R project, for practitioners.*

Environment

As it has been explained the user must feel as comfortable as possible. The testing team should do everything in their hands to try to reproduce a realistic environment.

Tests should be recorded for further analysis. This can disturb some users, so it is better to ask for their permission first, and explain to them why the test is going to be recorded and who is going to watch it.

Some countries have privacy policies regarding this matter, and users should sign some kind of document allowing to be recorded.

A screen recorder will be needed to record the user actions and a cam or a webcam, to record the user itself (voice + video).

Minimal configuration and needs are shown in the next figure.

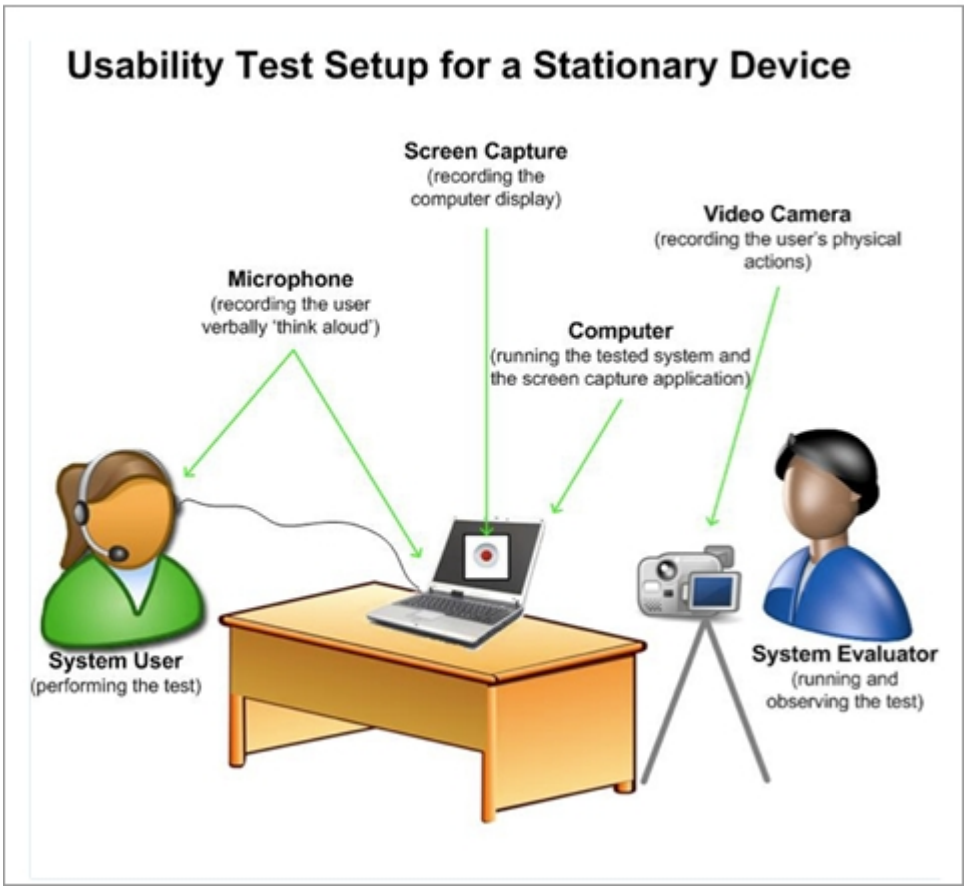

Figure 32*:* Minimal configuration and needs for usability testing.

Look for Target Users

Finding of participants includes the determination of the most suitable persons for running the test, according to the characteristic defined in the previous step of the methodology.

This process was detailed in part 2, also providing a profile questionnaire template. An anonymous ID should be provided to every user, then a table as the one following should be made.

ID	Trials	Group	Profession	Academic P.	Age	Languages
1	1,2	C	Student	Computer Sci.	18	Spanish, English(lvl), French(lvl)
...	...	C	...	...	...	...
7	3	B	Farmer	Basic	24	Spanish
...	...	C	...	...	..	...
11	4	A	Professor	Computer Science PhD.	42	Spanish, English (lvl)
...	...	A	...	...	...	...
13	4	AB	Project Leader	Agronomist (engineer)	39	Spanish, English (lvl), Chinese (lvl)

Table 10: Users' table template.

Conduct the trial and collect the data.

As it has been explained, one of the most important things to have in mind when conducting a trial – especially when you're working with students – is to make the users know that you're evaluating the software, not them.

The Usability team is looking for problems in the software and ways to improve it. Users must know if the software is not finished and understand that he is a very important person for us, since he will help us to improve the portal. As previously said, the user must not be afraid or influenced in any way.

Every test or trial must start with a briefing in which the moderator will tell the user about the subjects previously told and any other important information. A typical briefing structure should look like this:

1. Welcome users.

2. Thank user for taking his time to participate. Tell the user that we're not going to evaluate him; we're evaluating the product.

3. Explain that the product is not finished, and that it is the user who is going to help us making a good product. Make him feel important, in fact, he is so important that our team will make changes in the product regarding his experience.

4. Make sure that the user is not afraid about providing negative impressions regarding the product. Ask the user to give open and candid opinions, both good and bad.
    a. *"We know that our product has problems. More problems discovered, better for us."*
    b. *"Your name or any other personally identifiable information will not be associated with the data."*

5. Detail the structure and particularities of the session, explain the techniques and what user has to do, i.e.
    a. *"Session will go this way (...) it will take around X minutes." "We will be recording the session (...) Do I have your permission to record this session?".*
    b. *"While doing the task, please think aloud, describe your steps, what you are looking for, etc". → Describing "Thinking Aloud" technique to the user)*
    c. *"Try to complete the tasks as if you were doing this for real. Spend as little or as much time as you would normally do in them. It is ok if you cannot complete each task, and we may not complete every task. Ask for clarifications if you need, I will be neutral throughout the test". → Describing how to deal with the tasks to the user.*
6. Ask for any questions before starting.

Moderator should conduct the trial in order to answer the main questions established, and find out as much usability problems as possible. As all the statistical data could be extracted from records after the test, the moderator should not lose his attention making annotations about this subject and be focused on user interaction with the system. Observers could join the session and take notes about other concrete aspects.

Some helpful tips to extract data

- Consistency: Ask for the same tasks, in the same order, using the same words with every user.
- Users must feel emotionally and physically comfortable. Try to establish a connection with him.
- Respect the user's rights. Don't record him without asking for his permission, etc.
- Don't let the user get frustrated, before this happens assist him and take notes about this.
- Listen to the user, don't interrupt, don't give away clues or information inadvertently, be unbiased, let him talk and experiment with the product.
- Interrupting the users should be limited for providing assists or asking an important specifically question you **really need** to know. You can write down questions, i.e. *"Why did you do (…)?"* and ask the user about later, organize a complete review of the session with the user or ask him inside a focus group. Talk only when needed.

Review Tests and Debrief

Test should be reviewed in order to make a complete debrief, which should include statistical data. For the VOA3R example, the statistical data analyzed was:

- Number of errors.
- Time.
- Task successfully done (Yes/No)
- Help needed (Yes/No)
- Searching methods used (Only for test S02 A and S02 B)
- Searching methods used successfully (Only for test S02 A and S02 B)

Graphics, tables and diagrams should be used in order to compile the information and make it understandable at a sight.

DATA TABLE FOR TASK 2										
USER	ERR	TIME	PAL	EXP	SEM	ETI	NUB	OTR	A	E
1	7	5'07''	X	X	-	-	-	X	N	S
2	4	1'54''	-	-	-	-	X	-	N	S
3	2	1'41''	X	-	-	X	-	-	N	N
4	5	3'41''	-	-	X	-	-	-	S	S
5	10	5'37''	X	X	X	-	-	-	N	N
6	10	6'18''	X	-	X	-	X	-	N	N
7	1	2'05''	X	-	-	-	-	-	N	S
8	5	3'59''	X	X	X	X	-	-	N	S
9	6	5'58''	X	-	X	X	-	-	S	S
10	5	3'21''	X	-	-	-	-	-	N	S
11	4	2'30''	-	-	X	-	-	-	N	S
12	5	3'24''	X	-	-	-	X	-	N	S
13	5	3'21''	-	-	X	-	-	-	S	S

Table 11: Example of a table showing statistical data. [Martin–Moncunill]

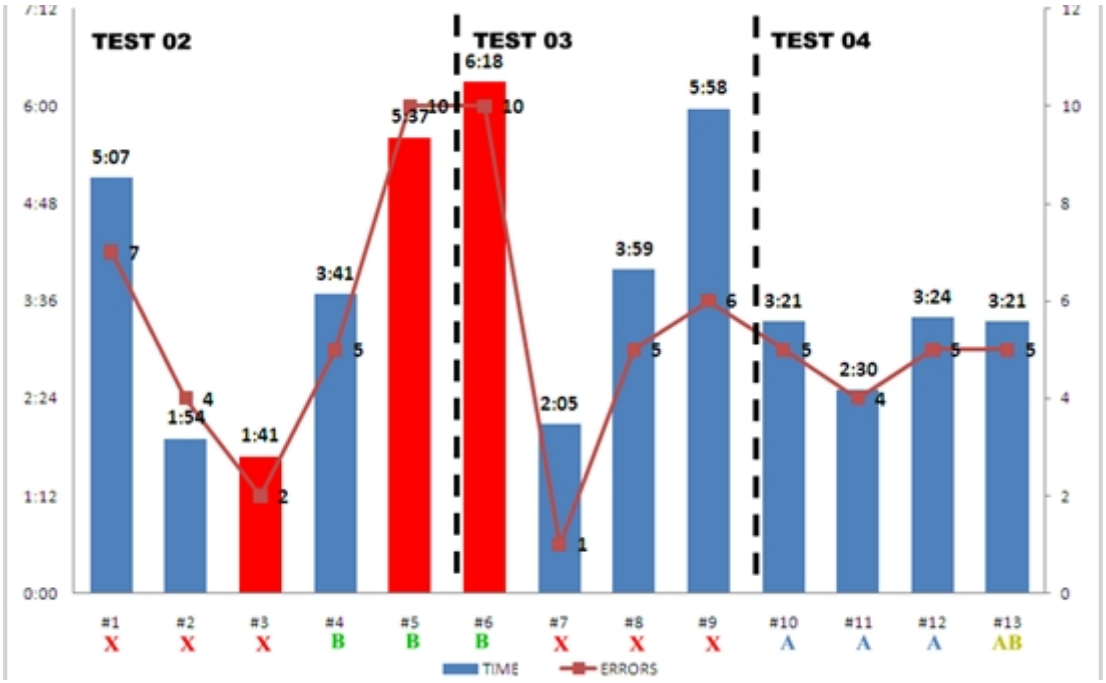

Table 12: The bar chart for Table 11 example. [Martin–Moncunill]

Complementary Techniques

User testing is the "main tool" for every usability study, but as it has been seen, there are other techniques that should be employed to take a deeper look in to specific areas. These techniques will be useful to get subjective opinions about the tested product, help to understand the statistical data gathered or try to find solutions for usability problems with the users help among others.

For the VOA3R study the two main complementary techniques were:

- A satisfaction on-line survey. The users filled this survey at the end of the tests sessions.
- Focus groups with researchers and practitioners to help the consortium to find out solutions for usability problems discovered and new features to improve communications between the theoretical approach of researchers and the real needs and implementation approach of the practitioners.

Analyze the data & Report

Raw data should be analyzed paying attention and describing any special circumstances occurring during the trials' session. This analysis will enable to identify usability issues supported by empirical results and not only subjective opinions from users or experts' points of view.

At the end of the process, what the usability team is expecting to have is a table of findings describing the usability issues, referring to the compiled data that allowed identifying them.

The following template shows the proposed way to do this:

I01 (Issue number): Issues' name.	
SEVERITY: DISABLING	**OCCURRENCE: CONSIDERABLE**

BRIEFING

"Short description of the issue, just a couple of lines."

Detailed explanation of the issue, do not forget to refer to your compiled data and add screenshots showing the problem.

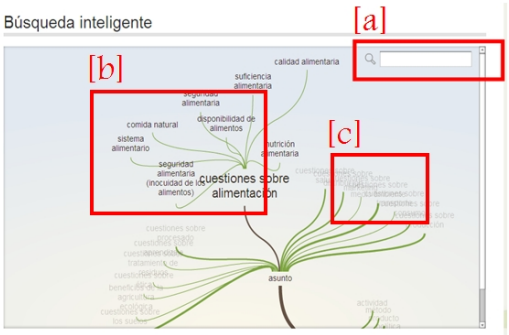

Figure 33: Screen capture with annotations.

RECOMENDATIONS

- How would you solve this issue?
- Did users provide some feedback about what would they want to change and how?
- If you think that you have a solution, do not forget to include mocks!

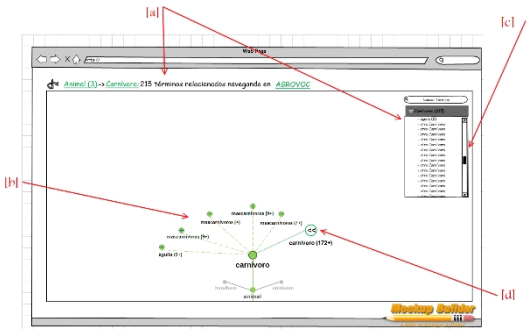

Figure 34: A mock detailing a possible solution for the usability issue.

Table 13: Template for reporting usability issues.

Severity ranking

Name	Definition
Irritating	The problem can be circumvented easily. It could be a cosmetic problem.
Frustrating	User won't probably be able to complete the task because of this UX issue or its experience won't be positive, so he won't probably use the functionality, interface or product in real live.
Disabling	When a user bumps into this problem he will stop trying to complete the task. He won't be able or won't want to use the functionality, interface or product. Also user could think he has found a bug or that the website is not working properly.

Occurrence Ranking

Name	Value
Low	> 0 % <= 25 %
Considerable	> 25% <= 50%
High	> 50 %

With this information the usability team will be able to help the consortium to decide about desirable portal changes.

It is important to notice that the consortium will not need and also will not have time to revise all the documentation of every process (e.g. original questionnaires, videos of the sessions, all the user comments, etc.).

Hosts will just have to send the final report with their conclusions following steps described in this chapter and using the templates given.

The rest of documentation must be kept in case it's needed for better understanding or verifications, complying with the affecting data protection policies.

IV. Expected Results and Conclusions

The experience in several European projects regarding the development of educational content portals has been useful to identify a number of problems concerning their approach to usability and other aspects related to testing and experimenting with users. These problems along with their solutions were described in Part II.

The overall analysis of these issues makes evident the need for something more than individual solutions and to address them in the best way possible. In order to achieve this a change in the methodology is required. This new methodology was described in Part III.

While the effectiveness of the individual solutions to the problems described above has been tested in several projects - as described in Part II - the new methodology presented in this work has not been fully used in any other project. This is logical, given that the proposed methodology derives from the analysis of very recent projects – and that some of them have not finished yet.

The aim of this part is to show the conclusions reached in this work and the expected results of the adoption of this methodology and of its needs.

1. Main risks and costs from the previous approach

The six main risks ordered by their relevance (cost) are showed in figure 35, according to what was explained in Part II.

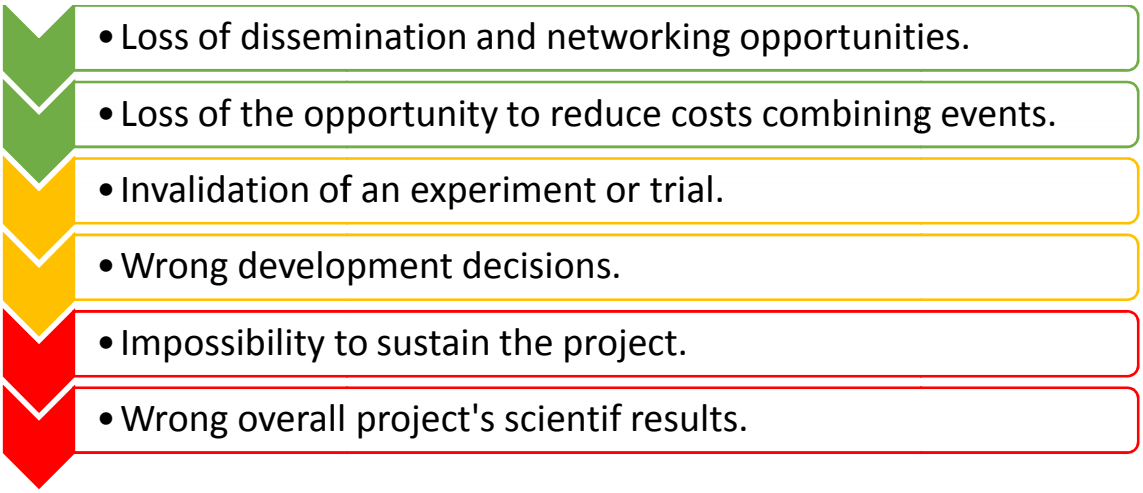

Figure 35*: Main risks from the previous approach ordered by their cost. Red ones are the highest.*

The **loss of dissemination and networking opportunities, as well as the loss of the opportunity to reduce costs by combining events** are the consequences of problems as 1.2, 1.4, 2.9 or 2.15 – detailed in Part II.

These are the less dangerous issues, since the loss of these opportunities will not make the project to fail but the opportunity cost could be really high – e.g. losing the opportunity to attract private funding from interested stakeholders.

When a trial or experiment is not well carried out, the data obtained could be spurious, and all the effort and resources spent could render it worthless, leading to one of these situations:

- Best case: the consortium notices about the spurious data and **invalidates the experiment or trial.**
- Worst case: the consortium includes the spurious data as valid results.

If the consortium includes this spurious data as valid results, they would **get to incorrect conclusions leading them to wrong development decisions**. In this way, the consortium would spend effort and resources in worthless or even harming – from the usability point of view – developments. The costs in this case could be really high depending on how wrong the development decisions are.

The key for the sustainability of this kind of projects is to have a considerate amount of users regularly using the educational portal. No matter what, if there are no users it is impossible to sustain the portal. So, if the consortium does not care about the real users' needs and preferences, they will not use the product and **the project will be impossible to sustain**.

Probably the most critical situation is when the consortium extracts overall scientific results from the project that are wrong due to the interpretation of several wrongly carried out tests and experiments.

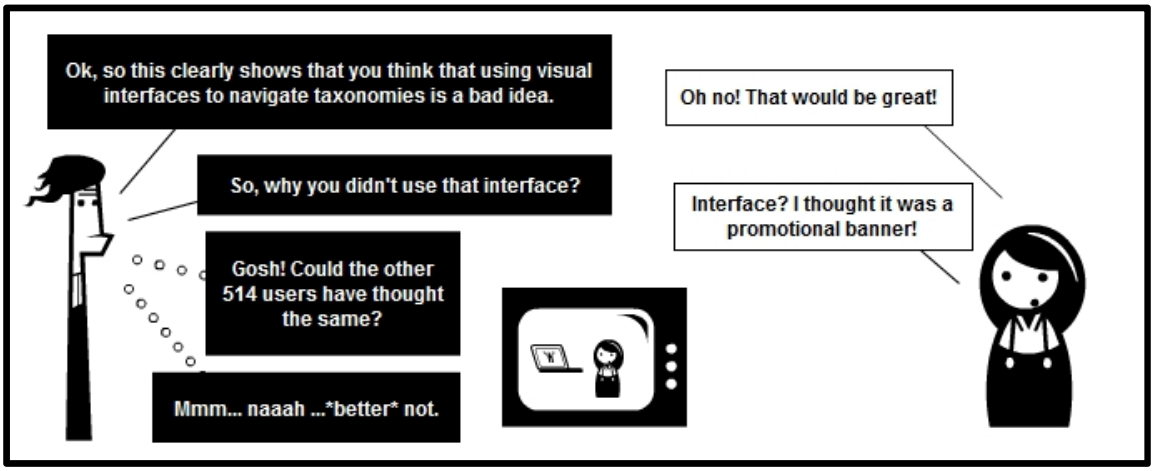

Figure 36*: Wrong scientific results (Cartoon)..*

The cartoon depicted in Figure 36 reflects how a usability problem could make users to avoid using a feature or even make impossible for them to identify it. The consortium could not realize about the usability problem and think that the problem is in the feature itself, leading to wrong conclusions.

The reason why this situation is so critical is because in this case not only all of the effort and resources spent in the project could be worthless but, even worst, wrong scientific conclusions could be taken as valid ones and be re-used in other projects.

2. Expected needs to implement the proposed methodology

The adoption of the proposed methodology will require a considerable effort to change the mentality of the consortium partners, as they usually are not familiar with the "User Centered Design", "User Experience" and "Usability" concepts. On the other hand, the costs are minimum, especially taking in to account the costs of the previously discussed situations.

Staff Requirements

The management team should have knowledge of the User Centered Development area. This team should continuously supervise the correct application of the methodology.

A usability expert should be hired and included as part of the management team. This consultant must have a complete vision of the project, making possible for him to take advantage of all the opportunities that may arise, including those related to dissemination actions.

The usability expert will also have to approve and supervise all the testing and experiment activities involving users or usability issues. Depending on the project size, more than one expert might be needed. The key is not to have a large team of usability experts, but a multidisciplinary team with a working and practical knowledge of usability, led by a usability expert.

Training Requirements

As it has been explained, it will take a considerable effort for the members of the consortium to change their mentality when adopting the proposed methodology, as it is essential for them to understand the new approach based on UCD.

Apart from this, the multidisciplinary team that will form the usability team will need to have a working knowledge of usability. Finally, every person in charge of trials and experiments should have the basic skills to properly carry them out, making possible to avoid all the problems described in this work.

To achieve this, some training will probably be required. The cost and effort of this training will significantly vary, as it depends on the background of the staff of the different consortium members.

Some best practices that will help with this issue would be:

- Taking into account the experience in usability, user experience, UCD, etc; when selecting the staff.
- Write manuals and guidebooks with auto-evaluation tests.
- On-line training sessions.
- Include training sessions during project meetings.
- Invite other consortium members to the trials and experiments carried out by the members of the usability team. (Will increase travel expenses)
- Invite a member of the usability team to help with the trials and experiments carried out by other consortium member. (Will increase travel expenses)

Other Costs

Problem 1.5 described that the budget for trials and experiments is not well estimated in many cases, since there is no budget to compensate users for their participation in this kind of events or even to make them feel comfortable enough, which is also related to problem 2.15 *'No one cares about motivating the users'*. These other costs should also be taken into consideration.

Finally, as it was described above, it is a good idea to invite a member of the usability team to help in trials and experiments (with user participation), and *vice versa*. This would increase travel expenses and should also be considered in the effort estimation of the staff participating in the events.

3. Expected results of the adoption of the proposed methodology

The benefits of the adoption of this methodology could be divided in to two major areas.

The first one is related to the opportunities and different benefits that arise thanks to the adoption of the new methodology, which are summarized in the following figure.

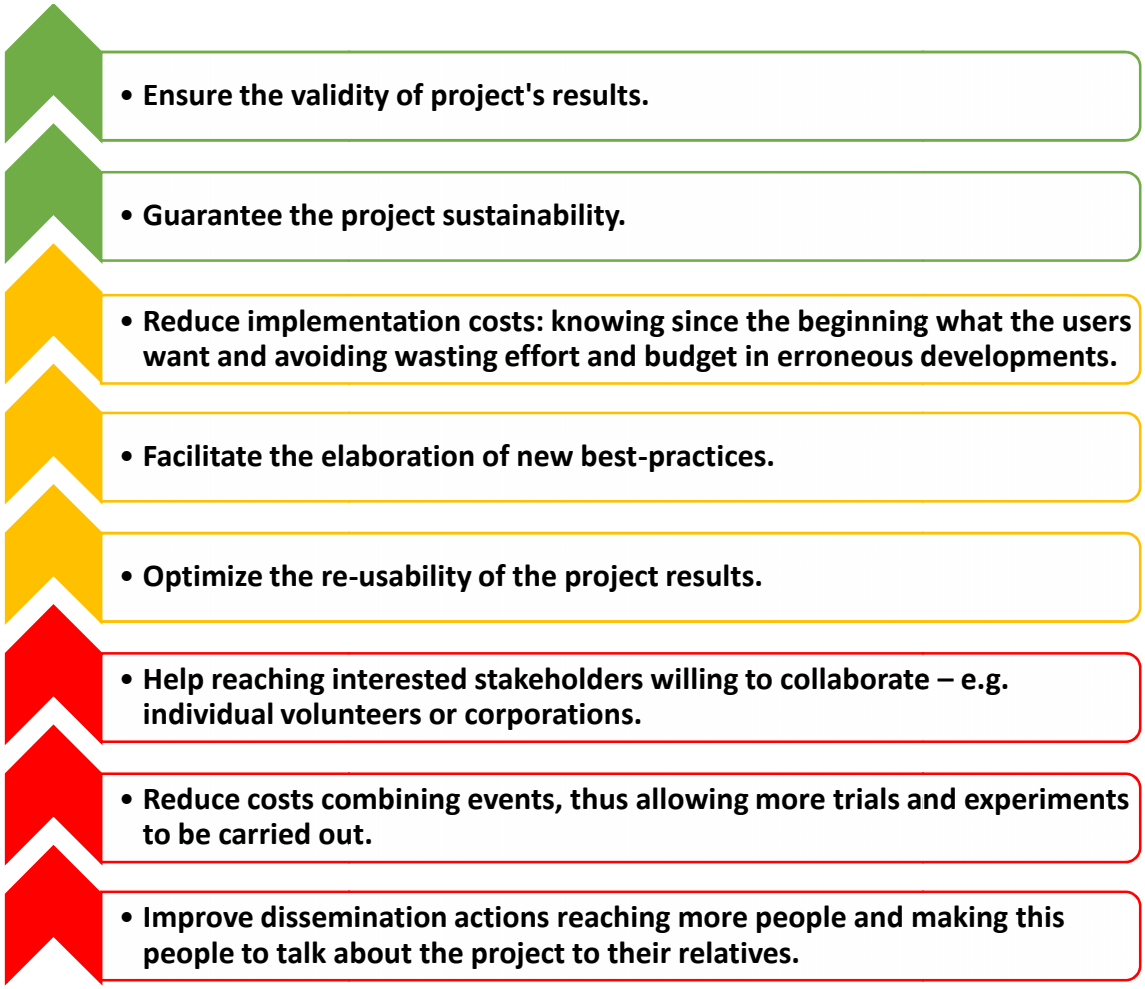

Figure 37*: Expected benefits due to the adoption of the proposed methodology.*

The second one is to avoid the problems described in Part II, which benefits have already been foreseen.

The adoption of the methodology will try to guarantee that the six main risks explained at the beginning of this chapter will be controlled and will not occur. It can be easily seen that the costs of some of these risks is extremely high, compared to the effort needed to control them.

4. Conclusions

The European Commission is actively promoting the development of educational portals in different areas.

Attending to their nature – they are European funded projects – and objectives, the best approach for the development of these kinds of projects should follow up the User Centered Design (UCD) model. As we have seen in the previous pages of this work, none of the analysed projects did so.

The aim of this work was to analyse what the usual way to deal with these projects was and how to transform it in order to provide a methodology for continuous usability assessment in educational content portals, based on UCD principles.

Several important problems related to the way in which trials with users were done were detected. Some of these problems were common to many or even all of the analysed projects. These problems could be harmful for both the research results and the sustainability of the projects:

- Reported research results could not be realistic. For instance, some conclusions about the relevance of some experimental features could be negative, but only because the users were not able to understand the interface, not because the idea of the functionality itself was incorrect.

- If there are no users willing to use an educational portal, the project will not be able to subsist.

The second part of this work has identified these common problems, explained them and showed different ways to avoid them. Also several tips to help with data gathering and analysis have been provided.

All the partners involved in the development of an educational portal must know about the relevance of usability and help to improve it as much as they can – no matter what their role in the project is.

Any functionality implemented by any partner could be worthless if users don't understand how to use it, or even worse, they will believe it is flawed.

If users do not understand the website's functionalities and possibilities they will simply not use it, rendering all the effort in other areas will worthless.

The third part of this work has detailed a methodology in which usability covers the whole project's lifecycle, according to the typical work packages structure used for these kind of European funded projects. For each phase of the project we presented different usability methods, techniques and tools that can be used in them.

Finally, a detailed description of how to manage usability testings was provided, including guidelines and templates in order to make easier the testing tasks and to assure the extraction of high quality, reliable and reusable results.

The most important conclusion is that the changes needed to comply with the methodology described in this work do not demand an increase in effort neither budget. The only major needs will be to add a small usability team to the project and employing some effort and budget in training. There are no special needs regarding hardware or software.

Some budget for recruiting or making users feel as comfortable as possible could also be an asset, but this could be overcome if the proper volunteers are found. On the other hand, this work also includes some recommendations that can generate new opportunities and provide revenue, if the trials are combined with dissemination events.

In any case, regarding economical aspects, it is important to mention that leading companies like IBM, Microsoft, Apple, Google, Whirlpool and Procter & Gamble have invested heavily in usability, which has yielded significant returns on investment (ROI). Research has demonstrated that ROI for enhancing the user experience is impressive: for each $1 invested, the returns can be between $2 and $100. These companies spend millions of dollars in usability before launching a new product.

This work has shown that:

- It is possible to design a methodology for continuous usability assessment in educational content portals, based on UCD principles.

- The methodology is feasible, since:

    - It has been adapted to the typical work packages structure asked by the European Commission for these kinds of projects, and perfectly complies with its regulations.
    - It does not require an increase in the effort made or in the budget.

- The methodology could report significant benefits to the consortium:

    - Avoiding errors and providing more accurate scientific results.

- Granting the sustainability of the project. By the use of this methodology the consortium will know what interested stakeholders might want from the portal and then be able to offer them so.

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