The Usability of a User Centered Design approach

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ABSTRACT
The usability of software will be extended, if developed by a User Centered Design approach. The drawbacks are not as obvious. This position paper describes a research plan for comparing the benefits and drawbacks of two software developing approaches, the traditional software development approach and a User Centered Design approach.

Categories and Subject Descriptors
D.2.9 [**Software Engineering**]: Management – *cost estimation*, *life cycle*, *productivity*, *programming teams*, *software process models, time estimation*.

General Terms
Management, Measurement, Documentation, Performance.

Keywords
Software development approaches, feedback methods, user evaluation, document reviews, cost and benefit analysis.

1. INTRODUCTION
Decision makers in the industry ask: If I have $300.000 and I want to develop software for my company, how can you convince me, that your User Centered Design (UCD) approach gives me the most value for my money? How can I know that the UCD approach gives me a better product than the traditional one? These are very valuable questions and really hard to answer. A recent survey by Vredenburg et. al. shows that measurements of the effectiveness of the UCD approach are limited [4]. One of the conclusions in that survey is that there is a great need for common evaluation criterion for the UCD approach across industry.

So, what is a good criterion for measuring a software development approach? Are the criteria: a) the quality of the product developed; b) the experience when using the different approaches; c) the organizational benefits; d) the financial benefits e) or some other criterion? Could the ISO definition [2] of usability, function as quality criteria for measuring a software development approach, that is: Could the approach be measured according to the definition of usability by measuring the effectiveness, efficiency and satisfaction?

The UCD approach has been described in various details over the past decade or so, starting with Nielsen [6] to the resent ones, Mayhew [5], Preece et. al. [7] and Gulliksen and Göransson [1] to name a few. The ISO 13407 [3] gives a certain consensus for describing what the UCD approach is, but there the UCD approach is described from a higher level of abstraction than in most methodology books. Evaluation criteria for the UCD approach should fit the industry as well as the different methodological approaches.

This position paper describes a research plan for measuring the usability of two software development approaches, a UCD approach and a traditional software development approach. The research has been planned to start in January 2005 and has already been prepared.

2. THE RESEARCH PLAN
This section describes the goal of the research, the projects involved, the structure of it, the planned measurements and finally the methods used.

2.1 The goal
The goal of the research is to answer the question:

What are the costs and benefits of using a User Centered Design approach when developing software compared to the costs and benefits of using the traditional software development approach?

Measurements will be done on the effectiveness, efficiency and satisfaction for the two approaches.

The goal of the research is illustrated in figure 1.

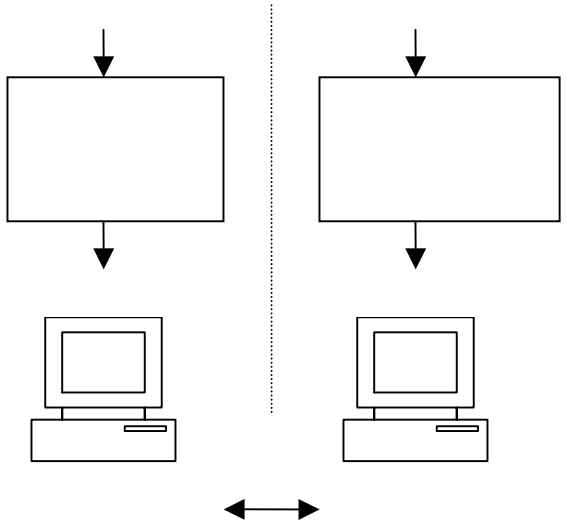

Figure 1: The goal of the research

During the same period of time, University students will develop software either according to a UCD approach or a traditional software development approach. In the UCD approach feedback on flaws in the analysis, design and programming is given to the students by concerning users, mainly through evaluating with users. In the traditional approach the students will get feedback on flaws from the customer or the mentor for the project through document reviews.

2.2 The software projects

Students in Computer Science do a complete software project as one of their final courses in their BS-degree studies. They usually work in a group of 3 people and get 12 ECTS points each for their work. Icelandic companies suggest the subject of the projects to the students and all the work is done at the company's site, where the students get all facilities and good connection to the customer and often the users, so these student projects are developed in somewhat real settings. In the following the students will be referred to as developers.

Usually these projects are 1.600 to 2.000 man hours running for five months with various subjects, one could be a plain CRUD (create, read, update, delete) project and another one could be more advanced, sort of a "proof of concept" project. No two projects have the same subject.

The data gathering in the research project will take two years and the estimated number of projects is 15 each year. The first year the developers will use a traditional software development approach but on the second year the developers will use an User Centered Design approach. Both approaches have the same milestones, delivering subprojects or documents with one months interval, see figure 2.

In the traditional software development approach the developers deliver requirements document, project plan and risk analysis during the first period of the project, design document during the second period and user and system manuals during the third period.

Finally the developers deliver the software developed and updates on all the documents on the delivery date.

All the documents need to be reviewed by the customer or the mentor for the project and a review summary will be made for each period of the project.

In the UCD approach the developers deliver the same documents during the first period of the project, but more focus will be on describing the users and their tasks than in the traditional approach. During the second and the third period the developers deliver prototypes that have been evaluated with users. For each period the developers deliver a summary of the user evaluations and comments.

The main difference of the two approaches is in the ways feedback is given to the developers, in the UCD approach users are contacted but in the traditional approach feedback is given to the developers through document reviews.

2.3 The structure of the research

As shown in figure 2, data will be gathered both during the process of developing the software and after the projects have been delivered. Five questionnaires will be used during the process, the first is mainly used to gather background information from the developers, the three iteration questionnaires will mainly be used to gather information on the methods used during that iteration and the developer's satisfaction. The final questionnaire will be used to gather information on the time used during the project and the developers overall satisfaction with the project and the applied software developing approach.

After the projects have been delivered, the quality of the outcome will be measured by user testing the projects with at least three users each. Furthermore the customer's satisfaction will be measured by using questionnaires and interviewing some of them.

The research will be running for three years, during the first two years the focus will be on data gathering, measuring the software development approaches during spring 2005 and spring 2006, but the last year will be concentrated on data analysis.

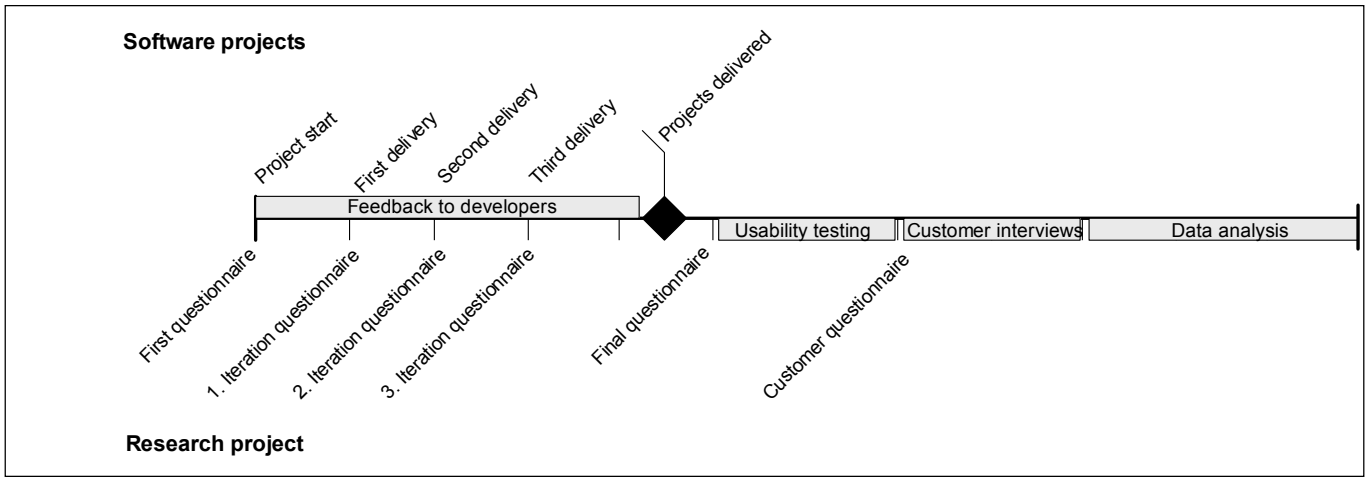

Figure 2: The proceeding of the student projects and the research project.

2.4 The measurements

The planned measurements are suited to gather information on the effectiveness, efficiency and satisfaction during and after using the software development approaches. In the following section, it is described what the planned measures are.

2.4.1 Measuring effectiveness

In the ISO definition of effectiveness [2] it is stated that: "Measures of effectiveness relate the goals or subgoals of the user to the accuracy and completeness with which these goals can be achieved". When measuring the effectiveness of getting feedback to the developers using a software development approach the collected data will be:

a) Was it manageable to get the feedback to the developers or not.

b) Number of problems found during the feedback gathering.

c) Quantitative measures on the quality of the feedback.

d) Quantitative measures on the quality of the product made.

2.4.2 Measuring the efficiency

Measures on efficiency are defined as [2]: "Measures of efficiency relate the level of effectiveness achieved to the expenditure of resources". Expenditure of resources is measured by time used here, namely by:

a) The time used by the developers for getting the feedback.

b) The time used by the customer or users for getting the feedback.

2.4.3 Measuring the satisfaction

Finally, satisfaction is defined as [2]:"Satisfaction measures the extent to which users are free from discomfort, and their attitudes towards the use of the product." Here satisfaction will be measured by:

a) Quantitative measures on the satisfaction of the developers after using a particular method for feedback gathering.

b) Quantitative measures on the satisfaction of the developers after following the whole software development approach.

c) Quantitative measures on the satisfaction of the customer with the product developed.

2.4.4 Testing the planned measurements

All questionnaires for the research have already been made and tested during similar software projects during spring 2004. Many iterations were made on the questionnaires and interviews were made to gather information. At first the questionnaires were on paper, but the developers liked the electronic version better.

2.5 The methods

Three main data gathering methods will be used: questionnaires, interviews and acceptance testing. Additionally information on the feedback to the developers will be gathered. In figure 2 there is an overview of the schedule for the data gathering and in the following subsections the methods will be described briefly.

2.5.1 Questionnaires

The software projects are done in 4 iterations, each with one month duration. The questionnaires will be used to gather information on the developers and customer's satisfaction and collect descriptive data on what methods were used and how much time it took to used them.

2.5.2 Interviews

Some selected customers will be interviewed to get a closer look at their satisfaction. This will be semi-structured interviews.

2.5.3 Acceptance testing

The acceptance testing will be done by running user tests that the developers have prepared. All the tests will be run in the same location and by the same person to get as little bias as possible. Three real users of the systems will be asked to attend and a pilot test will be run. The results from the acceptance testing are very important to compare if the UCD approach results in extended usability of the software as stated before compared to the usability of the software developed by a traditional approach.

3. DISCUSSION

Being able to describe the costs and benefits of using User Centered Design approach with quantitative data and compare it to the costs and benefits of using a traditional software development approach will be a good tool in the fight usability people are having every day, when trying to convince customers and other software development people that keeping the focus on the users in the development of software is a fundamental thing for better quality of the software.

4. ACKNOWLEDGMENTS

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