Goals and the Work Processes of the Users as a Main Point in User Interface Design

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ABSTRACT

User interface is the borderline of communication between a computerized system and its user. Therefore the design of the user interface should be planned and executed thoroughly. However the design of the user interface should not be separated from the design of the inner side of the system, because there is rarely time in systems development projects to postpone the design of the functions itself for later time in the project.

When the starting point of user interface design is the work processes of the end users the outcome should be an efficient tool for the users, because then the system really does what the user needs in its working environment.

This research studied user interface design methods that take the work processes and the goals of the users into consideration and also are in line with UML modelling language which is meant for design of the inner parts of the system. According to literature GUIDe user interface design method seemed to be such a method so it was tested in empiric. The meaning for the empirical study was to test that does the GUIDe user interface design method really take the work processes and the goals of the users into consideration and is it in line with the design of the inner parts of the system. It was also tested that what is the user interface design methods relation to the usability of the user interface.

The results indicated that the GUIDe user interface design method takes the work processes and the goals of the users into consideration. It was also validated that this method is in line with the UML modelling language and when using GUIDe user interface design method, following usability aspect will be enhanced; Match between the system and the real world, Flexibility and efficiency of use, Aesthetic and minimalist design, Help users recognize, diagnose and recover from errors.

Keywords: User interface designing, U.I Design methods, UML modeling language, usability
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1 INTRODUCTION

1.1 Background

The user interface is the visible part of an information system. It is usually the only part the user sees and therefore “it is the system for the user” (Scogins & Phillips, 2005). It can be seen as a borderline of communication between the user and the system. The design of the user interface is therefore a crucial part in determining how good the whole system is in the eyes of the user. (Laakso, 2004)

What is a good user interface then? The goodness of the user interface is many times measured with the concept of usability (Powell, 2002). ISO standard defines usability: “Usability is the extent to which a site can be used by a specified group of users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use” (International Organization for standardization, 2002). In this light, the concept of usability defines a good user interface.

Many times the user interface is designed at the same time as the whole system. The outcome is usually that the main focus is on the functions inside the system and the user interface is only a by product of the coding process. (Spool, 2004) Coders usually think differently than the end users do. Usually coders think how the system work, not how it will behave, communicate and inform with the user. One of the reasons for this is that the coding is so demanding and difficult that the coder has to concentrate on the coding itself, in order to produce something that works. The outer aspects like the user interface are usually left to the phase where the functions already exists. These reasons explain partly why the focus is usually on the inside of the system and the usability issues are being neglected and the user interface is very far from what end users think as a good to use. (Cooper, 1999)

The usual reason for the fast design of the user interfaces is that the system development projects are completed as fast and efficient as possible. By designing and making the system fast, the system designing firm can keep the costs low and get competitive advantage over its rivalries with lower prices. However neglecting the proper design of the user interface can come also expensive, thus making the short time used for design and development lost their meaning as a mean to save costs. If the user interface is not usable for its users, it usually leads to an expensive changes and fixes at the implementation phase. (Riihiaho, 2004)

It is very common that the system designing process starts by defining use cases for the system. Use cases define the demands the designed system has to fulfil (Fowler & Scott, 2002, 35). The use cases are defined with the customer at the start of the design phase and usually during the coding process. This is a fast way to get started with the system development project, but unfortunately this way neglects the proper design of the user interface. (Scogins & Phillips, 2005)
The usual aspect that is being neglected in the design of the user interface is the work processes and the goals of the end user. If the work processes and the goals of the users have been neglected in the design phase, the outcome is often only a one frustrating tool more for the end user. It is common that the end user has to use external tools like memory notes and spreadsheet computation programs to complete the tasks the new program was developed for, thus making the new system inefficient. By developing new operating systems based on the needs and the work processes of the users, this kind of problems can be avoided. (Laakso, 2004)

This study compares different user interface design methods that take the work processes and the goals of the users into sufficient consideration. One method will be selected under empirical study and it will be analysed from the point of view of how good it takes the work processes and the goals of the user into consideration. It will be analysed also from the point of view of how the method is in line with the design of the inner parts of the system. There will be also discussions and evaluations about the user interface design methods relation to the usability issues and to the issues of technology acceptance.

1.2 Definition of concepts

Because some of this study’s simultaneously used concepts are broad, it is useful to present what they precisely mean in this study.

*Inner part of the system* - concept refers to the functions inside the system, in other words to the code architecture for the functions in the system.

*Outer part of the system* - concept refers to the components of the system that are visible for the user. Thus the whole system is presented as two different areas; the area that are the components that execute the commands from the users and the area that presents the functions of the system for the user.

*Work processes* – The concept of work process in this study means the activities done to reach occupational goals and obligations such as grading of students and planning of meetings, etc.

*Information Technology (IT)* – IT concept deals with the use of electronic computers and computer software to convert, store, protect, process, transmit, and retrieve information. (Wikipedia, 2006)

*Efficiency* - term means amount of output divided by amount of resources used. This term can be connected to the term system when we are talking about the efficiency of systems. System in general can be for instance a teachers system where classrooms are reserved and students graded. (Checkland & Scholes, 1999)
1.3 Purpose of this study

Main purpose in this research is to study user interface design methods that take the work processes and the goals of the users into consideration. One method will be tested in a case site in order to validate that the method does take the work process aspect into consideration and that the design method is practical in a way that it takes also the inner parts of the system into consideration.

Usability in user interface design is one of the key issues when talking about “good” user interfaces. Usability in this study is defined through Jakob Nielsen’s list of usability heuristics and through the Nielsen’s (2005) theory, the user interface design methods relation to the usability of the system is evaluated. Therefore this raises one more purpose for this study, that is to evaluate the user interface design method’s relation to the usability of the designed system.

The result of this study will be a statement of which user interface modelling method takes the work processes and the goals of the users into consideration and is in line with the design of the inner parts of the system. Also a statement of what is the user interface design methods relation to the usability of the system will be presented and discussed. Another result will be also a user interface prototype for Kemi-Tornio University’s information management system.

1.4 Problem discussion

User interface is the borderline between the user and the computerized system. It tells the user what happens in the computer and it tells to the computer what the user wants to do. User interface is in crucial role in defining the usability of the system, that is, how easy and satisfying it is to use the system (Brown C, 1999).

Despite the crucial role of the user interface in a system, its design is many times incomplete. The system development projects are many times completed in a tight schedule and the main focus in on the functions inside the system. (Laakso, 2004) This causes problems because it is hard to build a usable user interface if it has to be built on the top of the already coded functions. Those functions work usually as the coders have imagined, not like the future end user has wanted them to be. Usually the way coders have imagined the functions to work differ a lot from the end users point of views. The user interface should be designed first, based on what the end users have wanted. The functions should be coded inside the system based on the designed user interface. (Cooper 1999)

This study concentrates on user interface design methods that are in line with the goals and the work processes of the users. Still the design of the user interface is only a part of the whole system. Because of the fact that the design of the inner parts of the system affects on the user interface, this study takes also into account the design methods for inner parts of the system. Because the case site’s information management system is object oriented and UML modelling language is the most common way to model object oriented systems, I will use UML as the design viewpoint for the system’s inner parts.
UML (Unified Modelling Language) is a very popular modelling language in the field of system designing. For example, nearly 70% of the IT shops that design object oriented systems use UML as a modelling language (Pender, 2003). The problem with the UML is the fact that its focus is on the inside the system. It offers very little, if any solution to the proper design of the user interface. (Scogins & Phillips, 2005) Still many of the system development projects, in my experience, use it as the only design method for the user interface.

There are numerous methods for the user interface design, but the most of them are not usable to be used with UML. The user interface design methods are usually concentrating on the external aspects of the system. That is the visual user interface. In order for the user interface method to be effective it has to be in line with the internal design method such as UML. To be usable and useful, the method has to be able to used simultaneously with UML. (Scogins & Phillips, 2005)

These problems and aspects give us a good setup to present the research question.

1.5 Research question

How to model a user interface for web based programs in the field of information management systems, in a way that it takes the goals and the work processes of the users into consideration?

If we break the research question in to different pieces it hopefully opens up the situation. First of all, there is the “How to model a user interface”. This is the nucleus of the study. The purpose of this study is to research different user interface design methodologies and use one of them to produce a user interface for the case site.

In the research question is the phrase “for web based programs in the field of information management systems”. This defines the case. The case site is the web based Information management system in the Kemi-Tornio University where the users have had problems adapting to its user interface. Information management system in this organization is web based software used for example in sharing of scientific articles. In this study I will analyze different user interface design methodologies that take the work processes and the goals of the users into account and are in line and can be used with the UML use cases.

After suitable methodologies are analyzed I will use one of them to design a user interface for the case site. The one design method will be chosen with the help of Pugh’s decision method.

The goals and the work processes of the users are important part of the research question. It defines two important aspects that have to be taken into account when designing usable user interfaces. Hohmann states that: “The cornerstone of creating usable applications is based on an intimate understanding of the users, their needs, and the tasks that must be accomplished” (Brown C, 1999). The goals and the work processes are interconnected and treated as the same in this study, because the goals are inside the work processes. A person who executes his work processes has a goal in the background; goal can be for instance a purpose to get a meeting room reserved or to inform students about some issue. In any case the work processes exists because somebody wants to reach some goal. In this study the goals are work related.
The previous research question is the primary question in this study because the focus is on the work processes and in the goals of the users. As stated before the user interface design should be in line with the design of the inner parts of the system in order to create comprehensive system that is usable and possible to construct technically. Thus a parallel research question is presented:

*How to model a user interface in a way that it takes also the inner parts of the system into consideration?*

Through this research question the user interface design methods linearity with the modeling of the inner parts of the system will be studied.

There is also the aspect of usability present in this study. The usability concept’s importance in user interface design is too crucial to bypass so it will be evaluated in empiric. This aspect will be treated as a secondary issue since it is not the main focus of this study. One more parallel research question is presented:

*What is the user interface design methods impact to the usability of the user interface?*

### 1.6 Delimitations and limitations

I will limit my research area to concern only web based user interfaces in the field of information management. The reason for this limitation is the fact that the platform for this study is web based information management system and therefore generalizations made in this study can concern most directly only these kinds of systems.

The results of the study will be thereby applicable only in designing user interfaces for web based information management systems.

There are always aspects in the work processes and in the goals of the users that has to be neglected when designing a user interface. The purpose is usually to find a compromise between different goals and work processes. The user interface that will be designed in this thesis will be an example of user interface that is designed to be compatible for all of the users of the case site.

### 1.7 Significance of the study

This study compares different user interface design methods. The emphasis is on end user’s goals and work processes. The study will bring out different design methods and pinpoint the one’s that take the goals and the work processes of the user’s into consideration and are in line with the use cases of UML. The result will be validated on the case site by designing a user interface with the help of one chosen method.

Kemi-Tornio University teachers has problems with their information management system’s user interface. This study will produce a new prototype for the user interface and validate or invalidate user interface design method in a way that they are taking the goals and the work processes of the users into sufficient consideration.
Kemi-Tornio University of applied sciences teaches future system developers. They want to keep the information they teach up to date and valid. This study also helps them to achieve the objectives they have defined for the quality of teaching and try to find new and valid things to teach. This study also tries to validate what they are already teaching.

This study is significant for University of applied sciences because it tells to them are they teaching the right things and what they should consider to teach.
2 THEORETICAL REVIEW

2.1 User Interface

One can define the concept of user interface in many ways. In this study the definition is connected to computer sciences. We can look the concept of user interface through these two definitions:

- User interface is the point of communication between the computer and a human being (http://www.azatiko.com/glossary/u.php).
- “User interface is a set of commands or menus through which a user communicates with a program” (services.eliteral.com).

These two definitions are in different level of abstraction. If we look at the first definition it tells about the communication between the computer and the user. We can see the user interface as a communication boundary between the user and the computer. It translates the binary language of the computer into a form that the user can understand it and vice versa.

The second definition goes deeper. It tells about the properties of the user interface. The user communicates with the computer for example by giving processing orders for the computer by commands. In the definition menus are mentioned. Menus keep the commands and other functions of the user interface organized in a way that the user interface is more comprehensible for the user.

2.1.1 Usability

Software system that is meant to be operated by human beings has to have user interface that is usable for its user. That brings us the concept of usability. In Brown (1999) Hohmann defines this concept like this: “Usability refers to the complex set of choices that ends up allowing the users of the system to accomplish one or more specific tasks easily, efficiently, enjoyably, and with a minimum of errors”.

The popularity of the Internet has grown enormously in the past years. According to the latest numbers, updated on November 9, 2005, the Internet has over 964,289,000 user’s worldwide (Internet usage statistics, 2005). As has the Internet grown so has the importance of the usability. According to the Internet Software Consortium the number of Domains worldwide is currently close to 400,000,000 (www.isc.org, 2005), so if the web site is not usable, there are lot’s of alternatives to go to a site that is more usable. Especially corporations who use the web as a marketing place have to accept the importance of usability and implement it as a part of their strategies. (Nielsen, 2000)

Usability has nowadays a big role in the software industry; Often people who use computer programs as their tool in daily work routines do not have the luxury to use different, more usable programs. Instead they have to use the same program whether they like it or not.
Programs that are not usable are hard to use, thus the users need a lot’s of help when using the programs. This is expensive for the software industry, because every call from the clients, costs a lot of money. It is estimated that the half of the calls that comes to the help centres are related to the usability problems. (Nielsen, 2000)

2.1.1.1 Jakob Nielsen’s list of usability heuristics

Jakob Nielsen has been one of the pioneers in the field of usability issues when talking about web based programs. The Nielsen’s heuristic list (Table 2.1) of ten usability issues is often used as a principle in user interface design in web based applications. (Rajesh Vijayan, 1997) The list gives a good framework for taking a closer look what the word usability holds in:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Visibility of system status</td>
</tr>
<tr>
<td>2</td>
<td>Match between system and the real world</td>
</tr>
<tr>
<td>3</td>
<td>User control and freedom</td>
</tr>
<tr>
<td>4</td>
<td>Consistency and standards</td>
</tr>
<tr>
<td>5</td>
<td>Error prevention</td>
</tr>
<tr>
<td>6</td>
<td>Recognition rather than recall</td>
</tr>
<tr>
<td>7</td>
<td>Flexibility and efficiency of use</td>
</tr>
<tr>
<td>8</td>
<td>Aesthetic and minimalist design</td>
</tr>
<tr>
<td>9</td>
<td>Help users recognize, diagnose, and recover from errors</td>
</tr>
<tr>
<td>10</td>
<td>Help and documentation</td>
</tr>
</tbody>
</table>

Table 2.1 List of ten usability heuristics (Nielsen, 2005)

Let’s take a closer look of the table 2.1 one by one. With visibility Jakob Nielsen states that the system should be transparent for the user. Transparent in such a way that the user knows all the time that in what state the system is. (Nielsen, 2005)

Making the system in such a way that it matches with the real world concepts, languages and phrases is the message in the second segment in the table. This means that the system should be culturally and logically in line with the user to make the communication between the user and the system fluent. (Nielsen, 2005)

Undo and redo buttons are familiar sight in most of the word processing programs and is one way to add user’s control and freedom when using the system. User’s control and freedom means of course more than just the named buttons, it is important to design the whole system in a way that the user don’t get frustrated with the system. It is easy to get the user frustrated for example with endless dialogues with advertisements or with navigation bars. This is the meaning behind the third segment of the table 2.1. (Nielsen, 2005)
Standardization and consistency (segment 4 in the table) is a way to enhance the user’s trust towards concepts such as words and actions among other things. It is easier and faster to use the system if there are familiar elements from other systems. For example we have used to the fact that the trashcan icon usually means erasing of data and if we see this familiar icon in a new system we already can assume its meaning, thus we have learned something about the new system just by noticing something familiar. (Nielsen, 2005)

Design the system in a way that it is hard to make mistakes with the system is the message with the segment five. One way to design the making of errors hard is to implement confirmation functions places where the user has to decide something. Implement confirmation functions in situations where the user is for example about to erase something. (Nielsen, 2005)

Recognition rather than recall is the sixth segment. It means that it is faster to use the system when the user does not have to memorize actions he has done in previous stages. Nielsen explains this part: “The user should not have to remember information from one part of the dialogue to another”. Elements such as visible navigation paths and information elements about the system’s state help the user to recognize. (Nielsen, 2005)

The needs of the users can vary very much. User that has used the system several years can have drastically different needs than a novice user. That’s why it is important to give the user an option for customization. It enhances the flexibility and efficiency of use (segment seven) if the expert user has a possibility for example to hide help boxes from the system that the novice user might use constantly. (Nielsen, 2005) When talking about efficiency of use it can be explained with the following sentence: The term efficiency means amount of output divided by amount of resources used. (Checkland & Scholes, 1999, 39)

It is important to emphasize relevant information with aesthetic and minimalist design (segment eight). This means that the site should contain only information that is essential for the use of the site. Any irrelevant information can take the user’s focus off from the essential information. (Nielsen, 2005)

Error boxes are familiar sight in many systems. It helps the user to recover from errors (segment nine). It can help the user by explaining why the error occurred and how the situation can be repaired. Also error boxes should be designed with the principles of aesthetic and minimalist design by avoiding technical terms. Technical details might be useful for the administrator of the system, but it many times confuses the main user group. (Nielsen, 2005)

Help has to be available when needed, is the message in the last segment. Information about the principles of the system and examples of common problems and how to solve them can be useful for any user. Thus this kind of information should be easy to find and use. (Nielsen, 2005)

When the design of the user interface is neglected in the systems development project many problems occur. Laakso states that unfortunately many times the user interface is only a by-product of the coding process. Many times the system development project is carried out in a hurry in order to save time and money and the most important thing is to get the coding process started. This causes problems because the design of the user interface is out of the focus and very little, if any time is spent on analysing the user interface and its relation to the needs and goals of the users. (Laakso 2004)
2.1.1.2 Problems with usability

When the user interface is poorly designed, it causes expensive changes and reprogramming in the end of the system development project. When the system is about to be implemented and the end user tries to perform work tasks with the user interface the problems can occur. (Laakso, 2004)

Computer software, including user interface, consists of programming code. So the usability of the user interface is based on the fact that is the architecture of the code designed to be usable. So the concept of usability does not include just the user interface, it is also tied to the whole architecture. Based on that, In Brown (1999) Hohmann states that the system is usable if the whole architecture is designed to be one.

This brings up the fact that the design of the user interface is tied up to the design of the whole system. There are several methodologies for designing of the user interface, but the most of them lack the insight to the code structure itself. UML on the other hand is a very popular modelling language for the internal system, the whole architecture, but it lacks the insight to the user interface. (Scogins & Phillips, 2005)

2.1.2 User interface design methods

In this chapter three user interface design methods are presented. These methods are selected from the related literature using two criterions: The method has to take the work processes and the goals of the users into consideration and it has to be in line with the UML modelling language.

2.1.2.1 UMLi

The idea was to found user interface design methods that are in line with UML and are capable to take the work processes and the goals of the users into account. UMLi (Modelling Language for Interactive Systems) is such a method.

The UMLi is a creation of the Information Management Group in the University of Manchester. The development of UMLi started in 1998 from the idea to expand the popular UML modelling language in a way that it is suitable for designing user interfaces. UMLi is a combination of UML modelling language and user interface design method. The mentioned user interface design method is MB-UIDE (Model-based user interface development environments). (Pinheiro da Silva, 2002)

MB-UIDE is a modern approach for modelling and implementing user interfaces. However MB-UIDE is only a technology that helps the designer to produce a user interface. It even in some cases generates the code for the user interface, but it lacks the insights and functions for the inner parts of the system. It does not specify how objects inside and outside the system interact with each other. (Pinheiro da Silva, 2002)
UMLi is based also on the facts that the UML modelling language is effective to use when designing the inner functionalities of the system, but is not suitable as it is, when designing user interfaces. (Pinheiro da Silva, 2002) The other fact is that the most of the current user interface design methods do not take the other processes of the system development into consideration.

UMLi takes the work processes and the goals of the users into account with the concept of Interaction design. Interaction design is a way to take the end user’s point of view to the user interface design process. (Cooper, 54)

2.1.2.2 Lean Cuisine+

The development of this method, just like with UMLi, was motivated by the fact that the user interface design methods and design methods for the inner parts of the system are separated from each other. Lean Cuisine+ is developed from the UML, thus making it also a expansion of the UML modelling language. (Scogins & Phillips, 2005)

Lean Cuisine+ is a graphical notation language for the designing of user interfaces. Lean Cuisine+ was developed in the middle of the 1990’s from a Lean Cuisine dialogue modelling language. The Lean Cuisine+ combines both, the task modelling- and dialogue modelling languages. The combination of these two different modelling techniques is its best feature because it is one way to design the inner and outer parts of the system at the same time. (Scogins & Phillips, 2005)

Task modelling is a way to model the flow and decomposition of tasks. Usually task modelling is used to describe what operations the system under development should have, that is, what functions it has to be able to process in order to fulfil the requirements of the user. Use cases are good example of task modelling. Use cases are usually used to describe the requirements and the functions of the system. (Scogins & Phillips, 2005)

Dialogue modelling in user interface design is a mean to visualize the behaviour of the user interface at an abstract level (Scogins & Phillips, 2005). The Dialogue models present information about the static and dynamical communication between the computer and its user and in some cases communication between the user interface and the inner parts of the system. They present the information about the user interface in many levels. They can describe shape and icons in the user interface, they can describe the order and structure of methods and services in the user interface and they can present the affects of the user interface dialogues in to the system’s inner functions. (Elwert, 1996)

As stated, Lean Cuisine+ combines external user interface modelling with the modelling of the inner parts of the system. The modelling with this method is based on dialogue tree (Figure 4.1). The idea with the dialogue tree is that it presents the user interface in terms of its constraints and dependencies. In the picture 4.1 is shown a dialogue tree where the task model is superimposed. The bold boxes present the task sequence and the solid arrow present a user actions and the dashed arrow presents a system action.
Dialogue model is also in the picture as a tree, where the tasks are placed. The tree describes the order and a structure of methods and services in the user interface as a hierarchical data structure. This is the way Lean Cuisine+ combines the dialogue- and task modelling.

![Dialogue tree](Image)

**Picture 2.1 Dialogue tree (conducted from Scogins & Phillips’s example, 2005, p.290)**

The connection to the UML is obvious if we look the picture 2.1. The tasks in the picture (bold boxes) and the arrows between them look and are the same as they are in the UML use cases. When the design of the system is presented like this, it is easy to continue modelling the system also with other nodes, like class diagram, offered by UML modelling language.

The focus in this study is on user interface design methods that take the work processes and the goals of the users into account. In the Lean Cuisine+ that part is mainly on the dialogue aspect in the models that present the communication between the user and the system. (Scogins & Phillips, 2005) Elwert, 1996, states that the dialogue model gives a common ground for the communication between the end user and the designer. By communicating via dialogue model with the end user a designer can get information and feedback of the designing and thus getting the user interface more valid in the light of the user’s work processes and the goals of the user. (Elwert, 1996)
2.1.2.3 GUIDe

GUIDe is first of all a user interface design method. It is a process model, based on goal-based use cases and goal-derived user interface design. The idea behind the whole method is that the user interface is designed at the beginning of the system development and the prototype of the user interface works as a definition of demands. The prototype is developed based on the goal-based use cases that are conducted from the end user’s work processes and goals. (Laakso, 2004)

The user interface in GUIDe design is developed in the beginning of the system development process because it allows the testing of the user interface in a phase where the changes to the design are easy and cheap to implement and execute. Testing of the user interface reveals that is the user interface suitable for the purpose it was designed to be. (Laakso, 2004)

Goal based use cases are the ground for the user interface design. The idea is to study what work processes the end users might have and make use cases based on the findings. The use cases are called to be goal based. It means that they are developed for example listening and observing end users ideas about their day to day work tasks and what goals they might have in their work processes. (Laakso, 2004)

When the user interface is designed it can be tested. The testing can be in the form of walk-through meetings where the end users and user interface designers analyze together the suitability of the user interface for their needs. Another way to test the user interface can be a expert review with usage simulations. This testing involves external user interface experts and their evaluation of the user interface with the help of the simulation models. This kind of simulation model can be, for example, a slide show of the user interface. (Laakso, 2004)

Work processes and the goals of the users are the main point in this user interface design method. Those come up with many aspects in this method, like in the goal-based use cases which are derived from the analysis of the end user’s work processes and in the whole structure of the design process. (Laakso, 2004)

This user interface design method is in line also with the UML modelling language. The user interface is derived from the goal based use cases which are closely related to the UML. Use cases in GUIDe are not just like in UML, but the main principle is the same, that is the modelling of the tasks of the system. Because this modelling language produces data about the static tasks, it is easy to continue modelling with other nodes in UML by deriving them from the goal-based use cases. Thus it is fair to say this modelling language to be in line with the modelling of the inner parts of the system. (Laakso, 2004)

When the user interface is designed and evaluated the coding process of the system can begin. The user interface works as a definition of requirements for the system.
2.3 UML

The UML (Unified Modelling Language) is a modelling language. It is a standardized language for the specification, visualization, construction and documentation of the components of software systems. (authors.phptr.com/morris/glossary.html) It can be used also to model a business processes and data structures. This study’s focus is on software systems.

UML is mainly a collection of notations and a number of modelling techniques distilled together. Notation is a graphical description that is used in models. It is the syntax of the modelling language. (Fowler & Scott 2000, 2, 5) In this study modelling stands for the designing of software applications before coding.

Modelling is an essential part of development of software systems. It is a vital communication method between the system designer and the system to be and between different designers and coders in the systems development project. It is the only way to visualize the system in an early phase of the development process and the best way to validate the system against the requirements before coding. This is very important especially in large software development projects, because the model of the system can help to find critical errors in the design and thus preventing expensive reprogramming. (http://www.uml.org)

2.4 Intranet

The focus of this study is in user interfaces on web based intranet applications. The concept of intranet means a Local Area Network (LAN) that is being used internally in an organization. Among other things it can be a information storage, communication tool and learning environment, in its usual sense it is a web based working tool for an organization. (Wikipedia, 2005)

80 percent of today’s company’s outputs are documents in some form, thus making the management of documents challenging. Intranet is very valuable asset for companies to manage this huge flow of information in the form of documents. The management of information can be a factor that affects to the effectiveness of the organization, thus making it a factor of competitiveness. This makes the organizational effects of the intranet permanent. (Info Tech Research Group, 2003)
2.5 Decision Theory

Design in today’s environment is a process full of different operations. Many times designers face situations where they, among other things, have to be able to solve problems, be able to receive and seek information in every situation, in other words be able to learn, be able to present their findings and thoughts to a large variety of people and especially be able to make decisions. (National Research Council, 2002)

Varieties of decisions have to be made during design process. For example decision about different properties of the design.

In a study like this, where a decision has to be made between different options, it is suitable and valid to use a guideline to support made decisions. In this study, decision theory will be used to be this guideline.

This study concentrates on user interface design methods. The purpose is to study and evaluate different design methods. The selection from the different options will be based on predefined requirements that the method has to fulfil. As a framework for the selection of the method I will use a decision theory. The theory, and the way how it will be conducted in this study, will be presented in the following chapter.
2.5.1 The Pugh method

The Pugh method is based on decision matrix. It is a method to support its user’s decisions between different options. The purpose of this method is not to produce a mathematical result of what is the “best” option, it just helps to make a “best possible” subjective decision between different concepts. (Committee on Theoretical Foundations for Decision Making in Engineering Design, 2001)

This method is based on decision matrix. The decision matrix is table where are the requirements and different alternatives listed together. See the table 2.3.

<table>
<thead>
<tr>
<th></th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement1</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Requirement2</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Requirement3</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Requirement4</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sum</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*Table 2.3 Example of the Pugh’s decision matrix*

Another word for the decision matrix is the priorization matrix. Priorization describes well the meaning of the matrix. It prioritizes the alternatives over others thus making the decision easier. The basic idea is that the alternatives is compared against requirements one by one and the best alternative is marked with some symbol. Usually the symbol is “+” with the good alternative and “−” if the alternative is bad against the requirement. (University of Massachusetts economics of engineering design, 2000)

In situations, where there are difficult to define is some option bad against a requirement, it is possible to use more defined scale to determine the options relation to the requirement. The “+” and “−” signs can be also defined with numbers (Table 2.4). In many situations the option’s goodness or badness is not, so to say, “black and white”. On the contrary, usually in situations where decision matrix tools have to be used, the different options have little difference against each other. (University of Massachusetts economics of engineering design, 2000)
Table 2.4 Variation for scoring in Pugh’s method

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+3</td>
<td>meets criterion extremely better than datum</td>
</tr>
<tr>
<td>+2</td>
<td>meets criterion much better than datum</td>
</tr>
<tr>
<td>+1</td>
<td>meets criterion better than datum</td>
</tr>
<tr>
<td>0</td>
<td>meets criterion as well as datum</td>
</tr>
<tr>
<td>-1</td>
<td>meets criterion not as well as datum</td>
</tr>
<tr>
<td>-2</td>
<td>meets criterion much worse then the datum</td>
</tr>
<tr>
<td>-3</td>
<td>meets criterion far worse than the datum</td>
</tr>
</tbody>
</table>

This method suites well to this study because it takes the stakeholders input into consideration. The stakeholders’ viewpoint in this study is important, because the method is chosen partly based on the requirements from the stakeholders. Another viewpoint that makes this decision method valid to use is the fact that it is based on subjective selection. It is important because the compared phenomenon in this case is selection of user interface design method. There are lot of different kind of user interface design methods and in some point one has to be selected, even if there are many alternatives that fulfil the requirements. In that point the selection is subjective: the researcher chooses alternative that he thinks to suite him well. After all, at the end of the day, design process is quite subjective process full of personal innovations.

2.6 Information management system

“Information management system (IMS) is any of several system environments available with Database Manager and Transaction Manager, capable of managing complex databases and terminal networks” (IBM, 2004). IMS is basically a computer program meant mainly for to manage large amount of data in organizations. In this study the system is web based. Web based information management systems are used using web browsers which allows easy access from any desktop in organization. (Brown, Williams, McLaughlin, 1998)

Work processes in this study concern the occupational activities of teachers. With the selected user interface design method, the work processes of the teachers will be implemented to the organizations information management system as far as it is feasible to implement those in to computerized system. The information management system will work as an platform to implement the work processes into electronic form.
The purpose with this study is to bring to the surface different user interface design methods that take the work processes and the goals of the users into consideration and are in line with the UML modelling language. In the previous chapter three user interface design methods were presented and the purpose of this chapter is to compare these methods and select one of them under more detailed empirical study in the case site.

There are some requirements for the design methods before they will be selected under comparison. The design method has to be in line with the UML modelling language, because the design methods for the inner and outer parts of the system have to be compatible with each other. The UML modelling language has been selected to be the design method for the inner parts of the system because of its popularity and because of the requirements of the case site.

Other requirement for the design method is that it has to take the work processes and the goals of the users into consideration. As stated before the work processes and the goals of the users are in main focus in this study because of their crucial role in usability.

The design methods have been selected from the related literature. After considerable time had been spent for reviewing the literature three suitable design methods were found. These design methods are UMLi, LeanCuisine+ and GUIDe.

3.1 The comparison and selection of the modelling language

The aim of this thesis is to compare user interface design methods and select one of them under more specific study. The selected method will be validated or invalidated with the help of a case study. A selection of a design method is a part of everyday decisions for example in engineering. (Frey & Lewis, 2005) This is very important phase, because the selection of the method can have huge consequences, because when wrong method for the situation is selected, it can cause expensive changes to the project. It can cause for example severe problems to the project if the whole method has to be changed in the middle of the project.

The purpose with the previous example was to emphasize the importance of structured decision making in business engineering and in science engineering. The decision method in this study is Stuart Pugh’s decision matrix called the Pugh’s method. It will work as selection advisor in this study. The structured method selection in the form of Pugh’s decision theory in this study is important, because it gives a good framework to compare different design methods towards requirements. With the help of the decision theory this chapter compares three different design methods against the following requirements.

There are two primary requirements. The most important requirement for the user interface design method is that is has to take the work processes and the goals of the end users into consideration. This requirement is the most important because it defines the core of this study. The emphasis is on user interface design methods that take the aspect of end user’s work processes as its main focus and requirement.
The second requirement is that the method has to be in line with the design method for the inner parts of the system. In this study the method for the inner parts is the UML modelling language. This requirement is also a very important aspect because no user interface design method can neglect the aspects of designing and coding of the inner parts of the system. However many times the design of the user interface is not connected to the designing of the inner parts of the system and problems occur. However the main focus is on the work processes of the end users so that will be treated as a more important requirement in the decision matrix (see the table 3.1).

There are other requirements as well, that are brought up by the practical aspects in this study. First secondary requirement is that the user interface design method has to be relatively fast to use. The reason for this is from the fact that only a limited amount of time is available to conduct the empirical phases of this study, so the use of a method that needs significant amount of time and resources has to be limited out.

Another secondary requirement is that the design method has to be relatively cheap to use. This study has limited money resources so building of expensive prototypes is out of the question. This is interconnected also to the time resource aspect but has to be dealt separately, because some methods can be fast to use but expensive. The whole design process in these kinds of student based projects is constant balancing between time and money and “time is money” might not be equivalent phrase in these cases. Therefore the idea about expensive, but fast method has to be neglected in this study even if it would be eventually cheaper for some organization to use.

After the most important requirements has been introduced, it is time to use the decision matrix to conclude which design method will be taken under more specific study. Four different stages can be conducted from to process to produce the matrix. (University of Massachusetts economics of engineering design, 2000)

The first stage is to conduct the criteria for the comparison. One of the purposes in this stage is to develop a set of goals for which to follow. The goals can be, for example, engineering targets, engineering requirements or scientific objectives. Another purpose in this stage is to examine what requirements the customer has and implement them to the matrix. In this study this stage holds in the implementation of scientific requirements and examination of the requirements brought by practical boundaries, such as money and time resources introduced previously.

In the second stage the alternatives are being selected. In this study the alternatives are UMLi, Lean Cuisine+ and GUIDe. They were selected based on two different requirements: First it had to take the work processes and the goals of the users into consideration. Secondly it had to be in line with the UML modelling language. In this study UML presents method for the design of the inner parts of the system.

In the third phase is the scores generated. As presented in the table 3.1 the scores have been generated with a seven step scale. The Scales are from “-3” to “+3”.

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The fourth phase is for calculating the scores. As you see, the scores are very close to each other. The reason for this is that the methods were already selected under tight requirements, that were the consideration for the work process aspects and the method had to be also in line with the UML modelling language.

As shown in the table 3.1 the GUIDe method will be the user interface design method that will be used as a mean to design the user interface for the University of Applied Sciences. The biggest difference became from the first requirement. As stated before, this decision matrix method is based partially on subjective insights. This was the case in this matrix also. Practically all of the design methods were good for taking the work processes and the goals into consideration, but the GUIDe method were the most comprehensible in this part. The other design methods might well be as good as the GUIDe against the first requirement in some other designer’s use, but this time due to fact that the differences between methods were small, the choose were subjective and was directed to the GUIDe.

Lean Cuisine+ takes the work processes and the goals of the users into account mainly via being a communication tool between the designer and the end user. Helping the communication this method gives a good platform for the designer to understand the real goals of the users, but too much is left open in order to compete with GUIDe; The communication situation with the end users in GUIDe is directed to concern the work processes where the Lean Cuisine+ is being neutral and not steering the communication situation to anywhere. Therefore the collected data for the user interface is more in line with the work processes and to goals of the users in GUIDe.

When talking about UMLi and its relation to the work processes and the goals of the users the gap to GUIDe’s properties was as big as it was with Lean Cuisine+. The UMLi leans to interaction design in producing data from the end users work processes. The connection was also too inexact in the data collection phase for it to produce detailed data from work processes and goals of the users. The user interface is designed in each of these three methods following the interaction between the designer and the user, therefore the most content of the interface is based on the sayings of the users. In GUIDe the users are steered to give exact information of

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**Table 3.1 Decision matrix for comparison of user interface design methods**

<table>
<thead>
<tr>
<th></th>
<th>UMLi</th>
<th>Lean Cuisine+</th>
<th>GUIDe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takes the work processes and the goals of the users into consideration</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Is in line with UML</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Is relatively fast to use</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Is relatively cheap to use</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sum</td>
<td>6</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
their work processes in natural working environment and the content in the user interface is then very closely in line with the true goals and the work processes. In the other two methods, as mentioned before, the data collection is quite general and gives the users too broad framework to give exact data when talking about the work processes. Therefore the possibility is quite high that there are unessential content in the user interface towards the work processes and the goals of the users.

UMLi and the Lean Cuisine+ were absolutely brilliant concerning the UML modelling language as a requirement. They interconnected to this design method for the inner parts of the system very well, thus getting the best score against this part of the requirement. GUIDe was also good in this part but not as strong as another two, because the GUIDe is not directly based on UML modelling language as another one. The UMLi and the Lean Cuisine+ are directly based on the UML modelling language and are partly produced as a graphical nodes as the UML itself. Therefore it is fluent to use these two modelling language together with the UML, because they all are based on the same syntax, that is the graphical nodes or written use case description. The goal based use cases in GUIDe are not entirely the same as the original UML use cases, but they are closely related. This difference reflected to the matrix (table 3.1) as a lack of one point for GUIDe.

The emphasis of this study was in the user interface design methods that take the work processes and the goals of the users into account. The interconnectivity with the UML modelling language is a part of the study but not as important as the previous aspect. Therefore the selection was GUIDe. GUIDe’s starting point and the emphasis is on the usability aspect such as in the work processes and in the goals of the users. It took the UML into account but it was only this method’s extension. UMLi and the Lean Cuisine+ took the work process issues into consideration, but these methods concentrated on getting the user interface design process and the process for producing the inner parts of the system interconnected. Producing of the work process issues were not as structured as it was in the GUIDe. Its starting point is the mapping of the work processes of the users and they are the main requirement during the whole design process so there was no doubt that GUIDe is the best choise in this case.

The differences against the time and money requirements were small between the candidates. There was no method what could crucially be more expensive or time consuming than another one that is why the equal score in the matrix between the three methods.
4 METHODOLOGY

“Research is a carefully planned attack, a search-and-discover mission explicitly outlined in advance” (Leedy & Ormrod, 2005, p.3)

This pertinent description of a scientific research gives us a good starting point for description of this methodology chapter. This chapter explains the methodologies I will use to conduct this research.

This methodology chapter consists of eight parts. In the first part I will explain the differences of inductive and deductive study and explain where this study belongs to. The second part analyses the differences between the quantitative and qualitative studies and motivates the selection between these two. The third part explains the research method for this study and fourth how the data will be collected. Fifth part explains the more specific methods for the empirical part of the study. Sixth part handles the aspect of confidence of this study and the seventh part introduces the concept of data analysis and how it does show up in here. Last part is dedicated to the explanation of the case site.

4.1 Inductive or deductive study

The way to conduct research can generally be divided into two different categories: Into deductive and inductive reasoning. Inductive reasoning in a scientific study means a situation where somebody forms a theory from empirical observations. It is a situation for example where a scientist forms a theory of the behaviour of birds based on the observations he has made. (Leedy & Ormrod, 2005)

Deductive logic is the other side of the coin. It begins with a theory that has been accepted to be “true” in some sense. The phenomenon that has been argued to be true is then tested with empirical observations and thus validating, or in some cases even invalidating the assumption. (Leedy & Ormrod, 2005)

This study is deductive. In deductive studies empirical data comes after theories. One of the purposes with deductive studies is to test those existing theories. It means that with the help of empirical data, existing theories can be validated or invalidated. (Niskanen, 2005) That is the purpose in this study, to find out a good theory for user interface design and to validate it in a case site.

Research with deductive or inductive logic needs a theoretical framework to follow. Theoretical frameworks can generally be divided into two categories: Into qualitative and quantitative studies. (Yin, 1994)
4.2 Quantitative or qualitative study

Quantitative study is a way to “identify the characteristics of an observed phenomenon or exploring possible correlations among two or more phenomena” (Leedy & Ormrod, 2005). In other words the idea behind a quantitative study is that it describes phenomenon as it is. Large amount of collected data is descriptive attribute of quantitative studies. As an example, there can be a survey study, where a scientist collects opinions from a specific group of people via phone tabulating and analysing the answers (Leedy & Ormrod, 2005).

The purpose of the qualitative study is to describe events, understand actions or give a theoretically valid interpretation of the phenomenon under study. (Leedy & Ormrod, 2005) It is suitable for situations where a certain phenomenon in its natural environment needs deeper understanding, such as it is in this study. Leedy and Ormrod (2005) states four more detailed purposes for the qualitative study. The purposes are described in the following table:

<table>
<thead>
<tr>
<th>Description</th>
<th>Purpose is to reveal the nature of certain phenomenons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpretation</td>
<td>Purpose is to get insights about different phenomenons</td>
</tr>
<tr>
<td>Verification</td>
<td>Purpose is to validate different assumptions, claims or theories</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Purpose is to judge effectiveness of different policies, practices or innovations</td>
</tr>
</tbody>
</table>

Table 4.1 Purposes of the qualitative study (Leedy & Ormrod, 2005, p.134-135)

The qualitative approach is suitable for this study, because the emphasis is on verification and evaluation of different user interface design methods. As stated before, verification and evaluation are one of the purposes behind qualitative studies.

There are numerous research methods for qualitative studies. Case study is the method for this study. It is a qualitative method and it will be the topic in the following paragraph where I will give explanation for the use of this method.
4.3 Case study

The purpose of this study is to find and test user interface design methods by studying theories from related literature and producing a new user interface for the case site using one of the theories. In other words test a found theory on a single case site. The research question in this study is: How to model a user interface for web based programs in the field of information management systems, in a way that it takes the goals and the work processes of the users into sufficient consideration?

Research strategy should be selected based on the research question (Yin, 1994). This study concentrates on how to do something. Based on Robert K. Yin’s theory a case study is suitable approach for answering questions about how. (See the table 4.2)

<table>
<thead>
<tr>
<th>Strategy</th>
<th>form of research question</th>
<th>requires control over behavioral events?</th>
<th>Focuses on contemporary events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>how, why</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Survey</td>
<td>who, what, where, how many, how much</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Arrchival analysis</td>
<td>who, what, where, how many, how much</td>
<td>no</td>
<td>yes/no</td>
</tr>
<tr>
<td>History</td>
<td>how, why</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Case study</td>
<td>how, why</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>

Table 4.2 Relevant situations for different research strategies (Yin, 1994, p.6)

A case study tries to find an answer for how and why questions in a present day environment. How and why questions are explanatory in their nature and they lead to need for a deep understanding over some phenomenon. (Yin, 1994) Thus the idea with case study is to gain deep understanding of the phenomenon under study. A case can be an event, a process, a human being, an organization, a part of an organization, etc.

4.4 Data collection

As stated before, one of the purposes of the research method is to make a framework for solving the research problem: How to model a user interface for web based programs in the field of information management systems, in a way that it takes the goals and the work processes of the users into consideration.

The problem will be solved by searching different user interface design methods from related literature. When suitable user interface design methods are found, they will be evaluated with the help of Pugh’s decision matrix and one of them will be selected under more detailed study.
With the help of the selected method a prototype of the user interface for the case site will be designed. The prototype will work as hypotheses. Hypotheses will be tested in the case site by *end user walk through* and with *feedback from others* method. This will produce the actual empirical data. Walk through will be conducted with the main end user group that are the teacher’s of the University. A couple of IT professional will be selected for the feedback from others method.

### 4.4.1 Review of the related literature

The literature is very important information source in this deductive study. I will use literature in many instances: of course the theory chapter is made almost totally based on the related literature, but it has very big impact also in the empirical part of the study. I will use the related literature in the empirical part as a mean to get information about existing user interface design methods.

Almost every study is based, in some sense, on existing literature. The literature gives the researcher more deepened understanding of what others have thought about the phenomenon under study. Related literature can give you new ideas and perspectives, it can validate your findings, it can give you new literature sources you can use as a reference, it can reveal new tools for you to use in your study, etc. The list is never ending. In other words, together with empirical findings it is a base for your study. (Leedy & Ormrod, 2005)

### 4.4.2 Interviews

One distinctive attribute in qualitative studies is that the researcher has to be open in situations where the data is collected. This is due to the fact that the research process in qualitative studies has to be open in order to understand the situation in all its complexity. Interviews in qualitative study are due to this reason semistructured and flexible. Interviewing in a research means that the researcher asks questions from the people related to the study. According to Leedy and Ormrod the questions can concern facts, opinions, feelings, motives, etc. (Leedy & Ormrod, 2005) The questions can practically concern anything if it opens up the complex situation for the researcher, the answers are not always the main point. Thus Yin argues that a research is many times about questions and not necessarily about answers. (Yin, 1994)

#### 4.4.2.1 Feedback from others

Feedback from others is one method of interviewing (Soininen, 1995). It is a way to validate the findings the researcher has done by seeking opinions from colleagues in the field through interviews. The idea is to ask from the colleagues their opinion about the possible hypotheses and perhaps get new insights to the study. (Leedy & Ormrod, 100)

In this study the user interface will be validated with the help of this method. Together with walk through method this method will form triangulation of the data, thus giving a broader validation for the research result.
4.4.2.2 End user walk-through

End user walk through is a method where end users of a designed system evaluate the user interface thus giving the designer valuable data about different aspects from the user interface. This method does not require a working prototype of the user interface. (Riihiaho, 2004) Series of screenshots from the user interface, that are arranged in a way that the user can illustrate the steps and functions can work as a prototype for the walk-through session. This session holds in the end user and the user interface designer that go through the screenshots from the user interface. The user navigates in the user interface and explains what he is experiencing. The designer guides the session in a way that he can get feedback from the aspects he is evaluating. (Laakso, 2004)

4.4.3 Observations

Observation in a research means that the researcher observes the happenings of the real world situations. The observations in qualitative studies are unstructured and free flowing because of the same reason as it was with the interviews, the situation has to be open for the sake of the situation itself. The researcher can be in an observation situation outsider or participant. Outsider observatory tries not to influence to the situation. The purpose can be for instance to follow a workers daily routines that he does every day. Participatory researcher influences to the situation. The researcher can for instance be a part of a design team that develops new outlook for organization’s web site. (Leedy & Ormrod, 2005)

4.4.4 Heuristic usability evaluation

Heuristic evaluation (Nielsen, 2005, b) of a user interface measure the extent that how the user interface is in line with the usability heuristics. This is measured with the help of evaluators who judge the user interfaces. The idea behind the evaluation is that other persons than just the designer takes a look at the system in the light of the usability heuristics. When more than a one person takes a look at the user interface it is a good chance to find out usability problems from the interface what the designer has not noticed.

The evaluation is arranged in a way where the evaluators have time to look and inspect the user interface alone. When this is done they navigate through the user interface evaluating the user interface based on the Nielsen’s list of usability heuristics (Table 2.1). The evaluator talks aloud what he is experiencing when navigating through the user interface. At the same time there is a person observing the situation and collecting down the aspects the evaluator tells to him about the user interface and is it in line with the heuristics.

The evaluation can be executed in a phase where the user interface is only a paper version because the evaluators do not perform any real tasks. In this thesis the evaluators will have a user interface that is produced as a series of screenshots which are arranged in a way that it makes the navigation possible.
4.5 Reliability and Validity

It is important to emphasize the importance of valid research results. Careless way to collect data in a case site can make the whole study invalid by producing misleading information. Thus it is important to present two important concepts that guide the collection and analysing of data. These concepts are reliability and validity. (Yin, 1994)

4.5.1 Reliability

By reliability is meant the measurement instruments capability to produce results consistently. This means that for the instrument to be reliable, it has to produce data all the time at the same level of accuracy, that is, the data collection procedures should be able to repeat in such a way that it produces the same results. (Yin, 1994) As an example can be a interviewing of people: When the researcher asks questions from different people at different times, the environment where the interview is held has to be every time sufficiently similar. By this I mean that there shouldn’t be any disturbing factors in the environment where the interview is held. If there are disturbing factors in the environment, they have to be present in every interview in order to produce answers that are in line with each other. When the interview situations are identical with each others, and the questions are asked in the same way, the data collection tool is quite reliable.

The reliability in this study will be ensured by conducting the interviews consistently. The interviewing of people in a qualitative study is usually semistructured, as it is in this study, so the interview process can not be formal and structured. The way to enhance the reliability in this study is to make few main questions that are asked the same way and at the same order in every interview and that way keep the interview at least in some level structured. Another way to ensure the reliability is to make sure that the interviewing situation is free from disturbing factors. This is possible by keeping the interviews in a space where are only the interviewer and the respondent. Third aspect to enhance the reliability in this study is to carefully select the respondents of this study. This study concerns the information management system that serves the needs of the teachers in the University. That’s why only full time teachers were selected to the study. The selection of respondents was also planned in a way that there are equal amount of representatives from both sexes.
4.5.2 Validity

By validity is meant the measurement instruments capability to measure the phenomenon it was supposed to measure. Yin states that there are three ways to examine the validity of a case study. Those are:

- construct validity
- internal validity
- external validity

Construct validity is an aspect that examines that is the operational measures in line with the concepts that are under study. One way to make sure that the study has construct validity is to use multiple sources of evidence. This can be done for example using interviewing and observation as a data collection method for the same phenomenon and making sure that the results are in line with each other.

Internal validity examines causal relationships in explanatory studies. This is done for example using pattern matching method where the researcher compares empirical data with the ones in the existing theory. If these two are in line with each other, it enhances the internal validity of the study. (Yin, 2004, 106-107)

External validity examines are the finding of the research generalizable also to other instances than just the ones in the case site. Case studies are usually based on subjective analytical generalizations that are conducted from the empirical data, so the question arises; “is the result valid in other cases too?” If the research is conducted and reported in such a way that it can be repeated it improves external validity, because the study can be repeated in other cases too. (Trochim, 2005)

Observations and interviews together form a methodological triangulation in data collection phase. Methodological triangulation is an operation where the subject is being studied with more than one method. Triangulation contributes several advantages for qualitative study. One of the advantages in this study is the fact that triangulation gives more construct validity in a single case study. When the same subject is being studied with different methods, it gives more generalizability. (Virtual Mercuria, 2004) This is the case in this study. The data is collected using observations and interviewing in order to produce coherent data.

Pattern matching strategy in this study concentrates on finding similarities between the empirically noticed patterns and the predicted ones. Through this the Internal validity of this research should strengthen.

In order to ensure external validity in this study, I will explain all the stages of this study in a way that this research can be repeated in another case site by anybody. By repeating the study in different case sites is ultimately the only sure way to ensure the external validity of some research. (Trochim, 2005)
4.6 Data analysis

4.6.1 Secondary data analysis

It is important to have a general strategy for data analysis in mind in the beginning of a case study, because the researcher should have an idea what to do for the collected material when the time is for data analysis.

That’s why Yin states that there are two general strategies for data analysis. The first strategy, relying on theoretical propositions, is the most common. It means that the researcher should follow the original theories that led to the case study in the first place. The theories are the ones that reflected to the researcher in a way that new insights and questions raised up and motivation for the research got its ignition. This study’s ignition came from theories and observations which revealed that a good user interface is not self-evident truth. On the contrary, it seems that the designing of user interface is only a side point of system development. Such theories can give insights in the data collection phase for revealing what is important for the study and what is not. (Yin, 1994)

The second general strategy is developing a case description. It is the alternative to use when the subject is very new and innovative and there are no suitable existing theories to use as a theoretical proposition. Developing of a case description means that a researcher builds a descriptive framework in order to organize the content of the study. This study uses, as you probably noticed in the previous paragraph, theoretical propositions.

4.6.2 Primary data analysis

The primary data analysis is conducted using Creswell’s data analysing model. The model consists of five parts through which the data is filtered and analyzed. This method is often used with qualitative case studies such as this one so with little modifications it suites well to this study also.

The model consists of five steps. The first is organization of the information about the case site. In this phase the idea is to categorize the specific information of the case site into logical order.

The second step is for categorization of the collected data itself. In this study this means the categorization of the different data collected about the user interface. Practically most of the data concerns the validation of the user interface. The data is categorized by what the data is validating. For example one category can be a validation of the usability of the user interface. Such a data is collected from a various sources so it is important to categorize it in order to make the data more readable and through that make the deep analysis easier. The model presents the third step as a interpretation of single instances. (Leedy & Ormrod, 2005)
METHODOLOGY

The fourth step is identification of patterns. The purpose is to reveal something that single instances can’t show and find information “between the lines” so to say. The patterns can characterize the case more broadly and give a deeper meaning in that way. This is especially important in studies where there are multiple cases. When finding same patterns from different cases the mentioned deeper understanding can be achieved. This study operates with a one case site so the identification of patterns and thus deeper understanding can in some way be possible through triangulation of the data. Of course the meaning is not the same, but this step, as mentioned before, can be adjusted to fit to this study also. The fifth step is for synthesis and generalizations. The idea behind this step is to form an overall picture of the case and the data. Through this generalization conclusions are drawn that might be valid in other cases too. (Leedy & Ormrod, 2005)

The data analysis in qualitative studies is quite hard to fit into any specific framework, because the data tends to be quite unique. When dealing with unique data the following of step by step data analysis theories can be said to be even pointless because the researcher should in the beginning of the study to think how the data will be categorized and handled in the analysis phase. Trying to fit the data analysis phase into some specific mould, in mine opinion, can even harm the sampling of the data if the researcher has done some kind of general strategy for handling the data in the beginning of the study. Still there is good to be some general theory in the analysis as a guideline in order to gain validity with the organization of the data. This is the case in this study also. The Creswell’s data analysis theory will only work as a guideline when executing the analysis due to the previous reason.

4.7 Selection and description of the site and participants

The user interface design theory will be tested with the help of one case site. The case site is a university of applied sciences in northern Finland. Kemi-Tornio University of applied sciences is a school in Lapland. It has education units in different towns, but this study has taken its focus into the Tornio’s business and ICT unit. The focus is on Tornio’s unit, because it is a representative sample of the whole University of applied sciences and it is large enough to produce all the data needed with its 33 teachers.

Kemi-Tornio University of Applied Sciences has a new information management system for the staff. Teachers of the University are the largest end user group. They have had problems in adapting to the new system because they feel that the user interface is not efficient to use and it is hard to learn. The University of Applied Sciences wants such a user interface model for the system that is efficient and easy to use. They also want to get more information about different user interface design methods that can be used in this kind of situations, because they teach system designing and this study would give valuable information for their teachings.

This setting gave a perfect ground for this study. The case site is a public organization thus the interviews are easier, because there are no business secrets to protect. Perfect ground also, because the University of applied sciences can use the data the study is producing in many ways; the designed user interface would give them information about what kind of user interface would be suitable for them and the University of applied sciences would get information to support their teachings. This setting makes it easier to get cooperation from the case site, because the site benefits from the study.
5 EMPIRICAL DATA

5.1 Testing of the method

This phase describes how the user interface design method, selected in the previous phase, was tested in the case site. As explained in the methodology chapter, the Kemi-Tornio University of Applied Sciences was perfect ground for this study because of its interest to the study and its promising system that needed a new viewpoint for the user interface. The access to the field started using tools in the design method. The idea was to follow the GUIDe method step by step to produce the user interface and then test and analyse it from different aspects. Because the meaning is to produce a user interface in order to test it and thus the GUIDe theory itself, the field work started by collecting the data for the user interface.

5.1.1 Designing of the user interface

The user interface was designed by using GUIDe design method. The GUIDe method has three main phases for producing a user interface that is a requirement for the rest of the system. The study concentrates on these three steps thus producing a prototype of the user interface. These three steps are: development of goal based use-cases, designing of the user interface and the testing of the user interface. The first step is explained in the following chapter where the most important data for the user interface was collected.

5.1.1.1 The development of the goal based use cases

The goal based use cases are the starting point of the GUIDe method. Goal based use cases mean that use cases are designed based on the goals the user has in his working environment. A goal can be for instance an aim to give information for students or reservation of meeting room. The user interface is designed based on these use cases.

Goal based use cases are developed with the help of contextual interviewing and user observation. Because this design method tries to take the work processes and the goals of the users into consideration the interviews are contextual. It means that the interviews are held on the natural places of the work processes. The idea behind this is that the working environment can stimulate the user to show and explain the work processes he has thus giving a valid picture of the work processes for the designer.

User observation gives the designer a possibility to see the work processes of the users in their natural environment. The end user can forget something in the interviews so the designer has the possibility to fulfil the information he gets from the interviews. Looking at the work processes in their natural environment gives a more coherent picture of the situation and what requirements the user interface might have.
I started the development of the user interface with interviewing and observing the teachers that are the end users in this case site. I interviewed teachers from different disciplines and departments in order to broaden data from work processes and avoid the situation where they might lack work processes from some other departments. The goal is after all to make a user interface that could serve as many teachers as possible. The interviews were held in the teacher’s workroom that is the natural working place for the teachers. That is, natural working place excluding the classroom. Classrooms in this case are not natural working places because the teachers have their own workrooms where they do their working tasks excluding the physical teaching. Physical teaching is activity that can not be included in the user interface in question.

The teachers told about their daily activities what belong to their work processes. In other words, what tasks they have to do in order to reach their occupational goals. The results didn’t vary a lot even if I interviewed teachers from many different disciplines and from different departments. The teachers seem to have quite similar tasks even if they teach and study different disciplines.

Observations were also held in the same space as the interviews, that is the workroom. I followed teachers with their daily routines, but it didn’t reveal anything dramatically new compared to the interviews. On the other hand the observations validated some of the data what was collected with the interviews. It was easier to understand more throughout the work processes the teacher had when I could observe it happen with mine own eyes thus it was easier to make the goal based use cases. In the table 5.1 is presented the work processes that could be conducted from the interviews and observations.
<table>
<thead>
<tr>
<th>Use case</th>
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<tbody>
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<tr>
<td>Finding of articles</td>
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<tr>
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<tr>
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<tr>
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<tr>
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<td>Interviewing</td>
</tr>
<tr>
<td>Reading of phonebook</td>
<td>Interviewing/Observation</td>
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Table 5.1 Results from the interviews and observations

As it was mentioned before, goal based use cases are conducted from the interviews and observations executed with the teachers. The idea behind these goal based use cases is to bring the real work processes and the goals behind them into awareness. When the work processes and the goals of the users are in awareness the purpose is to analyze which of these processes and how they are sensible to implement to the user interface and in that way, to the whole system. This is a part where the designer should think about changing of the work processes in a way to make them more linear when achieving the goals behind them. For instance there might be goals in the teachers work processes that could be achieved more efficiently than they currently are. This is a way how GUIDe affects to the whole working environment, not just in the form of utility software, but also by changing the way the work is being done.

Linearity in this thesis means, in some sense, systems integration and efficiency of work processes. In general, the concept system integration is wide. If we break the concept in two and analyze the concept of system and integration separately it might be the best way to demonstrate this phenomenon. Commonly accepted definition for the concept of system is defined to be a “set of objects together with relationships between the objects and their attributes related to each other and to their environment as to form a whole” (Schoderbek, Schoderbek & Kefalas, 1990). When talking about integrated systems there are several systems that are tightly connected together in order to achieve a common goal. However the systems can operate also separately from each other (National Academy of Engineering Staff, 1988). Even if this definition is old in some sense, it is still valid in this case. System integration here means
that different functions (systems) are grouped together to form one segment to serve a bigger role together. Still every function still can operate also alone to fulfil some different goal.

When talking about linearity in this thesis, these two phenomenons; efficiency and integration of systems exists. The Goal based use cases together form a teachers system, a system to reach occupational goals. The system is made more efficient by integrating the goal based use cases together in a way that the resources used to reach the output, would be smaller than before. Thus making the work processes more linear.

This thesis concentrates to analyse user interface design method in a way, that does it take the work processes and the goals of the users into sufficient consideration. Due to this, the changing of the way the goals are achieved is not emphasized in this study. They are interconnected to the method and will be mentioned, but not analyzed in more detail.

Goal based use case in GUIDe is in written form. The use cases describe the goals the teachers have in their working environment in a relatively high level of abstraction. This means that the goals are described in such a high level of abstraction that it is a little bit higher level than the system that is being designed. This helps the designer to keep his mind of the technical boundaries when making goal based use cases.

In this study the development of the use cases were made at the same manner as the theory advises, that is keeping the mind away from the systematic boundaries and focusing only to conduct the use cases from the observation and interview data. The use cases were developed also thinking of the opinions the users had about what they wanted to leave as they were in the work processes. In the picture 5.1 is presented one example of the use cases in this study. The example presents the goal based use case where the teacher has as goal to change the classroom reservation. The rest of the goal based use cases, developed in this study are presented in the appendixes 1-9.
Use Case: Change the classroom reservation

The goal of the teacher:
The teacher wants to reserve a bigger classroom for his lessons, because there will be more students than he has estimated. There is already a booked, small classroom for the lessons so the goal is to cancel the reservation of the small classroom and reserve a bigger one.

Time:
The lesson will be in 3 days from now

The classroom:
The current classroom’s capacity is for 15 students. The need is for a classroom for 25 students

Availability of such a classroom:
There are no available classrooms for the scheduled time. There is available big classroom on different time. Teacher’s goal is to make the reservation even it is in different time.

Picture 5.1 Goal Based Use Case

5.1.1.2 The development of the user interface

In this study the most crucial difference to the work processes came with the new user interface that integrated many of the work processes into one place. When I had conducted the goal based use cases from the interviews they were analyzed in a way that the work processes which were done efficiently with the current manner, were not interfered with the new user interface. The way the processes were done was left as they were.

In this case such a work process was communication via email. This was aspect that all the people that were interviewed said it to be good as it is and didn’t want to change to way this work process was executed. Many of the other work processes were closely related to the email so they were also left outside the user interface. One such process was the process where the goal was to get the teaching plan to the programme administrator. The teachers wanted to continue the usage of email for this purpose.

After the analysis of the use cases were done, 5 goal based use cases were cut out from the design of the user interface. As stated before one of them was the communication via email and another was the sending of teaching plan to the programme administrator. The grading of students use case was cut off because the current grading system is relatively wide and the access rights are focused mainly for the chancery officers. Implementing wide system to the user interface might make it too complex taking the fact into account that teachers need it approximately 4 times in a year. Another aspect that influenced to the fact that this use case was left as it is were the teacher’s opinions. Most of them wanted to leave the old system as it was because it is efficient to use. However most of the teachers wanted to have direct access to the
grading system so it was fairly motivated to insert a direct access link to the grading system from the user interface. Goal based use cases, that was decided to leave out from the user interface are presented in the table 5.2.

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Table 5.2 Use cases not to be implemented to the user interface

Contacting to IT support was also a use case to be left out from the user interface. Every person who was interviewed said that the communicating with IT support works best via email and phone. Also the fact that the need to contact to the IT support is quite uncommon motivated to leave this use case out of the user interface.

Receiving of learning tasks use case is interconnected to the use of email, because the students send their learning tasks to the teachers via email. Designing a new system to receive learning tasks was not motivated, because regarding to teachers, the current system is quite straightforward and usable.

The goal based use cases that are implemented to the user interface are presented in the table 5.3. The reservation of classroom use case was the first to be implemented to the user interface. It is very common work process for the teacher to reserve a classroom. Many times there are situations where there are wrong classroom reserved for the lecture or there have come a need for a different kind of classroom. It is also common for the teachers to reserve meeting rooms. These two goals; to reserve classrooms and meeting rooms, were decided to combine under the same function in the user interface in order to group similar functions together and make the achieving of the goal more linear.
### Use case

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Table 5.3 *Use cases to be implemented to the user interface*

Checking the schedule is probably one of the most common goals for the teacher. The schedule reveals the agreed meetings and what lectures there are to keep. However, in this case the checking of lectures and the other meetings has to be checked from different places. The lectures have to be checked from the internal web sites and other meetings wherever the teacher had saved them. This was a place for system integration.

These two different goals was united into the same place by designing a calendar component to the user interface where are all of the meetings for the teacher, including the lectures. The *change to the time of the lesson* use case is connected to the calendar component in that way it is connected to the *checking of the schedule* use case. It is connected to the calendar component in a way that the user has an opportunity for direct access in to the mark in the calendar and that way change the time of the lesson. (See the picture 5.2). The fourth goal that can be integrated to this same component is the change of the *classroom reservation* use case. The change to the classroom is integrated to the calendar at the same manner as is the *change to the time of the lesson* use case; the access is executed through the direct access in to the markings in the calendar (See the picture 5.2). The *inform students* use case is also partially integrated to this same component. The teacher has an option to select a function in the component where the time and the place of the lesson can be changed that sends automatically a notification to the students that the time or the place has been changed. The mind model behind this GUIDe method promotes this kind of system integration in order to make the work processes toward goals more linear. The combination of these mentioned five goals makes it more linear to achieve the goals behind the work processes so it can be assumed that this thesis has followed the principles of GUIDe in this part of the work.
Inform of students use case was implemented to the user interface first of all because all of the interviewed teachers felt that would be useful to have such a function in the user interface and secondly because of the reaching of students already have a built system but it is quite difficult to use. The user interface holds in a link that opens a form where the teacher has an opportunity to input messages to the students (see the picture 5.3).
Finding, reading and saving of articles are tasks that every teacher has to do quite often so it was necessary to implement these goals to the user interface. By articles in here is meant articles that concern study material, scientific publications and any material that includes information that is essential for the teacher’s profession. I have integrated these three to the same place because difficulties have been experienced in the previous system where the articles are in different places. The sharing of the articles is the fourth aspect that has been integrated to the same segment. Sharing of articles is common process to many teachers because often teachers have to give material to the students in electronic form and often they want to share them with other teachers. Because these four goals belong to the same category, it is motivated to implement them to the same place and that’s why the user can found the four actions that help the teacher to achieve any of these four goals (see the Appendixes 4 and 5).

The using of electronic forms use case and reading of organizational directives use case are also implemented to the user interface and integrated together. The teachers have to use electronic forms for instance when applying mileage allowance from using own car in work related trips. Organizational directives have to be found in order to check organizational protocols over different manners. These two goals include the usage of electronic material that is located in the organizations intranet and sometimes teachers need directives and guides how to use the electronic forms and so on. The point is that these two goals, the usage of electronic forms and the reading of directives are many times interconnected together. With this as motivation I integrated the usage of electronic forms, the reading of directives and the instructions forms in the same segment in the user interface (see the appendixes 5 and 8). Phonebook use case is essential part of the use case (see the appendix 9). Many of the interviewed teachers wanted the
phonebook to be a part of the user interface and when observing the phonebook was many times in the teacher’s hands.

5.1.2 The testing of the user interface

Now when the user interface is designed, it is time to evaluate the user interface design theory. In this thesis the designed user interface will work as hypothesis and is evaluated with the end users and with the IT experts. The hypothesis is: The user interface is presumably in line with the end users work processes and goals. This hypothesis is formed because it supports the primary research question and steers the focus of this study to concern the work processes and the goals of the users.

The hypothesis was tested with the end users using “walk-through”- and feedback from others methods. The feedback from others method gives data also for the second viewpoint; is the design method in line with the UML modelling language. This part of the study is also important in keeping the other side of the system development process alive in this study; the design of the inner and outer parts of the system and their relation to each others.

There is also one other viewpoint in this study, which is here to deepen our picture of the user interface design method; usability. The third data collection method, heuristic usability evaluation, gives the primary data for this aspect in the study.

5.1.2.1 End user walk through

I started the testing of the hypotheses with the end users by making screenshot pictures of the user interface to a computer where the users tested the user interface by clicking the pictures in a way that the navigation in the user interface was almost authentic compared to the real system. The biggest difference was of course the fact that the functions didn’t work in the user interface. The walk through was arranged in a way that the teacher was in his usual working room imagining to use the real system. The walk through was guided in a way that the focus was on the work processes and goals behind them. This session didn’t focus on aesthetical aspects, but they were dealt with at the beginning of the walk through.

The end users that participated in the walk through sessions were from different departments from the University of applied sciences in order to get as broad feedback as possible. The feedback from the interviews was mainly in line with the hypothesis. Five sessions were held where the users had all the time necessary to test the user interface.

The first session started by looking at the overall picture of the user interface. The purpose was that the user has an opportunity to look at the user interface in general. We discussed with the users about the aesthetical aspects of the user interface and I emphasized for the user that he or she should focus on the functions and navigation itself. The user had the task to imagine him in a situation where he is using the system in a real life context. After the user had taken a first glance of the system we discussed about the work related goals which were collected in the interviews. The user navigated through the work related goals. The navigation started by telling the user that the first task is to achieve some work related goal, for instance to reserve a meeting room. When the task was told the user navigated through the functions that reserve the meeting room. Every goal, collected in the interviews and observations, were navigated and in that way
achieved with in every session. Through this session the users got quite comprehensive picture of the whole user interface.

During the navigation and the process where the users tried to achieve work related goals, they spoke out loud what they were experiencing. They told what was unclear for them and did they felt that the current process where the goal was reached was in line with their real world work processes.

Outcome in all of the sessions were that the users felt that the user interface is in line with their work processes. One interesting aspect arose from the sessions when the users navigated in the user interface. The aspect was that all of the concepts in the user interface were very familiar to them. They felt it easy to find the different functions and information because they were found under familiar concepts. Previous experiences for example from the current system were that the system holds in unfamiliar concepts to them what makes it hard to understand different meanings of different functions. Especially navigating is difficult in situations where unexpected functions are found under links that the user supposed to contain something totally different. Aspects like this makes the learn ability of the system quite hard.

It was also found out that the users felt that the user interface makes the reaching of some of the goals faster than they used to be. Especially the reservation of classrooms and meeting rooms, making a change to the time of a lesson, finding directives and instructions and the managing of articles was felt to be faster and linear now.

Users also felt that the system is easy to use. Especially managing the articles, directives and instructions and informing students is much easier than it is with the current system. Users mentioned that the reason is in clearer categorization, familiar concepts and in minimalist design that brings the users focus only on aspects and functions that are often used and necessary.

### 5.1.2.2 Feedback from others

The feedback from others method was used to validate following aspects of the user interface: Is the method in line with the work processes and the goals of the users, is the method in line with the UML modelling language and is the whole system technically possible to construct. This method will be conducted as a semi structured interview where the professionals evaluate the user interface concentrating on the questions that were given to them. The questions of the interviews are presented in the appendix 10.

The first aspect, Is the method in line with the work processes and the goals of the users, was evaluated in the interview in such a way that the professional had time to get familiar with all of the Goal based use cases that were conducted from the case site. At the same time they were explained what is the meaning behind the Goal based use cases and how do they work. Also general aspects of the case site were explained to the professionals. This phase was quite easy for the professional due to their expertise with the UML modelling language. They noticed a clear connection between the normal use cases and the Goal based use cases.

After the Goal based use cases were presented the professionals had time to navigate in the user interface with the help of the screenshot pictures. After a while they were asked goal by goal if the user interface give the user an opportunity to reach the work related goals presented in the use cases. For example the professional was asked to analyze how to reserve a classroom with
the help of the user interface. The professional explained the steps that have to be done in order to reserve a classroom and at the same time the professional gave his opinion that is the user interface in line with the current goal of the user. Every goal that was implemented to the user interface was gone through with the professional.

Second aspect, is the method in line with the UML modelling language, was evaluated with the professionals through analysing the Goal based use cases and the user interface. They looked the user interface as a framework in order to fully grasp the goal based use cases. The professionals evaluated the Goal based use cases one by one and analysed that is it possible to conduct usual use cases from them and continue creating another types of UML diagrams from them. In other words they evaluated the similarity of the Goal based use cases to the normal UML use cases.

Third aspect, the whole system technically possible to construct, was evaluated simply by analysing the Goal based use cases and the whole user interface. The professionals analysed the user interface function by function and gave the opinion that is the system possible to construct based on the user interface.

The feedback from others method in this study means that two IT professionals will be interviewed. The professionals were selected based on their experience with UML modelling language and with user interface design. The first person is highly experienced IT manager from International Corporation in the field of information technology. The person is experienced user of the UML modelling language and he has to deal with the user interface design aspects constantly in his work. This person in this study is called from now on as a professional A.

The second person is experienced IT professional that has background in the field of computer sciences as an educator and a researcher. He teaches UML and user interface designing in Finnish University. He will be called as a professional B.

When evaluating the first aspect, is the user interface in line with the goals and the work processes of the users, professional A said that he can imagine that if the goal based use cases describe the work processes of the end users, the user interface is very much in line with mentioned issues. The work processes that are implemented to the user interface was easy to understand for the professional A, because after analysing the goal based use cases, he felt that he could understand the work processes and the goals of the teachers in a way that he can argue the user interface to be valid for the case sites work processes. For the professional B the role as an educator is familiar so it was easy for him to understand the work processes of the teachers from the goal based use cases. After analysis the professional B said that the user interface is without doubt in line with the work processes and the goals of the users.

When it was time to evaluate the second aspect, is the goal based use cases and in that way the whole design method in line with the UML modelling language the professional A said that it would be easy for him to start making UML use cases based on the user interface and the goal based use cases. He said also that after the making of UML use cases he could start making another kind of UML diagrams from the system. User interface in GUIDE is important requirement for the rest of the system so it seems that it is usable in its role. When it was time for professional B to evaluate this aspect he agreed that he could conduct UML use cases from the goal based use cases and from the user interface, but he felt that the goals based use cases are little bit incomplete when thinking about dependencies in use cases. There are often aspects
in UML use cases that require the modelling of dependencies and they were not comprehensibly presented in the goal based use cases. The GUIDe method was familiar to the professional B and he said that GUIDe is perfectly in line with UML modelling language in general, but the dependency aspect in GUIDe method needs a little bit customisation from the designer.

The third aspect, is the user interface technically possible to construct, was clear for every professional. They thought that the whole system is simple and efficient and thus the system is easy to construct.

5.1.2.3 Evaluating the usability of the user interface

Usability in user interfaces, in short, means how easy, efficient and satisfying it is for the user to use the interface. This thesis is focused on the work processes and the goals of the users in user interface designing. Without doubt, these aspects of the users work processes belong to the issues in usability. We can see the work processes and the goals of the users in user interface design as a one branch of usability.

Designing the user interface in a way that it takes the goals and the work processes of the users into account contributes presumably an user interface that is easy, efficient and enjoyable to its users. Because usability is very important part of the user interface design, the usability of the user interface, produced with the help of the GUIDe method will be tested using Jakob Nielsen’s (2005, b) theory of heuristic evaluation.

The usability of the user interface is many times dependable from the designer’s personal features. This part of the study evaluates the usability of the produced user interface, but does not focus, for example, to the aspects of aesthetics or aspects that are results from the designer’s personal capabilities. The focus is on usability aspects that are interconnected to the properties of the user interface design methods. For example some positive aspect that increases usability of the system might be direct result from the user interface design method’s features. Such a positive aspect in this study is for example the fact that the learnability of this user interface is enhanced due to the familiar concepts in the user interface.

The evaluation was arranged by the principles of the Nielsen’s evaluation method. The idea behind the Nielsen’s method is that a group of people inspect a user interface using a list of ten usability heuristics. The user interface was inspected in two different phases. In the first phase the evaluators had time to get familiar with the user interface and the second one is for a deeper analysis where the list of heuristics is used. The session was open in a way that the evaluators had a possibility to ask questions whenever they wanted. The data from the sessions was collected in two ways: The observer of the session collected the data the evaluators had to say about the user interface. Also the evaluators had a paper with the ten heuristics where they wrote a part by part their opinions.

The evaluation of the user interface in question was executed in three different sessions. The three sessions are now presented using the list of ten heuristics. Every session was started by explaining the principles of the user interface to the evaluators. The evaluators had time to ask questions about the interface and from the place the user interface is designer for. After this the
evaluators had time to get familiar to the interface. After the first glance the evaluators had time to discuss about the user interface in general and ask more questions if needed. Then the evaluators started inspecting the user interface heuristic by heuristic.

Table 5.4 presents the results from the Heuristic evaluation. The table reveals many aspects that are not connected to the properties of user interface design method and are results from the designer. The aspects only that are connected to the properties of the user interface design method will be notified in the data analysis phase.

<table>
<thead>
<tr>
<th></th>
<th>Visibility of system status</th>
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</thead>
</table>
| 1 | 1. In the classroom reservation form it would be good if the functions the user has to do are made active just when it is time to use them  
   | 2. Affirmations about successful actions should be notified more clearly for the user |

<table>
<thead>
<tr>
<th></th>
<th>Match between system and the real world</th>
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<tbody>
<tr>
<td>2</td>
<td>1. Some of the components and concepts like the calendar component are already familiar to the teachers. This enhances the match to the real world</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>User control and freedom</th>
</tr>
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<tbody>
<tr>
<td>3</td>
<td>1. “Close” buttons should be labeled as “Cancel”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Consistency and standards</th>
</tr>
</thead>
</table>
| 4 | 1. “Close” buttons should be labeled as “Cancel”  
   | 2. The time field in the calendar cell editing form should be static, because the user might think that the time can be editable directly from the textbox |

<table>
<thead>
<tr>
<th></th>
<th>Error prevention</th>
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<tbody>
<tr>
<td>5</td>
<td></td>
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<table>
<thead>
<tr>
<th></th>
<th>Recognition rather than recall</th>
</tr>
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</table>
| 6 | 1. “Close” buttons should be labeled as “Cancel”  
   | 2. There should be instructions visible for the user about how to select different cells in the classroom reservation form  
<p>| 3. There should be a notification in the main calendar window that how to use the calendar |</p>
<table>
<thead>
<tr>
<th></th>
<th>Flexibility and efficiency of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>1. This part is fulfilled fine. Different tools that the teachers use in their working environment are integrated into one user interface. This enhances the efficiency of the overall system</td>
</tr>
<tr>
<td></td>
<td>2. Different functions in the user interface are presented clearly in the navigation bar so the efficiency improves</td>
</tr>
<tr>
<td></td>
<td>3. Some of the components and concepts in the user interface are familiar to the user so it enhances the flexibility</td>
</tr>
<tr>
<td></td>
<td>4. The user should have a possibility to choose the start page in the system</td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Aesthetic and minimalist design</td>
</tr>
<tr>
<td></td>
<td>1. The user interface is easy to use and efficient because of the minimalist design</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Help users recognize, diagnose, and recover from errors</td>
</tr>
<tr>
<td></td>
<td>1. User interface is “linear” so it minimizes the risk to make mistakes</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Help and documentation</td>
</tr>
<tr>
<td></td>
<td>1. There should be instructions visible for the user about how to select different cells in the classroom reservation form</td>
</tr>
<tr>
<td></td>
<td>2. There should be instructions visible for the user about how to modify the cells in the calendar component</td>
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</tbody>
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Table 5.4 Empirical data from the heuristic evaluation
6 DATA ANALYSIS

This research analyses different user interface design methods focusing in the aspects of goals and the work processes of the end users. The first step was to conduct a literature review and find suitable user interface design methods under study. Three methods were found, analysed and compared in decision matrix. Work processes and the goals of the end users were the most important factor within the comparison. The GUIDe user interface design method was selected.

The design method was tested in a one case site which was Kemi-Tornio University of applied sciences. The method was tested in a way that a user interface was designed for the teacher’s information management system using the selected design method. The user interface was then evaluated using three different evaluation methods; end user walk through, feedback from others and heuristic usability evaluation.

Data analysis in this study starts by analysing first the primary issue using the empirical data collected. Then we use the empirical data as a framework to analyze the GUIDe user interface design method from other aspects such as its relation to the UML, its relation to the usability issues and finally its relation to the acceptance of a new technology. The inspiration for the structure of this analysis came from the Creswell’s data analysis spiral presented in the methodology chapter. The use of the spiral model as it is wasn’t sensible with the data in hand and basically the biggest overlap between the model and this analysis was the categorization of the data, because the categorization here is done as it is recommended in the model that is; grouping the data into meaningful groups.

6.1 Validation of the primary issue: Work processes and the goals of the users

The primary issue; is the user interface in line with the work processes and the goals of the users, was validated through two different methods; end user walk through and feedback from others. The first method produced the data in a way where the end users evaluated the user interface. The second method involved information technology professionals who inspected the user interface based on the goal based use cases and based on the information about the end users.

Five walk through sessions were held where the end users evaluated the user interface. Session after session the result was that the users felt that the user interface is really in line with their work processes. The interviews were unstructured deep interviews so the users had an opportunity to freely comment whatever they are feeling about the user interface. Following aspects was brought up in the walk through: Concepts in the user interface are familiar for the users making it easier to adapt to the user interface and making the use of the interface more efficient. The GUIDe method enhances the use of familiar concepts in the user interface because most the data for the interface comes from the users thus enforcing to use familiar concepts. Due to the fact that most of the work processes were integrated under the same interface the users felt that the goals behind the work processes were faster and easier to reach. Because the GUIDe method emphasizes the analyzing of the work processes of the users as a starting point to design a user interface it is crucial to think how to make the achievement of the goals behind
the work processes as linear as possible. This aspect enforces the user of the design method to integrate different systems together in order to achieve the linearity.

Together with end user walkthrough the feedback from others worked as a validation mean for the work process aspect. Two IT professionals were interviewed to get feedback from different issues. One of the aspects the professionals had to evaluate was the work process aspect. The respondents evaluated the aspect through goal based use cases. The interviewed professionals were familiar with the UML modelling language so the understanding of the goal based use cases, which originate from the UML, were easy for them. The result from the both interviews was that the user interface is in line with the presented work processes. Other aspects that revealed from the interviews were: The user interface has successfully integrated together essential work processes making the reaching of occupational goals more efficient. As stated in the previous paragraph this property of the user interface is direct result from the use of the GUIDe method. The user interface is clear because there are only essential information and functions in the interface. The fact that the beginning of the design of the user interface starts by analysing of the work processes produces such an user interface where is no functions and information that does not relate to the achievement of the goals behind the work processes. This automatically produces an minimalist and clear user interface.

These two methods together form a methodological triangulation where the purpose is to validate the research result. The research result is validated if the same result is achieved using two different data sources. Both of the methods in this study, which evaluate the work process aspect, support each other thus validating the result to be true. The GUIDe user interface design method, if used correctly, produces user interfaces that are in line with the work processes and the goals of the users.

In the empirical part of this study a hypothesis was presented; The user interface is presumably in line with the end users work processes and goals. The hypothesis is correct based on the result of this study.

6.2 Validation of the secondary issue: UML and user interface designing

The selection of the modelling languages was conducted through two important requirements: The work process- and the UML aspect. Only such design methods were chosen which are in line with the UML modelling language. This aspect was important to include to this study because it is crucial to keep the design of the inner parts of the system in the picture when designing user interfaces (Scogins & Phillips, 2005).

As was stated in the phase where the different design methods were compared, the GUIDe method is theoretically in line with the UML modelling language. The GUIDe method takes the UML modelling language into account in its very fundamental part; the goal based use cases. Theoretically the goal based use cases are very close to the usual UML use cases so the modelling of the inner parts of the system could be done based on these goal based use cases. This aspect was empirically tested using feedback from others method.

The feedback from others evaluation method held in the interviews of two IT professionals. The purpose of this evaluation was to validate that is the GUIDe in line with the UML modelling
language. If it is in line, then it could be assumed that the GUIDe method takes the design of the inner parts of the system into account.

As presented in the empirical part of this study, the UML aspect was evaluated with the IT professionals using the goal based use cases and the user interface as a framework. The professionals had time to inspect the user interface and get acquainted with the goal based use cases. After the time they needed the professionals gave their opinion that could it be possible to use the user interface and the goals based use cases as a requirement for the inner parts of the system.

The first professional’s opinion was that it could be easy for him to conduct more detailed design of the inner parts of the system based on the goal based use cases and the user interface. He felt that they are a good starting point and requirement for the designed system. More detailed and other kinds of UML modelling charts could be conducted from the given requirements. The opinion of the first interviewed professional was that the GUIDe method is in line with the UML modelling language.

The second interviewed professional said also that it would be possible for him to design the rest of the system based on these goal based use cases and the user interface. However he said that the goal based use cases missed the explaining of the dependencies. Dependencies in UML describe usually what shared actions there are between different use cases (Eriksson & Penker, 2002). The professional stated that this can be seen as a lack in the design method, but does not prevent the use of the goal based use cases as the base of the system’s inner part design.

Based on the feedback from others method it can be assumed that the theory about the GUIDe method’s linearity to the UML modeling language is true. Even if there are some aspects in the GUIDe method that does not take all of the aspects of the UML modeling language into account, still it can be argued to be in line with the UML in a sufficient level to design the whole system based on the GUIDe’s produced requirements.

6.3 Validation of the third issue: Usability issue’s relation to the GUIDe method

The purpose of this study was not to dig into usability issues, but nowadays bypassing usability in user interface related study would lessen the generalizability of the work. Where ever you find user interface related articles or information, the usability issues appear in some way. Anyway usability is today’s phenomenon when speaking about user interface design. As mentioned, this study does not concentrate on usability issues, but they are still evaluated from the designed user interface. How usability issues can then be related to the GUIDe method and therefore in this study: The key was in heuristic usability evaluation.

The data collected with the heuristic evaluation will be analysed in a way that the data which has resulted from the methods properties is conducted into a table. Context will be the table 6.1 in the page 54.

There are always aspects in the user interface design that are connected partly to the designers properties and partly to the method’s properties, usually they overlap. This aspect makes this evaluation quite tricky, but the evaluation and comparison is still important task to be done,
because just even the discussion about the usability aspects of the design method is important. Therefore the purpose of this usability chapter is just to discuss about the usability aspects in the GUIDe user interface design method in a general level.

One example of usability issue that overlap between designers and methods properties is the help and documentation issue (10 in the table 5.4). Many of the help and documentation related data could be improved with the help of the GUIDe design method, because the method has iterative nature and the issues could came up in later on with the form of end user’s feedback. Still these aspects are categorized to the designer’s properties section, because this analysis will concentrate only on such revealed aspects that are resulted directly from the method’s properties. In other words I will handle only aspects that do not overlap with the designers properties and are results of the method’s inner properties.

<table>
<thead>
<tr>
<th>2.1</th>
<th>Match between the system and the real world</th>
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<tbody>
<tr>
<td>7.1</td>
<td>Flexibility and efficiency of use</td>
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<tr>
<td>7.2</td>
<td>Flexibility and efficiency of use</td>
</tr>
<tr>
<td>7.3</td>
<td>Flexibility and efficiency of use</td>
</tr>
<tr>
<td>8.1</td>
<td>Aesthetic and minimalist design</td>
</tr>
<tr>
<td>9.1</td>
<td>Help users recognize, diagnose and recover from errors</td>
</tr>
</tbody>
</table>

Table 6.1 Heuristic evaluation aspects related to the design method

First aspect that was clearly related to the design method’s properties was the part 2.1 in the table 6.1. The feedback from the evaluation was: Some of the components and concepts like the calendar component are already familiar to the teachers. This enhances the match to the real word. This aspect is related to the user interface design method, because it is direct result from the use of the GUIDe method. For example the concepts are familiar for the users because the user interface is constructed based on what the teachers have said and done in the interviews and observations where the data for the user interface was collected. Therefore the user interface is built on the real work processes of the users and no extra functions and concepts that might be confusing are added to the interface. This aspect came up also in the end user walk through when the teachers mentioned the same thing. Based on this the GUIDe user interface design method increases the match between the system and the real world thus enhancing the usability of the system to be.

Aspect what was also connected to the design method was flexibility and efficiency of use. The usability evaluation revealed three aspects that support this part of the usability.

- This part is fulfilled fine. Different tools that the teachers use in their working environment are integrated into one user interface. This enhances the efficiency of the overall system. (7.1 in the table 6.1)
- Different functions in the user interface are presented clearly in the navigation bar so the efficiency improves. (7.2)
- Some of the components and concepts in the user interface are familiar for the user so it enhances the flexibility. (7.3)
One of the GUIDe method’s most efficient qualities seems to be system integration. This method strives to find all of the work processes the users have and tries to integrate them under one clear and simple user interface and making achievement of the goals behind the work processes as linear as possible. So the aspect 7.1 is direct result from the use of the GUIDe method. Part 7.2 might look like it would be a result from the designer’s properties, but is not. This aspect is a result also from the design method’s properties, because the principle in the GUIDe method is that it creates a user interface what holds in only the essential functions from the end users point of view. When there are only functions that are directly related to the work processes of the end users the user interface stays clear and efficient. This is true especially in this case because the teachers didn’t have enormous amount of different work processes that would had to treated separately as different functions what would increase the amount if information in the user interface. This is an aspect that might not be true in some other case site, but hopefully somebody will test this also in different kind of case sites and evaluate this aspect. The 7.3 aspect is the same as it was in the 2.1, but it is also valid under this topic. When the user finds expected functions under familiar concepts and components work as the users expect efficiency improves when the user does not have to learn new components and use unfamiliar concepts which usually cause needless work.

Aesthetic and minimalist design was also an aspect that came up in the heuristic evaluation. The evaluators mentioned that the user interface is clear and easy to understand because only essential functions and instructions are visible for the user. This belongs to the properties of a user interface design method, because the idea behind the design method is to implement solutions to achieve goals behind the work processes as linear as possible and therefore there are no unessential information in the interface. The user interface holds in only the essential information and especially in this case it made the design of the minimalist user interface possible.

Help users recognize, diagnose and recover from errors is the last point what could be claim to be dependent on the design method. The user feedback upon this matter was that the linearity of the different functions prevents users to make mistakes. In other words the message was that the navigation through different functions was easy and returning from unwanted situations was easy because canceling of actions was made easy in different stages.

The GUIDe method seems to be quite capable to produce usable user interfaces. As mentioned before, many times the usability issues depend on both, the method and the designer, but at least in this case the design method itself produces some of the positive usability aspects. Also based on the heuristic usability evaluation and the end user walk through, the GUIDe does not hinder any usability issues when designing user interfaces.
7 CONCLUSIONS AND DISCUSSION

7.1 Conclusions

The purpose of this work was to study different user interface design methods that take the work processes and the goals of the users into consideration. The study was conducted by starting from the literature review to find suitable user interface design theories that fulfil the requirements. There were basically two requirements when the review was done; the method had to take the work processes of the user into consideration and the method had to be in line with the UML modelling language. The result from this phase was that three methods were found under comparison. The purpose was to compare these three methods against each other using number of requirements in the Pugh’s decision matrix. GUIDe user interface design method was selected based on its good properties in taking account the work processes of the end users.

The testing of the GUIDe theory was conducted in the Kemi-Tornio University of applied sciences which was the case site, thus making this a single case study. A user interface was created for the teacher’s information management system using the GUIDe method in order to empirically test the method. The method was followed very precisely in order to produce valid data. The created user interface was evaluated using three different methods.

The most important aspect, is the user interface in line with the end users work processes, was evaluated using two different methods; end user walk through and feedback from others. Both methods produced the same data: the user interface is in line with the end users work processes. This gave the answer to primary research question:

• *How to model a user interface for web based programs in the field of information management systems, in a way that it takes the goals and the work processes of the users into consideration?*

There are presumably other methods also that ensure the design of such an user interface that takes the work processes and the goals of the users into consideration, but this study proved with a one case that using GUIDe method correctly, a user interface is relatively easy to design that takes the goals and the work processes of the users into consideration. This result from the study is quite undisputed. The method was claimed to be efficient in taking the work processes and the goals of the users into account and that was proven to be true through two different empiric validation means. The picture that was in mind after the design process was that the method takes the aspect in question into account very efficiently and it is very inspiring way to take the end users perspective as a part of the design process.

It was also emphasized that it is important to keep the both sides of the system in surface when designing a new computer system. It is quite unwise when designing a system to just concentrate on user interface, because when talking about systems development, the designing
of the user interface is good to be in line with the designing of the inner parts of the system. Therefore the user interface design method’s relation to the designing of the inner parts of the system was evaluated using the UML modelling language as a reference. To guide this part of the study a secondary research question was formed:

- **How to model a user interface in a way that it takes also the inner parts of the system into consideration**

This aspect was important part when the different user interface design methods were searched from the related literature, therefore only such a methods were selected that were in line with the UML modeling language. Well, this aspect of the selected GUIDe method was empirically evaluated using feedback from others method. The result was that the GUIDe method produces data for the UML modeling language in the form of goal based use cases and the form of existing model of the user interface. Interviews revealed that the GUIDe makes the design of the inner- and outer parts of the system possible simultaneously, because the goal based use cases work as a UML use cases that are part of the system’s inner part model. Therefore the result is that using GUIDe user interface design method as a mean to design the user interface makes it possible to simultaneously design the inner parts of the system. This is as important aspect because, as stated before, both; the inner and outer parts have to be taken into account when designing a new system. After using the method the result felt very clear. The goal based use cases and the user interface felt to be perfectly adequate for me to design the rest of the system and after the interviews with the professionals I had no doubt about it; the designing of the inner and outer parts of the system is interconnected.

The usability aspect came to this study in the form of heuristic usability evaluation. Even if this study does not concentrate to usability issues the idea to totally bypass the usability in this study felt to lessen the deepness of this study. The usability is general concept and it can be tricky to connect to a study which concentrates only to the method and not to the user of the method, because usually usability issues overlap between the user interface design method and the user of the method. A research question was formulated in order to give a framework for the usability issue:

- **What is the user interface design methods impact to the usability of the user interface?**

The usability aspect was connected to the design method by separating data that is direct result from the use of the method itself. The heuristic usability evaluation was the source of the data. The data revealed that the GUIDe user interface design method has several relations to the enhancing of the usability of a user interface. In other words it can be claimed that the use of the GUIDe user interface method enhances following usability issues:

- Match between the system and the real world
- Flexibility and efficiency of use
- Aesthetic and minimalist design
- Help users recognize, diagnose and recover from errors

These aspects of the usability could be assumed to be a direct result from the use of the GUIDe method in this case site. I came to this conclusion because the picture from the design phase was that the method controls the designer quite a lot. The empirical data for the interface comes
mainly from the end users which enhances the match between the system and the real world. The method produces only essential data for the user interface thus leading the designer to use only important data for the user interface and especially in such an order that the reach of the goals would be as linear as possible; the three usability aspects are embodiments from this process. Therefore it is fair to claim that the presented four aspects from the usability heuristics origin from the method itself. But just like I mentioned, the purpose of this aspect of the study is to raise questions and hopefully raise discussion about the subject.

Overall evaluation from the GUIDe’s relation to the usability is that the design of a usable user interface is quite easy with the help of the method in question, but still the most important role, of course, has the user of the method and most of the aspects that enhance the usability are a mixture of the method and the designer’s capabilities.

7.2 Discussions

The GUIDe user interface design method, based on this study, takes efficiently into account the work processes and the goals of the users. The use of the GUIDe user interface method also ensures that the design of the inner parts of the system is in line with the user interface design. The GUIDe has little improvement when talking about the modeling of the dependencies of the UML use cases, but they can be still used and modeled even the modeling of the dependencies does not include to the method itself. It just need a little bit customization and flexibility from the designer, it is from mine point of view very common; the methods are rarely used without any customization.

It is not wrong to say that the GUIDe gives the designer such a framework that it is easy to produce usable user interface. This was the case in this study: The method was followed very closely without any modifications and the usability aspects was thought after the user interface was designed; still the result were surprisingly in line with the principles of the Nielsen’s 10 usability heuristics.

This study produced interesting data about user interface design methods relation to the acceptance of a new technology. Technology Acceptance model (TAM) is an information systems theory developed by F.D Davis. He developed the theory in 1989 and it is based on theory of: what influences on the acceptance of a new technology. TAM model holds in two main ideas: ease of use (EoU) and perceived usefulness (PU). (Fitzgerald, 2004)

Perceived usefulness (PU) means according to Davis; “the degree to which a person believes that using a particular system would enhance his or her job performance” (Wikipedia, a, 2006). By this he means that the end users resistance against a new system will lessen if the user sees the system as a mean to achieve the goals behind the work processes more efficiently. (Fitzgerald, 2004)

Ease of use (EOU) means “the degree to which a person believes that using a particular system would be free from effort” (Wikipedia). This means that if the end user sees the system as a easy to learn and simple to use it would lessen end users resistance towards a new system. These two concepts are interconnected and have causal relationship between each other. Greater EOU leads to higher PU, which leads to more usage of technology. (Fitzgerald, 2004)
The empirical data of this study revealed that the user interface design method has direct impact on the acceptance of new technology. The user interface design methods relation to the acceptance of a new technology is a known phenomenon for example in interaction design (Cooper, 1999), but the studied impact is not as direct and considerable as the empirical data indicates in this study.

The data from the end user walk throughs, feedback from others and heuristic usability evaluation indicated that the use of user interface design method creates automatically such results that the two aspects in the TAM model are fulfilled. Assumption is that the use of a user interface design method such as the GUIDe method lowers down the resistance towards new technology and the introduction of a new system is thus easier and the level of the use of the system is enhanced.

### 7.2.2 Future research

Many aspects came into surface when I made this study concerning future research. The most important thing is of course the verification of the results of this study in another case site. This case was information system in public organization and it would be valid to repeat the study is different kind of case site.

Secondly the empirical data revealed that the user interface design method has direct impact on the acceptance of a new technology. When reflecting the empirical data to the TAM model there are undisputed connection between the two. Therefore it would be essential to study what is the user interface design methods relation to the acceptance of a new technology.
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APPENDIXES

Appendix 1

**Use Case:** Reserve a classroom

**The goal of the teacher:**
Teacher X has to teach a lesson next week. The lesson is three hours long. The lesson has to be in a classroom where computers with Microsoft Visio software are available.

**Time:**
The lesson will be in 6 days from now.

**The classroom:**
The classroom should be suitable for 25 students. The classroom should contain at least 25 computers. There should be Microsoft Visio software in the computers.

**Availability of such a classroom:**
There are X amount of classrooms in the building that fulfils the requirements.

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**Use Case:** Check the timetable for the lessons

**The goal of the teacher:**
Teacher X wants to see when he has lessons and where they are.
Appendix 2

Use Case: Change the classroom reservation

The goal of the teacher:
The teacher wants to reserve a bigger classroom for his lessons, because there will be more students than he has estimated. There is already a booked, small classroom for the lessons so the goal is to cancel the reservation of the small classroom and reserve a bigger one.

Time:
The lesson will be in 3 days from now

The classroom:
The current classroom’s capacity is for 15 students. The need is for a classroom for 25 students

Availability of such a classroom:
There are no available classrooms for the scheduled time. There is available big classroom on different time. Teacher’s goal is to make the reservation even it is in different time.

Use Case: Change the time of the lesson

The goal of the teacher:
Teacher X wants to make a change to the schedule of his lessons.

Time:
The lesson will be in 4 days from now and the teacher has available time at that time.
Appendix 3

Use Case: Inform students

The goal of the teacher:

Teacher X wants to inform his students that there has been made changes to the schedule of the lessons.

Time:

The lesson will be in 4 days from now

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Use Case: Reserve a meeting room

The goal of the teacher:

Teacher X has an agreed appointment. Goal is to book a meeting room for the appointment.

Time:

Appointment will be in 5 days from now.

Meeting rooms:

There are two meeting rooms available.

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Use Case: Read article

The goal of the teacher:

Teacher X knows that there are database in the University’s intranet for Articles. Among other things there are Articles from the teacher’s field of science that is information technology. The goal of the teacher is to read information about WLAN architectures.

Needed article:

Any Article created this year concerning WLAN architectures

Existence of such an article:

There are two Articles in the database concerning WLAN architectures that are made this year.
Appendix 4

**Use Case: Share an article**

**The goal of the teacher:**

Teacher X has found a good article from Internet concerning teaching of challenged people. Teacher wants to upload this article to the article database. The goal of the teacher is to share this article with other teachers.

**Article:**

Article contains 35 pages and the size of it is 450Kbytes.

**Database:**

Database is in intranet and there is disk space available. There are two sides in the article database, a side for the public articles and a side for the private articles.

Use Case: Save an article

**The goal of the teacher:**

Teacher X has found a good article from Internet concerning teaching of students from Asian cultures. Teacher wants to upload this article to the article database. The goal of the teacher is to save the article for private use.

**Article:**

Article contains 9 pages and the size of it is 110 Kbytes.

**Database:**

Database is in intranet and there is disk space available. There are two sides in the article database, a side for the public articles and a side for the private articles.
Appendix 5

Use Case: Find article

The goal of the teacher:

Teacher X knows that there are database in the University’s’s intranet for Articles. Among other things there are Articles from the teacher’s field of science that is information technology. The goal of the teacher is to find information about WLAN architectures.

Needed article:

Any Article created this year concerning WLAN architectures

Existence of such an article:

There are two Articles in the database concerning WLAN architectures that are made this year.

Use case: Fill an electronic form

The goal of the teacher:

Teacher X wants to fill a form for travelling expenses concerning work related trip. The goal of the teacher is to find suitable form from the Intranet and fill it out.

Electronic form:

There are database for electronic forms in the Intranet. They can be accessed via Internet browser.

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Appendix 6

Use Case: Grade students

The goal of the teacher:

Teacher X has had a course which is over now. There are a system in the intranet where is possible to grade students of that course. The goal is to grade the students of the course with the help of the system.

Students:

There are 19 students who wait for their scores.

Grading system:

The system is in intranet and the use of it is possible with the web browser.
Appendix 7

Use Case: Receive learning task

The goal of the teacher:

Teacher X has a course he is teaching. The students have to make a learning task for the course. The teacher has to receive these tasks in an electronic form and grade them. The goal is to receive these tasks and evaluate them.

Students:

There are 23 students who are sending these tasks.

Tasks:

The tasks are word documents. They size vary from 100 to 1000Kbytes.

Use Case: Get software

The goal of the teacher:

Teacher X will have a software design course to teach in next month. Teacher wants to learn to use new MS Visio design tool before the course. The school’s IT-support has all the new programs. Teacher’s goal is to get the new program in his own work computer.

Time:

Appointment will be in 39 days from now.

IT-support and the new programs:

IT-support can come and install new programs when needed. They are reachable via phone or e-mail.
Appendix 8

Use Case: Check announcements

The goal of the teacher:
Teacher X wants to see announcements concerning his organization or himself. There are different bulletin boards for this purpose in the intranet which is reachable via web browser. The goal is to get information from different announcements.

Bulletin boards:
There are different bulletin boards in the intranet concerning organizational decisions and local announcements. They are located all over the intranet.

Use Case: See organizational directives

The goal of the teacher:
Teacher X wants to see directives concerning decision making in the organization. There is information in the intranet concerning the directives. Information is hard to find. The goal is the teacher X is to get information about from the directives

Directives:
Information about organizational directives is located in the intranet.
Appendix 9

**Use Case:** Send a teaching plan

**The goal of the teacher:**

Teacher X has a new course in next semester. He has done a teaching plan how he is going to teach the course. The teacher has to send this plan to the education programme administrator via Email. Teacher will give this same plan to students at the beginning of that course. The goal of the teacher X is to inform education programme administrator and students about the content of the course.

**Time:**

The course will be in 4 months from now.

**Teaching plan:**

Teaching plan that will be sent to the administrator is in electronic form and the one that the students will get is in paper.

**Use Case:** Use phonebook

**The goal of the teacher:**

Teacher X wants to contact another teacher via phone. The goal is to find the person from the phonebook in the intranet.

**Phonebook:**

The phonebook is in the intranet and is available for all the teachers.
Appendix 10   semi structured interviews for feedback from others method

Question 1

Does the user interface give the user an opportunity to reach the work related goals presented in the use cases?

Question 2

Is the user interface design method in line with the UML modeling language?
- Would it be possible to design the inner parts of the system, based on the goal based use cases and based on the user interface design?

Question 3

Is the system technically possible to construct?