

Usability and user-centred design, a necessity for efficient e-learning!

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Abstract

The purpose of this paper is to give a review of the development and concept of usability and user centred design (UCD). It points out the development and benefits of usability and UCD and presents a case study when using this approach.

It points out the principles of human-centred design, the main components and the five central activities that shall always take place during a human-centred design process.

It reports a successful project, a pre-study for the Swedish Net University, using the user-centred approach.

The pre-study was initiated with some overall requirements.

- *First, the process should encompass different stakeholders and different perspectives should be considered.*
- *Second, it had to be conducted during a short period of time and was not allowed to become a "monstrous" government investigation ranging years.*
- *Third, find solutions that avoided "re-inventing the wheel", i.e., if possible find current systems or parts that could be purchased.*
- *Fourth, students should be the most important user group.*

The approach with both a delegated decision-making process and a user-centred

process, with numerous participants, has demonstrated several benefits that may be utilised in further work.

- *First, the big differences in the student population and how they conduct their studies.*
- *Second, the value of participation and involvement cannot be stressed enough.*
- *Third, the power of engagement and commitment has been demonstrated..*

In summary, the user-centred design has provided sufficient tools to meet the challenging demands that the Swedish Net University Agency put on the pre-study.

1. Introduction

This paper is intended to give an overview of the area of usability and human-centred design and a practical example from using a user-centred approach in the development of a portal for net-based higher education.

Education and learning is one of the worlds largest markets for Internet applications. Learning and training at work is probably the fastest growing sector together with academic education. Without considering the usability of these e-learning applications, there is a large risk for failure. (See also Hunt, Burvall and Ivergard (2004) which gives an excellent overview of the subject.)

Usability is the concept that we intuitively know when we experience it. Usability is also a measure of how well a product or system such as a software package, intranet, a web site, a learning facility, etc. enables the user to be efficient, reduces the number of errors they make and makes the user satisfied with the product or system. The notion of usability can then refer to ease of use, ease of learning, efficiency and usefulness. To create a satisfying user experiences the product or system shall have a combination of these features.

The term usability is sometimes also used to describe the processes and techniques used to make products and systems ease to use, such as task and user analyses and usability testing.

But nowadays usability is even more. In more and more organizations, usability is a central part of development and it is recognized that not only is usability good for the users, it is good for business!

2. Usability defined

The definition of usability was probably first attempted by Miller (1971) in terms of measures for "ease of use" and these were then developed further by Bennet (1979) to describe usability. The concept of usability was first fully discussed and a detailed definition was attempted by Shackel in 1981 and Bennet in 1984.

In the beginning of the 1990 a committee within ISO, TC159 Ergonomics SC4 Ergonomics of Human System Interaction started to develop a formal definition and description of usability. In 1998 a standard, ISO 9241 part 11 Guidance on usability, was published. The formal definition of usability reads:

"usability: the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use".

The definition consists of three measurable objects:

- Effectiveness, accuracy and completeness with which users achieve specified goal. A common measure is whether users complete the task or not.
- Efficiency, resources expended in relation to the accuracy and completeness with which users achieve specified goal.

A common measure is the time it takes the user to carry out a task.

- Satisfaction, freedom from discomfort, and positive attitudes to the use of the product.

Can be measured by using a questionnaire.

The other critical factors which have an effect on usability are:

- Who the users are
- The user's situation (environment)
- What the user wants to do

which all can be specified.

With this description it is possible both to set usability goals and to measure them.

3. Principles of human-centred design

One way of improving then usability of interactive systems is to use a more human-centred design process. Gulliksen (2001). Berns (2004)

Making interactive systems more human-centred has a positive impact on economic and social benefits. Making systems more usable means that they are meeting both the organizations and the users' needs.

A human-centred systems support users and motivate them to learn. The benefits include increased productivity, enhanced quality of work, reductions in support and training costs and improved user satisfaction. There is a substantial body of human

factors/ergonomics knowledge about how such design processes can be organized and used effectively. However, much of this information is mainly well known by specialist in the human factors/ergonomics area.

An example of this is Gould & Lewis (1983) who more than 20 years ago described a methodology developed from their experience. They proposed four precepts for design for usability:

- User Centred Design - focused from the start on users and tasks.
- Participative design - with users as members of the design team.
- Experimental design - with formal user tests of usability in pilot trails, simulations and full prototype evaluations.
- Iterative design - design, test and measure, and redesign as a regular cycle until results satisfy the usability specification.

The standard ISO 13 407 - Human-centred design processes for interactive systems, from 1999 provides guidance on human-centred design activities throughout the life cycle of computer-based interactive systems.

ISO 13 407 states that a human-centred design is a systematic approach to interactive systems development that focuses specially on making systems usable. It is a multi-disciplinary activity which incorporates human factors/ergonomic knowledge and techniques. The use of human factors/ergonomic knowledge to interactive systems design enhances effectiveness and efficiency, improves human working conditions and encounters possible adverse effects of use on human health, safety and performance. Applying ergonomics to design of systems involves taking account of human capabilities, skills, limitations and needs.

The standard does not assume any one standard design process, nor does it cover all the different activities necessary to ensure

effective system design. It shall be seen as, and is complementary to existing design methods and provides a human-centred perspective that can be integrated into different forms of design process in a way that is appropriate to that particular context.

The main components in the human-centred design process are:

- the active involvement of users and a clear understanding of user and task requirements.
- an appropriate allocation of functions between users and technology
- the iteration of design solutions
- multi-disciplinary design

There are five central activities that shall always take place during a human-centred system development project:

- plan the human centred process
- understand and specify the context of use
- specify user and organizational requirements
- produce design solutions
- evaluate design against requirements

4. User-centred approach – a practical example

User-centred design is a tool to assure the quality of the resulting product. In the case of the Swedish Net University Agency, User-Centred Design was selected as the preferable method, to great extent because of its ability to handle the complex nature of the project stakeholders Berns, Hansson and Burvall, (2002).

The Swedish Net University Agency was commissioned by the Government to create and maintain an IT-portal for the Swedish Net University. The Swedish Net University is in fact neither a new educational institution nor an agency, but all the “traditional” Swedish Universities that provide Internet based courses.

The portal will be developed continuously to act as a common node for

universities and colleges, providing information on the range of IT-supported distance education available and providing possibilities to search and find existing courses. An IT-portal may, in addition to this, offer many different services, which support different user groups, i.e. students in their search for courses, in their distance learning and studying, as well as employees at the various higher education institutions.

The Swedish approach within netbased higher education commenced with the decision to start the Swedish Net University Agency from the Swedish Ministry of Education and Science. The idea was to collect all efforts within the Swedish higher netbased education under one umbrella, thus the Swedish Net University Agency was created. Due to the creation of such a constellation, with individual universities, influential power is crucial.

One of the most important tasks the new agency got was to create a portal for all netbased higher education courses. Potentially three phases can be distinguished within the decision-making process, initiation, review, and final decision.

- The decision to initiate was made to assure participation of a multitude of groups. One part of this was the user-centred process, but also to assure that local universities could respond to resulting suggestions.
- The requirements should be gathered, analysed and presented to local universities. Based on this, the universities can criticise and suggest improvements.
- Based on the responses a new suggestion can be gathered and the Swedish Net University Agency can decide on how to proceed and which priorities to make.

To guarantee the functionality and quality of the portal a user-centred method has been employed during the pilot study. A guiding principle for the pilot study has been

to capture the demands on the new portal from various interest groups, e.g., students and staff at the various institutes of higher education etceteras. Technical design and security aspects have not been prioritised in the study, so these issues will be more emphasised during later stages of development.

The pre-study was initiated with some overall requirements.

- First, the process should encompass different stakeholders, and different perspectives should be considered.
- Second, it had to be conducted during a short period of time and was not allowed to become a "monstrous" government investigation ranging years.
- Third, find solutions that avoided "re-inventing the wheel", i.e., if possible find current systems or parts that could be purchased.
- Fourth, students should be the most important user group.

Early in the pre-study the user groups were defined to involve two types of users, primary users (students) and secondary users (teachers, administrators and so on). The student user groups were divided into three important distinguishable categories:

- Younger students, 20-25 years.
- Work experienced students, 25-65 years.
- Students with Academic degree, who want to study further, 25-65 years.

Functional disabilities were considered the same as for the Swedish population; however, the importance to make the portal accessible was stressed throughout the pre-study.

In terms of motivation the user-group were considered highly motivated and perhaps more motivated with age, but the level of technical skill probably decreases

with age. The two latter groups would supposedly use the portal to a higher degree from home than the younger students.

The secondary user-group was all the staff working at local universities, librarians, teachers, counsellors and so on. They were considered between 25-65 years old and using the tool as part of their daily work, even though frequency can be quite varied.

To meet up with the challenging task to involve such a varied user group on a national basis, an ambitious project plan was set out, employing numerous methods.

- First, focus groups (group exercise where representative users are gathered to discuss an issue or concern) were conducted to gather information from various student groups, as well as from different types of university staff.
- Second, a variation of competitor analysis was conducted to gather information on important lessons and examples throughout the web. This was the first indication to see if there were any current systems that could be purchased whole or parts, to become the future portal.
- Third, the expert group was invaluable by providing experiences from projects throughout the world. The group consisted of netbased learning experts from Australia, Norway, Denmark, England and Canada.
- Fourth, to gather ideas and contacts a number of visits were conducted at other organisations in Sweden that had good experience of facilitating learning.

During all these activities hovered the quality concept, usability, and the potential implication for the future product. Efficiency, effectiveness and satisfaction will be highlighted during later phases.

All in all, these different activities

showed the importance of flexible learning opportunities for the students. Higher netbased education is conducted on various places and with different purposes, for example at work to get a new job, at work to do your current job better, at home while maintaining the household and so on.

The pilot study has resulted in 56 different suggestions concerning functions and resources for the portal. Many suggestions relate to human needs, technical infrastructure, but also organisational improvements.

- First, suggestions relating to human needs concern issues relating to the experience of the user group. One example of such a suggestion is the need for "faces", by providing a portal so that user may not feel lonely and also have the possibility to find peers. Another is that the course search facility will have to be flexible to meet the multitude of demands potential students have.
- Second, technical infrastructure is requirements for improving current technical environment. The requirements are, however, based on user requirements. Examples of this are that user will require better searching engines, another example is one application form for courses common for all the Swedish Net University.
- Third, organisational improvements are the ones calling for collaboration, new services and better support for the students. So for example could librarians be available 24/7 on the portal, and a national Intranet so teachers can collaborate on courses, staffing and so on.

The approach with both a delegated decision-making process and a user-centred process, with numerous participants, has demonstrated several benefits that may be utilised in further work.

- First, the big differences in the

student population and how they conduct their studies. So for example is a 20-year student full-time student very different from a 58 years old student in, among other things, their technical awareness, motivation and living conditions.

- Second, the value of participation and involvement cannot be stressed enough. The resulting list of requirements will be more likely, since various groups have been involved, to facilitate intended users in studies, while providing reasonable working conditions for university staff.
- Third, the power of engagement and commitment has been demonstrated. During the course of the project the project group was positively surprised of the amount of positive energy and engagement that have been raised among the participating organisations and users by this unusual approach.

To sum up, the method employed with user-centred design has provided sufficient tools to meet the challenging demands that the Swedish Net University Agency put on the management of the pre-study.

However, without decision-makers' awareness and understanding of the potential of such methods, these types of pre-studies will not appear.

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