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Usability – Through the use of guidelines and user participation

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BACHELOR'S THESIS

Computer Engineering and system development – with a specialization in programming of mobile applications

Department of Engineering Science

BACHELOR THESIS

Usability – Through the use of guidelines and user participation

Summary

The Department of Engineering Science at University West in Trollhättan was in need of a new system for scheduling personnel, as the existing system is based upon an Excel-file and is hard to work with and does not provide an easy way for the users to collaborate.

The purpose of this study was to examine how existing principles and guidelines regarding interface design can be used to create a new web based system with a high usability. The purpose is also to examine how participatory design affects the design process and outcome.

To create a system with a high grade of usability, a number of existing rules and guidelines regarding usability and a number of subjects regarding interaction design, were used by the development team as tools.

Even though the study showed that usability guidelines can be a valuable tool and provide a good foundation it is important to emphasize the use of other techniques. For example the use of participatory design, which in the study was found to be of great value to the development team.

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EXAMENSARBETE

Användbarhet - Genom riktlinjer och användardeltagande

Sammanfattning

Institutionen för ingenjörsvetenskap vid Högskolan Väst i Trollhättan var i behov av ett nytt tjänsteplaneringssystem då det nuvarande system som är Excel-baserat är svårt att arbeta med och ej erbjuder något effektivt sätt för användarna att samarbeta.

Syftet med studien var att studera hur de principer och riktlinjer som finns gällande interaktionsdesign kan användas för att skapa ett nytt webbaserat system. Syftet var också att undersöka hur deltagande design påverkar design processen och dess resultat.

För att skapa ett system med en hög grad användarbarhet har ett antal regler och riktlinjer som berör användarbarhet och ett antal begrepp inom interaktionsdesign använts av utvecklingslaget som verktyg.

Även om studien visar att användning av användarbarhetsriktlinjer kan vara ett värdefullt verktyg och erbjuda en god grund är det viktigt att använda fler tekniker. Till exempel användandet av deltagande design, som i studien har funnits vara av stort värde för utvecklingslaget.

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Preface

I would like to thank everyone who has been involved in this project. First of all, my friends and team members, Jim Johansson and Daniel Ström, with whom I have developed the system. Jim has studied the tool (WebMatrix) that we used during development of the system and Daniel has studied the existing system, which functionality the new system needs, and how the functionality should be implemented in the new system. You may read about their findings in "*Microsoft WebMatrix – Enkelheten i dynamiska webbaserade system*" and "*Från Excel till webbaserat tjänsteplaneringssystem*".

I would like to thank Eric Lind for his help with technical details and Dena Ala-hussain for feedback given on the thesis.

A special thanks to my supervisor Linn Gustavsson Christiernin and our main client Mikael Ericsson.

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1 Introduction

This thesis project is going to be carried out at University West in Trollhättan, Sweden. The purpose of this study is to examine how existing principles and guidelines regarding interface design can be used to create a web application with a high usability. The purpose is also to examine how participatory design affects the design process and outcome. The study is carried out during the design- and implementation-process of a new system that the university is in need of.

1.1 Background

University West is an organization that is divided into four departments and where each department consist of a number of divisions. The university employs approximately 600 people and each year hundreds of courses are held in different subjects. To be able to track and control the personnel's working time several different systems are used at the departments. One of the four departments, The Department of Engineering Science, considered that the department and the university was in need of a new more efficient system for scheduling personnel as the existing system was hard to work with.

The existing system for scheduling personnel at the Department of Engineering Science is used to track and divide teaching hours among the personnel. The system is also used to track hours that each person have in regards of administration tasks, research projects, vacation and sick leave. The existing system is based upon an Excel-file and is hard to work with as it does not provide an easy way for the different users[1] to collaborate. Each user who makes a change is required to phone the other users and make sure that the decisions made are acceptable and so that they can update their version of the file. This procedure is time consuming, the risk of errors are high, and different divisions risk using different calculations.

1.2 Scope, objective & limitations

As described in the beginning of chapter 1 the purpose of this study was to examine how existing principles and guidelines regarding interface design can be used to create a new web based system with a high usability. The purpose was also to examine how participatory design affects the design process and outcome. The new system shall also to simplify and improve the process of scheduling personnel. Apart from the existing functionality the following functionality was desired:

- It should be possible to import data about courses from the course database *Kubiken*.

[1] A user is in this case a person who schedules personnel, most often head of division

- It should be possible to import data from Production Technology Centre's (PTC) research planning system.
- It should be possible to use the system from outside the university's computer system.
- It should be possible to trace when a planner has made changes to a resource that does not belong to his division.
- All personnel on a department shall be available for all planners.
- Backups shall be made regularly.

The study was primarily concentrated on the usability of the system and the involvement of users during the design process. Thereby trying to ensure that the aim of creating a system that is both easy to learn and easy to use.

Since the project had a very tight schedule, of only 9 weeks, several limitations and rules was needed.

- All desired functionalities were prioritized to ensure that a running system with at least minimum functionality existed at the end of the project.
- The research of this project was limited to using existing usability principles, and trying to involve the customer/user during the entire design process.
- The customer, University West, was to provide the needed server, software's, and database accesses needed.

1.3 Tools

The code was written in C# and the Razor syntax and the tools used for coding were Microsoft WebMatrix 2 Beta, and Microsoft Visual Studio 2010. The Web-Application was hosted on a Microsoft Windows Server 2008 R2 server running Microsoft Internet Information Services (IIS) 7.5. Static prototypes were constructed using Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS) while the initial prototypes were created using only paper and/or whiteboard and pen. No additional software was needed since all design elements, like buttons, menus and so on, in the system were styled/designed with ordinary CSS.

1.4 Report structure

This first chapter is an introduction to the project. Chapter two explains the methodology used during the study. Chapter three provides an introduction to the principles and guidelines that exist regarding usability and describes the subjects that designers have to keep in mind to achieve high usability. It also gives a brief introduction to usability testing.

Chapter four discusses the existing methods that exist on how to involve the users of the system in the design process.

Chapter five, six and seven contains the result. Chapter five describes the design process and how the suggested methodology functioned when applied to a real project. Chapter six describes the usability testing and the outcome of these. Chapter seven provides a view of the final design.

Chapter eight contains the discussion together with the conclusions, and section nine contains the references.

2 Methodology

Qualitative research methodologies are going to be used in this study; observations of and unstructured interviews with the customer will serve as methods for information gathering. The information will then be used during analysis and build the foundation for how to design the new system.

To aid the involvement of the users, weekly meetings will be held. The meetings will provide a forum for the development team and the users to interact. All aspects of the system can be discussed and different solutions evaluated. The main focus is to involve the users primarily in the design process. Observations done during the meetings will be written down and after each meeting, the development team will discuss the notes taken. The meetings will be attended by the development team and a main client, Mikael Ericsson, head of the division of automation and computer engineering at the department of engineering science. Three meetings will also be attended by a steering group consisting of end users (heads of division).

At each of the meetings the current version of the new system design will be displayed to the users, (a prototype or a functional version of a part of the system). The hypothesis for selecting this methodology is that letting the users examine and use the system throughout the development process will provide invaluable data concerning both the detailed and overall usability and graphical design of the system as well as how well the users understand and are able to use the functions in the system.

When the system is close to completed a number of testing sessions will be performed. A discount usability test [13] will be conducted to ensure that a system with a high usability has been produced. The test that is to be conducted is a combination of heuristic evaluation and think-aloud testing. Testing will be performed on three test participants. The testing method and the number of test participants has been chosen because it is time efficient and has proven to increase usability [9].

3 Usability

Usability is as a measurement on to which extent a human made product can be used to achieve specified goals with regards to effectiveness, efficiency and satisfaction regarding the specified context [7]. In other words, it is a measurement on how easily a product can be used and learnt by a user. Usability is therefore of greatest importance when designing a user interface. A user interface shall match the users' needs and requirements without interrupting the users' normal workflow or causing the users' irritation.

The next section introduces the term interaction design, a design discipline that is used to create digital things so that they are easy to use for humans [10].

3.1 Interaction design

Interaction design focuses on human behavior and provides a structure for the behaviors of interactive products and services when a user interacts with those products and services [22]. By having a deep understanding of a user's goals, needs, routines and experience interaction design tries to make sure that users can execute the right action at the right moment [19, 22].

A mental model is a person's representation of a system or an environment, i.e. the users of a system has ideas about how the system should function even before they have used it. Most often the system does not function as the users expect and the users are forced to learn how the system works [11, 12].

Mental models can be used to create a structure for how a system should function. If a model is fairly close to how the system functions, it's a high probability that the users of the system will be able to use it without difficulty [6, 12]. It is however important to make sure that the mental model that the design team has, corresponds well with the mental model that the users have.

The following subsections explain some of the subjects that a designer has to keep in mind when designing a user interface.

3.1.1 Metaphors

Metaphors are used in interaction design to help users to grasp new concepts by analogy. Metaphors can help a design team to capitalize on the relationship users has with objects in the "real-world" and by so enforce the user's mental model of the system and how the system functions [6, 19].

Metaphors are most commonly implemented as icons such as folders, documents, images, calendars, and so forth, but even the desktop itself is a metaphor as it represents a person's writing desk [6].

Metaphors can provide a mental model for the user and can help users that never used a system before, but it can also give users the wrong idea, and become an obstacle for more experienced users if the metaphors are not chosen wisely, i.e. the perceived function shall be consistent with system functions [6].

3.1.2 Mapping

The term mapping describes the relationship between two things, and it is most often used to describe the relationship between controls and the object that the control affects.

Good mapping leads to an easy to use interface, where the user can complete the right task quickly. Poor mapping can lead to failure and frustration for the user [6].

Natural mapping should be used whenever possible, as it takes advantage from the physical placement of an object, and is culturally neutral.

A commonly used example to explain the difference between good and bad mapping was originally presented by Don Norman; the author of *The Design of Everyday Things*. The example uses the placement of burner controls on a kitchen stove to explain how natural mapping can and should be implemented [6]. A stove with a bad or unnatural mapping can be seen in Figure 1 and a stove with good or natural mapping can be seen in Figure 2.

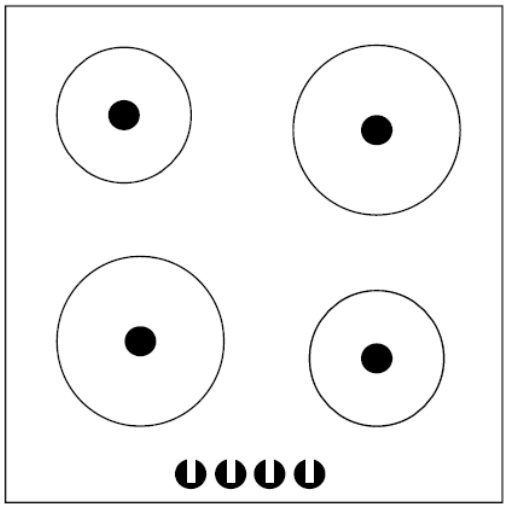

Figure 1. Stove with unnatural mapping

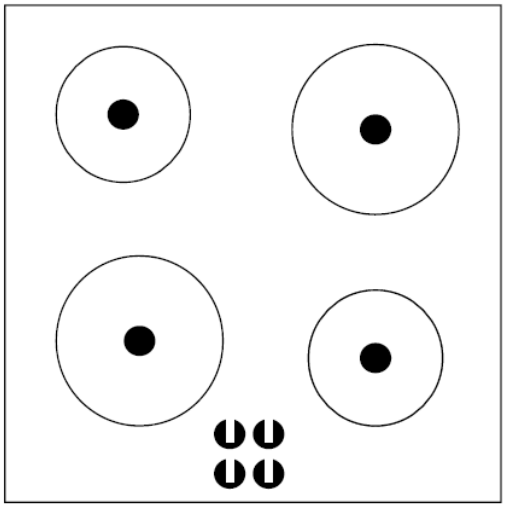

Figure 2. Stove with natural mapping

3.1.3 Affordance

Affordance is an object's capacity to suggest its own function, i.e. how obvious or not it is to use a particular object. In the field of interaction design, affordance is applicable to all objects that a user can interact with, e.g. buttons, sliders, menus, and so on. It is crucial to choose a design, of each and every one of the objects, which is perceived to have a high affordance, e.g. a button shall invite a user to push the button, and a door that shall be opened in a certain direction shall invite the users to either push or pull it without confusion i.e. the different sides of the door can and shall be designed differently to have a high affordance [2].

Different design choices will produce affordances that are perceived differently, and the object's design shall be designed in a way that helps the users to figure out how to interact with them [12, 19].

It is also important to recognize the fact that, what is seen as affordance to one person necessarily isn't the same for another person [6].

3.1.4 Feedback

Feedback is one of the most crucial elements to consider when designing a user interface; i.e. a system shall in some way let a user know that their input or action is being processed or that the system has produced a result according to the user's action [19]. All actions, no matter how small, shall be followed by some sort of notice, displaying that the system has acknowledged the action performed by a user. A user that does not get feedback might for example click an icon multiple times causing multiple instances of the programs to launch and thereby slowing down the computer.

Consider the difference of feedback given when starting an application in Windows versus starting an application in Mac OS X. In Windows, feedback is given by momentarily changing the style of the mouse pointer to a "loading style", while in Mac OS X the whole icon starts to jump up and down in the dock. The Macintosh system provides a nice effect, but the effect is also really useful as it gives the user instant feedback on the performed action [1].

As can be seen in the example above it is important to give feedback in a manner that suits the situation. Adding feedback can greatly improve the usability of a system but adding too much feedback can also confuse the system's users [12].

3.2 Existing principles/guidelines

Countless experts have through the years presented principles and/or guidelines to aid interface designers in their goal of making user friendly interfaces. The following section provides a brief overview to some of the usability-principles introduced by some of the most recognized experts in the field of usability.

3.2.1 Shneiderman's golden rules

Ben Shneiderman is a pioneer in the fields of user-interface design and user-experience who has with the help of many years' experience, created a set of 8 rules regarding the underlying principles of interface design [20]. The rules are:

1. Strive for consistency - Consistent sequences of actions should be required in similar situations; identical terminology should be used in prompts, menus and help screens; and consistent color, layout, capitalization, fonts, and so on should be employed throughout.
2. Enable frequent users to use shortcuts - As the frequency of use increase, so do the user's desires to reduce the number of interactions and to increase the pace of interaction. Abbreviations, special keys, hidden commands, and macro facilities are appreciated by frequent knowledgeable users.
3. Offer informative feedback - For every user action, there should be system feedback. For frequent and minor actions, the response can be modest, whereas for infrequent and major actions, the response should be more substantial.
4. Design dialogs to yield closure - Sequences of actions should be organized into groups with a beginning, middle, and end. The informative feedback at the completion of a group of actions gives operators the satisfaction of accomplishment, a sense of relief, the signal to drop contingency plans and

options from their minds, and an indication that the way is clear to prepare for the next group of actions.

5. Offer error prevention and simple error handling - As much as possible, design the system such as the user cannot make a serious error; for example, prefer menu selection to form fill-in and do not allow alphabetical characters in numeric entry fields. If users make an error, the system should detect the error and offer simple, constructive, and specific instructions for recovery.
6. Permit easy reversal of actions - As much as possible, actions should be reversible. This feature relieves anxiety, since the user knows that errors can be undone, thus encouraging exploration of unfamiliar options.
7. Support internal locus of control - Experienced operators strongly desires the sense that they are in charge of the system and that the system responds to their actions. Surprising system actions, tedious sequences of data entries, inability or difficulty in obtaining necessary information, and inability or difficulty produce the action desired all build anxiety and dissatisfaction.
8. Reduce short-term memory load - The limitation of human information processing in short-term memory (the rule of thumb is that humans can remember "seven-plus or minus-two chunks" of information) requires that displays be kept simple, multiple pages displays be consolidated, window-motion frequency be reduced, and sufficient training time be allotted for codes, mnemonics, and sequences of actions.

3.2.2 Nielsen's heuristics

Jakob Nielsen is a widely recognized expert in usability that has created ten general principles to follow when working with user interface design. Nielsen calls his principles "heuristics" because he states that they are more like rules of thumb rather than specific usability guidelines [18].

1. Visibility of system status - The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
2. Match between system and the real world - The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system oriented terms. Follow real-world conventions, making information appear in a natural and logical order.
3. User control and freedom - Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.
4. Consistency and standards - Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.
5. Error prevention - Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

6. Recognition rather than recall - Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.
7. Flexibility and efficiency of use - Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.
8. Aesthetic and minimalist design - Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.
9. Help users recognize, diagnose, and recover from errors - Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
10. Help and documentation - Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

3.3 Usability inspection

Usability inspection is a term used for a collection of methods that is used to find usability problems. Usability inspection is most commonly performed by letting a group of evaluators review and/or test a user interface. The evaluators can be trained usability experts, designers, software developers, or end users [15].

The following clauses provides a quick introduction to two usability methods as they are among the most commonly used, and as described in Chapter 2, a combination of them will be used to perform the usability test on this project.

3.3.1 Heuristic evaluation

Heuristic evaluation is according to its inventor Jakob Nielsen the most informal method used for usability inspection [17]. Heuristic evaluation is performed by letting a small group of evaluators examine a user interface and judge it depending on if it complies with the heuristics.

To produce an independent and unbiased result each evaluator inspects the user interface alone, and only when all evaluators have completed their evaluation the evaluators are allowed to communicate. Multiple evaluators are used as it can be hard for an individual evaluator to find every single usability problem (even though most evaluators performing heuristic evaluation are employed as usability experts), and as it has been shown that different evaluators find different usability problems [14].

Heuristic evaluations can be utilized at nearly any stage of the design and usability engineering process, although it is preferred that evaluations starts as early as possible. As the evaluators only review the system, rather than using it, evaluation can start as early as a sketch of the system exist [14].

3.3.2 Think aloud testing

Think aloud testing is performed by asking the test participant to continuously think out loud while using the system that is under review. According to Nielsen think aloud testing "*may be the most single valuable usability engineering method"* available [16].

Think aloud testing can be complicated to perform; as the situation can be experienced as unnatural, there is a risk that the evaluator biases the test participants behavior, and that the test participant wants to appear as smart as possible thereby filtering his or her statements.

If the test however is performed correct it can provide highly valued data [16]. Think aloud testing has the benefit of being affordable, vigorous, yet flexible, and both easy to learn and perform.

Most importantly, think aloud testing provides access to how users really think about a design, what misconceptions they have about it, and the designer can usually learn why users have trouble using a particular part of the design and why they find other parts of the design easy to use [16].

4 User/Customer involvement

User/customer involvement can be achieved through a wide number of different approaches, and the techniques to involve the user/customer differ to a high degree between the different approaches. The following sections describe two different approaches: (4.1) User-centered design – an approach or design philosophy that attempts to analyze and predict how users most probably are going to use the system. User-centered design utilizes a number of different tools; one of them is personas which is also described and discussed. (4.2) Participatory design – also known as "Cooperative design" and the "Scandinavian approach" is an approach to design that tries to actively involve end users throughout the design process [5, 21].

4.1 User-Centered Design

UCD (User-Centered Design) is used to design an interface based upon a user's abilities, needs, and requirements. UCD is used to create a useful and usable product for the user on the assumptions that [4]:

- The result of a good design is a satisfied customer.
- The process of design is collaboration between designers and customers. The design evolves and adapts to their changing concerns, and the process produces a specification as an important byproduct.
- The customer and designer are in constant communication during the entire process.

Even though many development teams try to work with usability and UCD in mind they miss the point as they tend to simplify or generalize a customer/user by creating a fictive user, i.e. personas [3, 12]. Personas are a technique where fictional people are created to represent one or more specific groups of the application's users. The goal of using personas is noble as it tries to make the development process more human centered but the truth is that since personas are imaginary they can't defend themselves as Lukas Mathis describes it in his book Design for Use [12]:

"Personas can be too elastic. Since personas are essentially imaginary people, they can't defend themselves. As a result, they can sometimes reinforce predetermined conclusions: if you're using imaginary people as your target audience, you can always come up with an imaginary scenario that validates whatever opinions you currently hold.

Personas give the impression of being human-centered without anyone having to interact with actual humans. They can be a fig leaf used to cover up a design process that is not human-centered at all. Personas can absolve designers from actually doing any of the hard work, such as going out there and testing design decisions on real people."

It can also be both difficult and time-consuming to transform all knowledge about the user into a persona that represents the user well, and thus not worth the advantages that personas actually can give if these issues are considered when creating the personas. As described in the following section, (Participatory design), design teams should instead be user driven with regards to understanding the user rather than identifying, describing, and ascertaining them [3].

4.2 Participatory design

Participatory Design is an approach to development where users are seen as an equal in the design team and during the design process, they are considered subject matter experts. All stages of the design shall also be a subject to revision, i.e. the team shall work with an iterative approach throughout the entire process. It is also important that the users are real end users, not their managers or a person representing the real users [4, 5].

Participatory design isn't flawless, it can be hard to get a good group of end users, it's both expensive, and hard to have the regular meetings that are needed. In return it provides the team with valuable input and data as the users has expertise knowledge about their field of work, knowledge that often is very hard to come by for the development team [4, 8]. End users are also very good at reacting to suggested system changes as design most often as to be concrete and visible [4].

To achieve a high level of user participation it is important to establish a set of guidelines. The guidelines can and shall contain information for which users to involve, when they should be involved, and how they should be involved. It can contain directions for how to communicate with the users and what terminology that should be used [5]. It is also wise to include information of a more practical nature i.e. specific time and date for meetings and so on.

5 Designing the web-application

Designing an interface requires the designer to have a distinct goal of what he or she is to design and for whom. As interface design is an iterative process and even though the goal of the design has to be distinct, it is also required that the designer is able to embrace changes made during the process.

The following section covers the different steps of the design process used during this study.

5.1 Design process

To be able to create a first prototype, a pre study and analysis was conducted to gain an understanding of how the current system was used and what the most used features were. To achieve this goal several meetings were held in an informal way, and with multiple users present. The discussions resulted in a list of clearly prioritized functions and provided a foundation for the first prototype. To ensure that the users participate and get further involved in the design process all fundamental design decisions was discussed, for example the decision that resulted in the use of a tabbed navigation layout.

The first prototype, seen in Figure 3, was created with pen and paper during a discussion and brainstorming session, among the team members, regarding the list of prioritized functions. Two main elements were found during the session; (1) a webpage consisting of a view displaying all available personnel, and placed underneath it, a view displaying a summary of the person selected in the list (2) a webpage much similar to the one described above, but containing information about the existing courses rather than all available personnel.

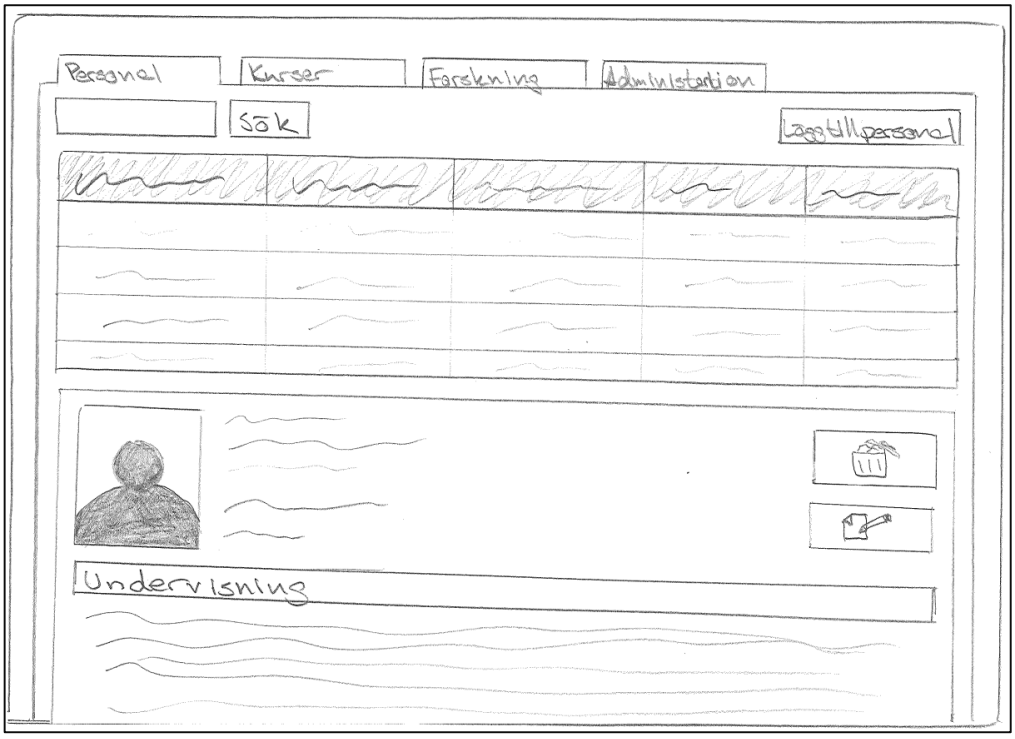

Figure 3. Hand drawn prototype

The sketch of the first prototype was displayed to the customer, who then improved upon the draft together with the implementation team, using a whiteboard. The improvements resulted in a decision to make a semi functional prototype using HTML and CSS. Again, all decisions were made together with the customer to ensure partitioning.

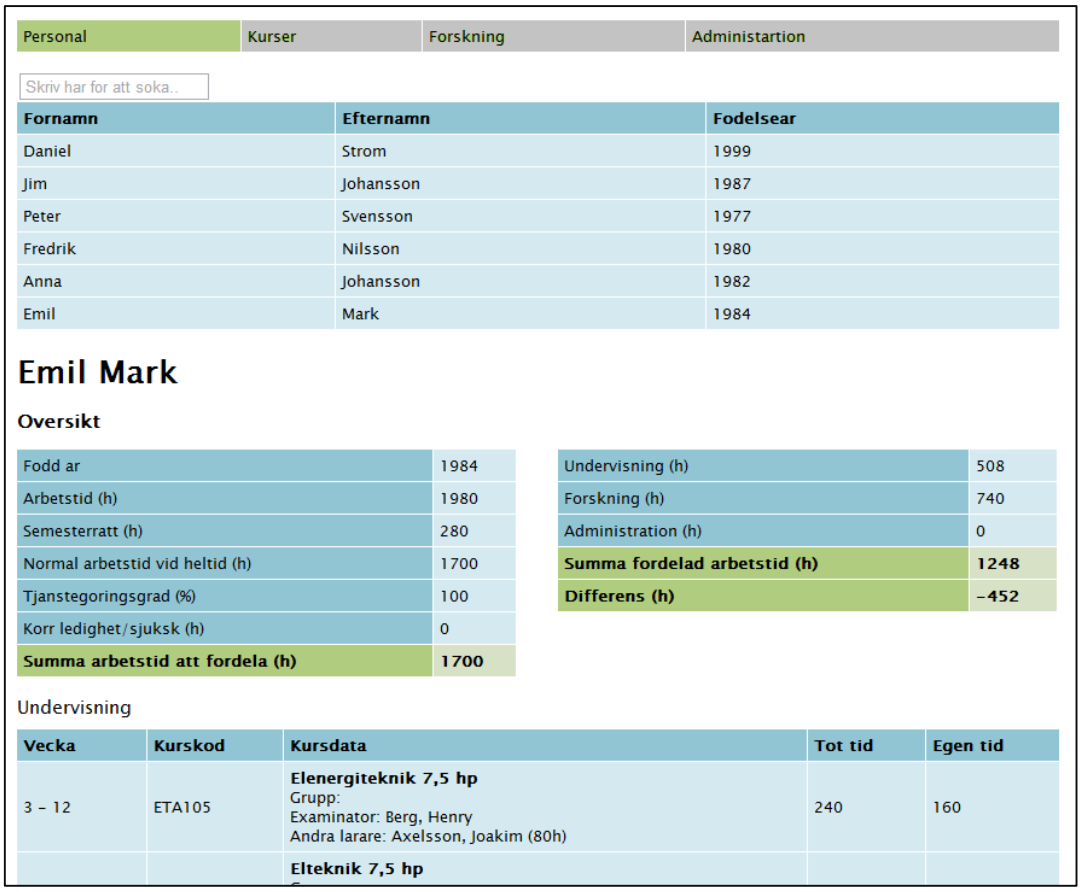

Figure 4. Semi functional prototype

A large portion of the layout used for a person's summary has been borrowed from the old system. The reason is that the layout used in the existing system was found to present all necessary information in an efficient manner.

The width of the webpage was chosen to be 960 pixels, a width that more or less has become a standard in web applications due to the fact that designers for many years were forced to design for the lowest common resolution of 1024x768 pixels. Many companies and institutions still use monitors with this resolution.

The idea and main concept of the first prototype was to show all necessary data and the list of all available personnel at once. This would allow a user to easily navigate between the different persons summaries with the help of the search box and a single click at the person's row in the table. Typing a search term in the search box will result in an automatic and real-time filtration of the table containing the available personnel.

After the semi functional prototype had been shown to the customer and some minor details had been adjusted it was decided that the prototype phase was over and work was to continue by starting to develop the system.

The system was developed incrementally by adding functionality according to the prioritized list of desired functionality.

Much of the functionality had been implemented and several weekly meetings had been held when the customer proposed a new design. The reason was that the page had become longer and longer as more functionality had been added. This resulted in a view that did not provide a good view of the information without excessive vertical scrolling. It was decided that a new prototype should be made until the next meeting where the table containing the available personnel and the view of a person's summary were separated into different pages.

As the system was under development it was decided that the new prototype should be made as a fork of the current system build, where only the newly proposed layout was to be implemented, see Figure 5 and Figure 6.

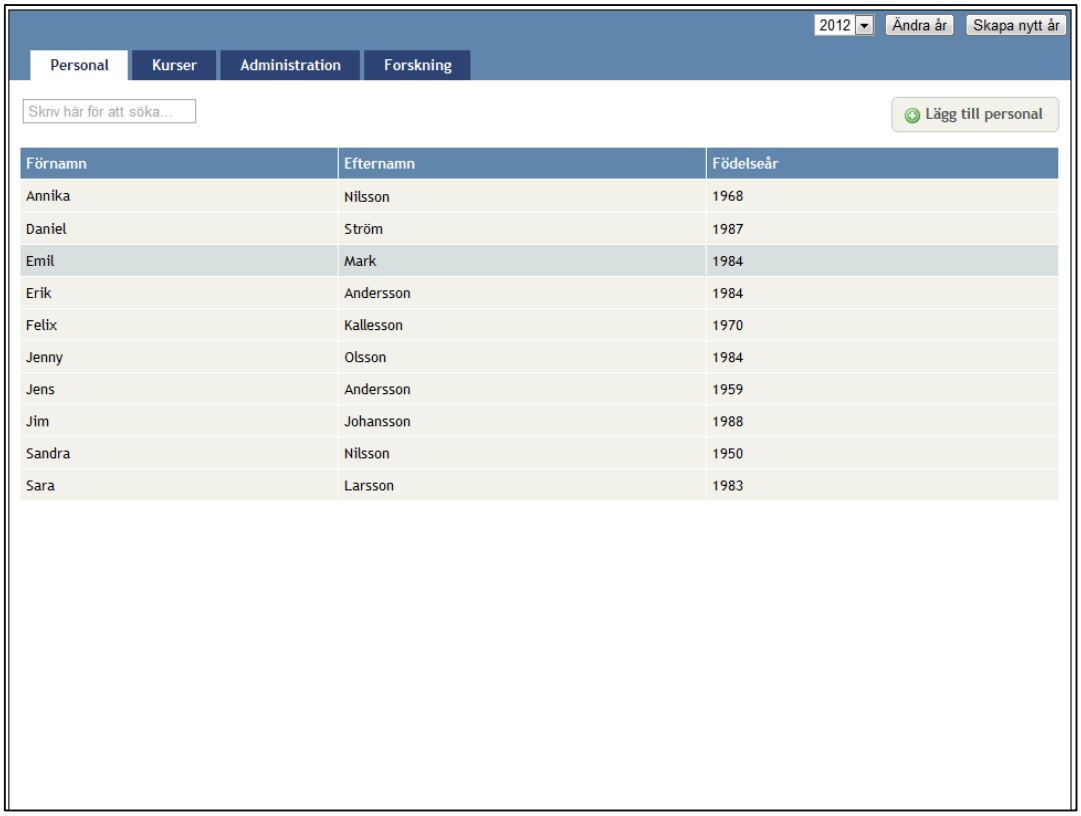

Figure 5. The newly proposed layout. Displaying the list of personnel

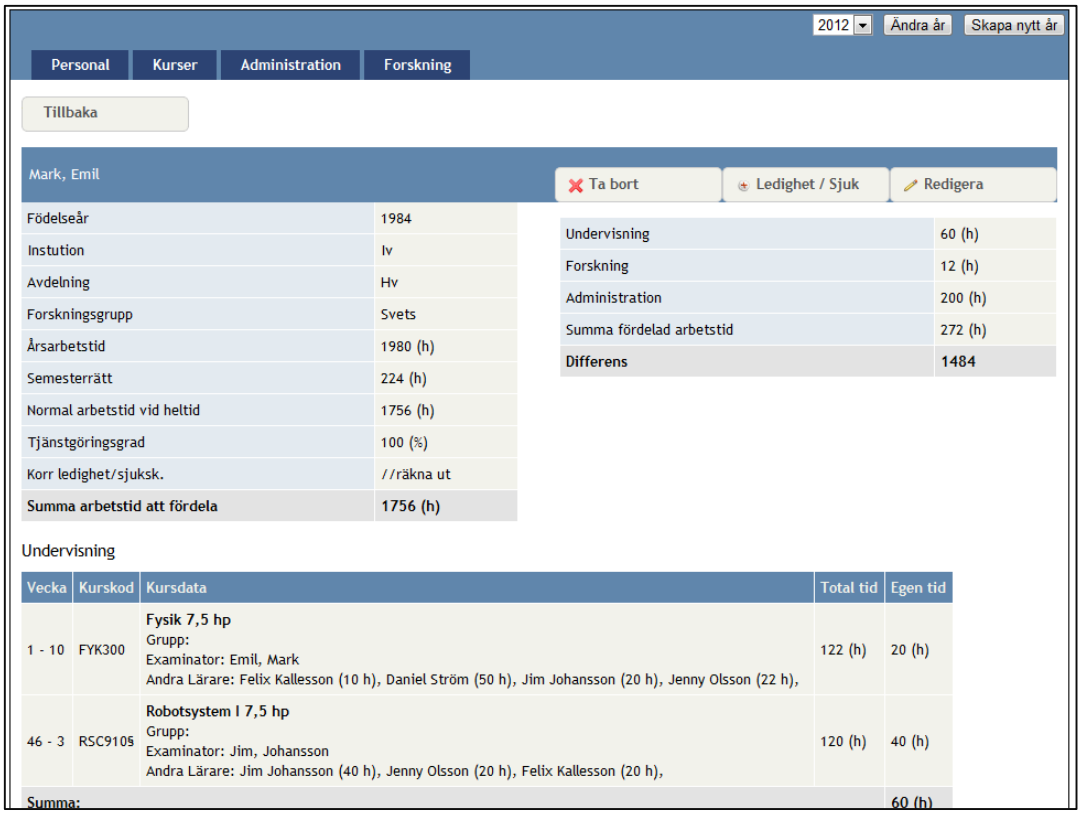

Figure 6. The newly proposed layout. Displaying a person's summary

The second prototype was reviewed during one of the weekly meeting and it was decided that the new prototype should be used as it proved to be both easier to navigate and provided a better view of the information. The second prototype discarded the main concept of the first prototype were a user was able to navigate to different person's summaries by just clicking a row in the table. But by doing so the second prototype offered a better overview of the information and better utilization of the screen-real estate.

6 Testing the systems usability

Even though the customer had been given a chance to try the system at all weekly meetings, a usability test was performed to ensure that a system with a high usability had been produced. The test was performed according to the methods described by Steven Krug in his book Rocket Surgery Made Easy and is, as described earlier, a combination between heuristic evaluation and think aloud testing. Checklists and other resources that have been used can be found on the book's companion website[2].

As suggested in Krug's book, the test was conducted on three users and each user was observed by three inspectors (the development team). By choosing test participants that not are among the group of end users we ensured that they did not have any predetermined knowledge of how the old system worked or any preconceived expectations of how the new system should function.

Each test participant was asked to perform a set of tasks which utilize functions that will be among the most used. It can be dangerous to focus on a small set of functions, but by carefully selecting which tasks and in which order the tasks where to be performed the overall system usability was ensured to be tested.

The majority of tasks where completed without any difficulties but the development team choose to postpone the testing session for the last test participant. The reason was that the observers independently of each other had observed the following two usability problems: (1) When viewing a course – It is hard to find which teachers' that has hours scheduled on the course. See the current placement, marked by a red oval in Figure 7. (2) When viewing a course – It is hard to find were to distribute hours among teachers.

Figure 7. Current placement of the button which was difficult to find.

[2] Companion website to Rocket Surgery Made Easy: http://www.sensible.com/rsme.html

It was decided to change the application accordingly to the comments we got from the test. The first problem was solved by adding a header with descriptive text and the second problem was solved by moving and changing the text on the button. See the changes made in Figure 8 below.

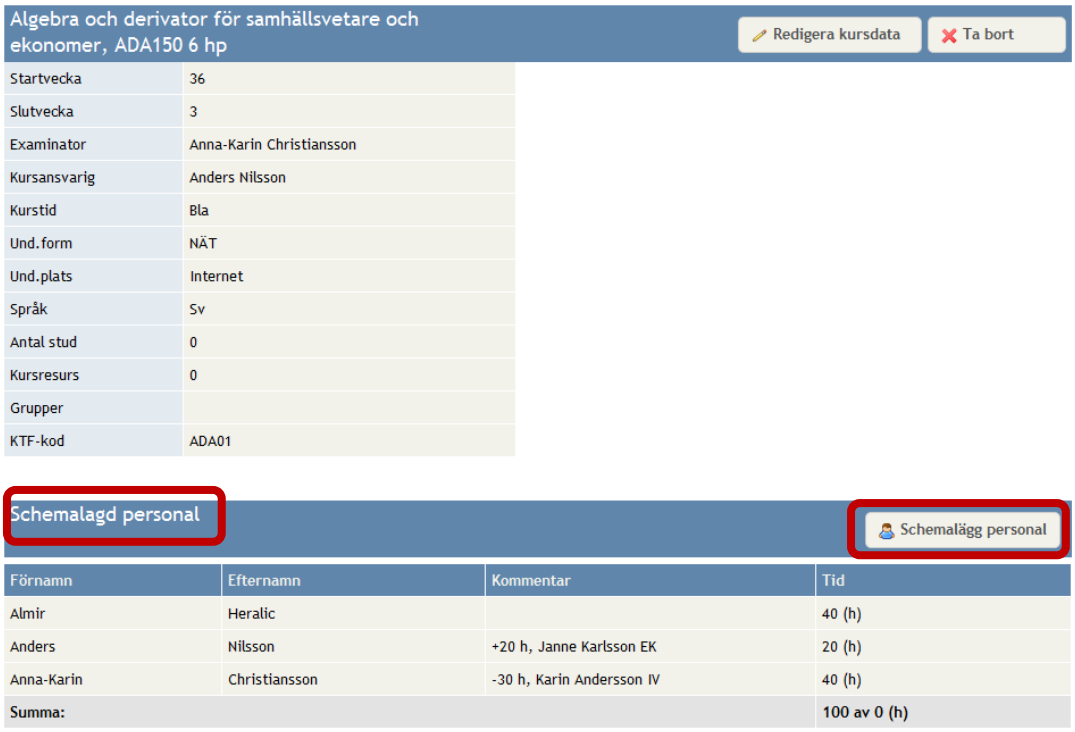

Figure 8. Changes made to solve the first usability problem.

In the second round of testing no usability problems were found and when the participants from the first round was questioned about the changes made they perceived the system to be easier to use.

Two out of three test participants commented on the placement of where to select which teacher/teachers that is responsible for a course, but after discussions between the development team and the customer it was decided to keep the current placement. The reasons being: (1) The end users will benefit from the placement in the long run, as it provides a better overview and is easy to work with. (2) The end users will learn this placement quickly.

7 Final design

This section provides a view of the final design i.e. the outcome and combination of the design process and the usability test.

As can be seen in Figure 9 and Figure 10, the final design is almost identical to the design and layout of prototype number two, the only difference being the changes made according to what was found during the usability testing.

The guidelines regarding usability and interaction design have been used to produce a system that is easy to use and has a high usability. Metaphors have been used sparsely, were found appropriate, and feedback is given to the users continually and immediately e.g. when filling in forms, when changing hours, and when changing which teachers that are responsible for a course. The elements, for example buttons, have been placed to have as natural mapping as possible and we can conclude that the buttons are perceived to have a high affordance as no usability problems have been detected. Nielsen's and Shneiderman's rules have been applied to as high degree as possible, for example their rules enforcing consistency have been applied to how text is presented, what terms are used in text, button design, button placement and so on.

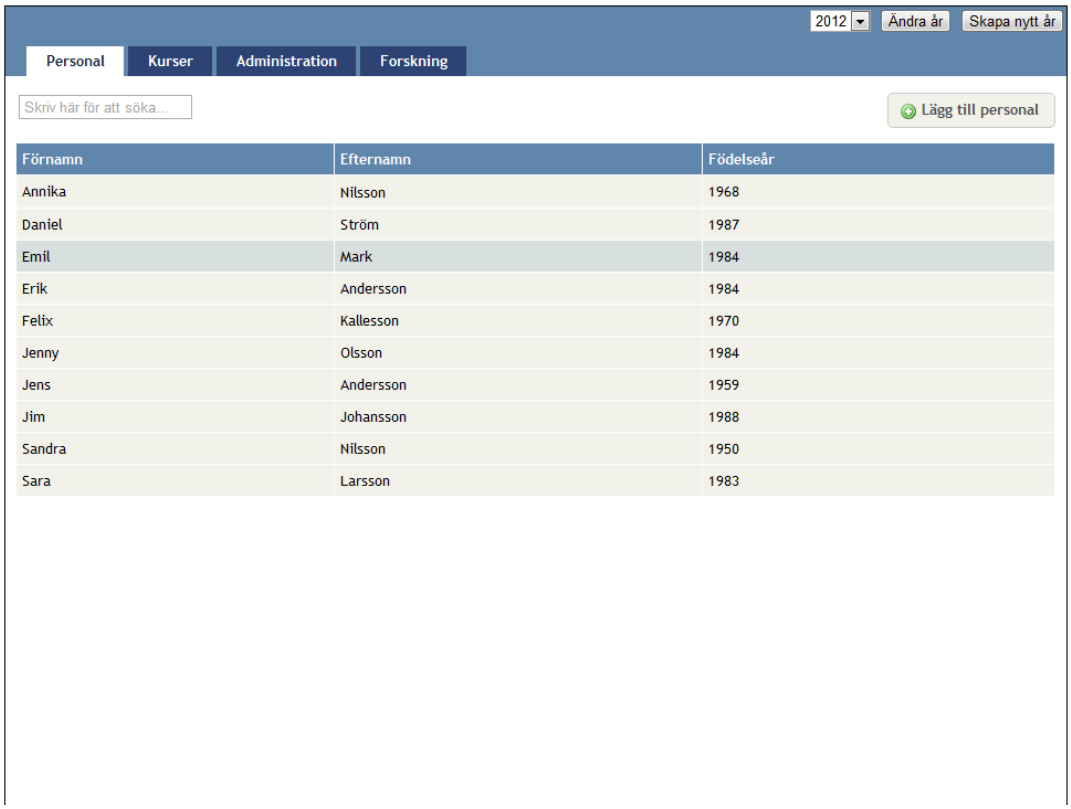

Figure 9. The final design. Displaying the list of personnel

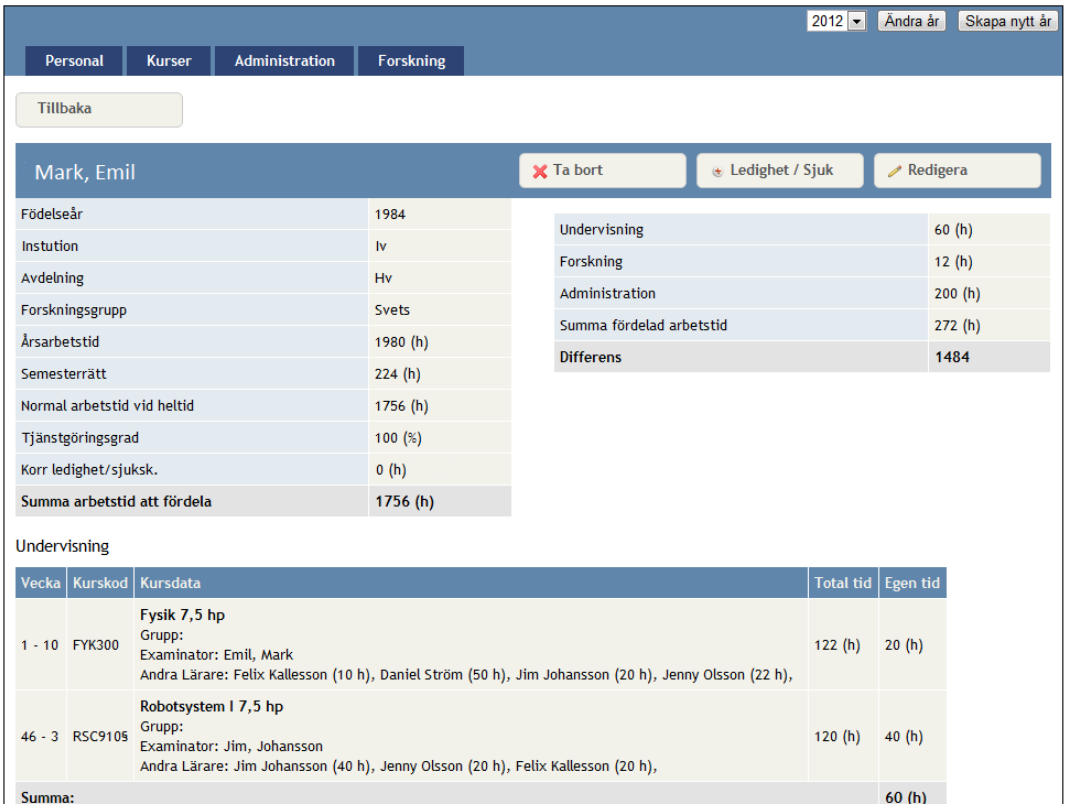

Figure 10. The final design. Displaying a person's summary

8 Discussion & conclusions

The result from this study consists of the web application itself. It also consists of the following observations made with regards to the two focus areas; usability guidelines, and user participation:

The use of *usability guidelines* has proved to be a valuable tool, and the development team has worked actively with them in mind during the entire development process. Working in this manner has with a high certainty affected the outcome of the usability testing, which overall was a pleasant process. If the development team had not chosen to work as actively with the guidelines in mind, the outcome of the usability test would almost certainly have been completely different, and containing a longer list of usability problems to solve.

Even though usability guidelines can provide a good foundation and ease the overall process, it is very important to test the usability with real persons. Neither guidelines nor testing is good on its own, and it can sometimes be necessary to bend the rules of Nielsen and Shneiderman, and by breaking or bending the rules provide the customer with an easier or more efficient workflow. The usability problem found during testing, of where to select which teacher who is responsible for a course found during testing (see chapter 6), is a good example where neither the test nor the guidelines provides a solution that is more efficient than the solution found and implemented together with the customer.

The level of *user participation* has been high throughout the entire design and development process and has provided valuable data and input. We can be sure that the development team, and thereby the final version of the system, have benefited greatly from it. If the development team had chosen another approach, without that high level of user participation, the final design had been much different e.g. the first prototype would most likely have been used throughout the process without anyone questioning its usability. And the second prototype, which changed the layout and workflow to a high degree, would in turn most certainly not exist.

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