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Abstract

Observation is a key skill in performing analysis and evaluation activities during development and maintenance of an information system. This paper looks at how this skill can be learnt by investigating the research question: "Can observation learning be improved by introducing a meta-observer?". This research consists of using a simulation of a real life situation of an observation scenario embracing three different roles: a user, an observer and a meta-observer. The user, while performing a task, is encouraged to 'think aloud' by the observer. The meta-observer's task is to observe the observer and to provide feedback. Findings in terms of strengths and problems concerning the role of the meta-observer are presented.

Keywords

Observation, human-computer interaction, information systems education

INTRODUCTION

There are many ways of evaluating the usability of a human computer interface (Nielsen, 1993; Nielsen & Mack, 1994; Preece, 2000; Preece et al., 1994; Rosenbaum, 1989; Rubin, 1994; Shneiderman, 1998). Observation, where someone watches a user interacting with the system (whilst taking notes) is one of the techniques used. This paper looks at how someone learns to observe, with the research question: "Can observation learning be improved by introducing a meta-observer?".

A person might observe the user unobtrusively or by interacting with the user, asking specific questions, thereby being obtrusive (D'Hertefelt, 1999). In this instance we are specifically looking at unobtrusive observation during a 'think aloud' exercise. The 'think aloud' technique (Boren & Ramey, 2000) provides a cheap usability evaluation method that involves a user, as opposed to formal usability testing (Rosenbaum, 1989; Rubin, 1994) in a laboratory. The role of observer can impact on the performance of a usability evaluation, and hence corrupt the data obtained through an unobtrusive observation of a user. Most studies examine the effect of evaluators on the results of the evaluation (Hertzum & Jacobsen, 2001; Jacobsen & John, 1998), this study focuses on improving the performance of the observer which in turn should improve the outcome of the observer orientated evaluation

There are several reports concerning observation used as an evaluation technique (e.g. Springmeyer, (1993); Jääskö & Mattelmäki, (2003)), many of which revolve around the 'think aloud' technique (e.g. Haak & Jong, (2005); Waes (2000)). These reports focus mainly on the roles of the observer and the user. In this paper, we suggest a new third role; that of a meta-observer. The meta-observer's role is to observe the observer and to present feedback to the observer (this role is further explained in Research Approach).

Our idea is to simulate the context that the observer will learn from. A context, where the observer is in focus and not the user (see figure 3). In this context the role of a meta-observer becomes important since possibilities arise for: 1) *Learning from feedback*: Using a meta-observer provides the opportunity for the observer to receive feedback about his/her actions and behaviour during the observation session, especially if they are inexperienced observers. 2) *Learning from watching*: Acting in the role of a meta-observer includes learning how to act as an observer. Since the meta-observer is studying the observer, the meta-observer can learn to observe from studying the observer's behaviour. 3) *Learning by understanding*: The meta-observer is expected to present feedback to

the observer. This means that the meta-observer can inform the observer of the problems and strengths of their behaviour. To be able to criticize, the meta-observer must have constructed their own understanding of what the user observation technique is about. An observer's behaviour can be affected by the positive or negative feedback. This feedback may influence the motivation of the observer to learn. Bandura (1986) describes vicarious reinforcement as enabling learning or vicarious punishment as inhibiting learning.

In the present paper we consider observation learning as a construction and a self-evident part of a context (Lave & Wenger, 1991). This is a constructivist perspective (Berger & Luckmann, 1966). Every actor creates his/her knowledge and structure, and makes sense of theories, and parts of their reality in his/her own way. Our approach to learning follows Ramsden's (2003) description of the learning concept. We focus on an approach to learning based on *how* students learn and *what* they learn; and our task as teachers is to, context dependently, organize for learning to take place. Students then experience the subject matter heterogeneously and structure their own knowledge (Bandura, 1986; Berger & Luckmann, 1966). We also try to encourage a holistic and deep approach to learning – a meaning orientation, with a focus "on the whole in relation to the parts" and "what the tasks are about".

In this paper we are focusing on the role of a meta-observer and the meta-observer's relation to the observer. We are not focusing on the user role and user's relation with the observer. Of course, the main role when gathering data from user interaction is the observer role. The role of the meta-observer should be perceived as a means to further learn observation. The research approach and case study are described next, followed by the findings. Finally we present the conclusions and suggestions for future research.

RESEARCH APPROACH

The research has been carried out as action research (Avison, Baskerville, & Myers, 2001; Baskerville, 2001; Checkland, 1991; Cronholm & Goldkuhl, 2003; Cunha & Figueiredo, 2002). The reason for choosing action research was that we had both an action interest and a research interest. The action interest was to plan and carry out an exercise for learning observation. The research interest was to study the exercise in order to learn more about how to teach observation. This means that we have both acted as researchers and as teachers (see Figure 1).

The action research model in Figure 1 describes our view of action research (Cronholm & Goldkuhl, 2004). There are three interlinked practices: The theoretical research practice (studying how observation learning can be improved by introducing a meta-observer), the change practice/empirical research practice (carrying out an exercise for testing the idea of introducing a meta-observer) and the regular practice (running university education).
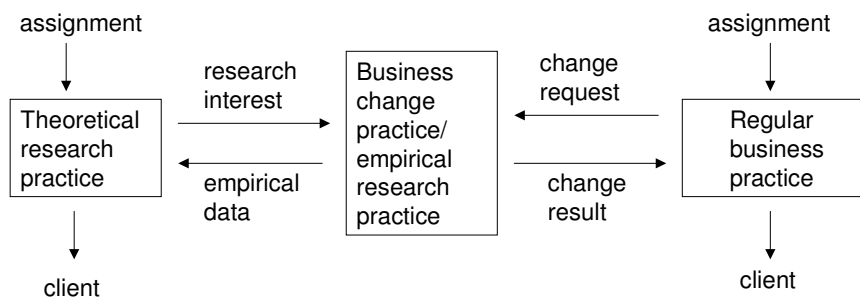

Figure 1. Three interlinked practices (Cronholm & Goldkuhl, 2004)

Research Process

In this paper, the research part that has been of primary interest since the aim was to develop new knowledge. The research part took place when we reflected on the introduction of the meta-observer. Therefore the exercise has served as a source for collecting empirical data, and been important as a source of knowledge, but is in itself of secondary interest. The practice of running university education has acted as base for carrying out the exercise. The existence of the theoretical research practice and regular business practice is legitimized by assignments and that the practices have clients (Goldkuhl & Röstlinger, 1999). It is important to note that they have different assignments and clients. There is also a flow of data between the practices. The flow consisted of data and results. A common criticism against participatory action research is that it lacks scientific rigor (Kemmis & McTaggart, 2000). In order to reduce this criticism we have been careful about the two roles researcher and teacher.

The research approach is based on the following process: 1) formulating an idea about how to learn observation, 2) testing the idea and 3) presenting criticism and suggestions for improvements of the original idea (see figure 2).
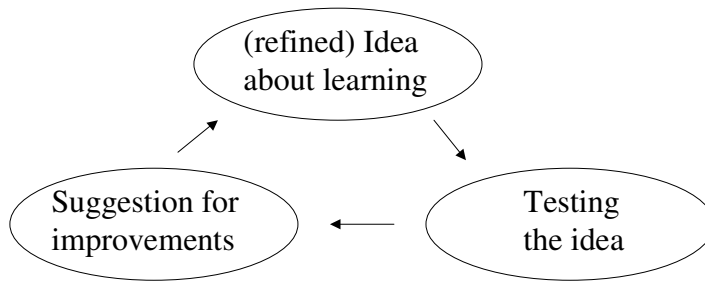
Figure 2. The Research Process

This research is reporting on one iteration of the research process. The results of this initial iteration will be used to improve subsequent iterations.

The Observation Learning Context

The idea for learning observation is to simulate a real life situation. The observation learning context embraces three different roles and three interaction modes (see figure 3). One role to play is that of a user, where the user tries to accomplish a predefined task. The user is encouraged to 'think aloud', that is to articulate what he/she is thinking when interacting with the system (Boren & Ramey, 2000; Monk, Wright, Haber, & Davenport, 1993). The second role to play is the observer role. The observer encourages the user to 'think aloud' and takes notes (uses an observation protocol, see table 1) of what is happening. The aim of the observer role in this exercise is to gain experience from acting as an observer. The third role is that of a meta-observer. The meta-observer's task was to observe the observer and the user. Since the learning context embraces three different roles and three interaction modes, the nature can be characterized as complex. To reduce the complexity, we have in this paper focused on the role of the meta-observer and the meta-observers interaction with the observer. This does not mean that we have neglected the other two roles and interaction modes. To further reduce the complexity we have provided the user with familiar tasks (see below).
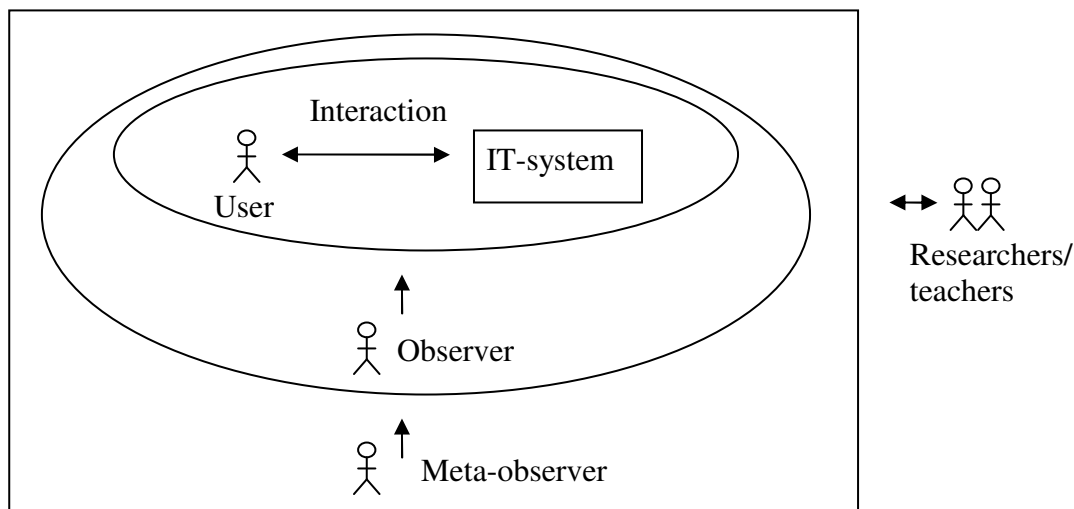

Figure 3. The Observation Learning Context

Testing the idea and proposed improvements

In order to try the idea of a meta-observer, a study was initiated with a usability elective class of university students. In the class, the students performed usability evaluations of IT systems where observation was a key learning objective. To improve the learning of this key technique, students performed an observation simulation scenario during an exercise.

As a lead up to the observation exercise, the students were asked to read an article regarding the 'think aloud' scenario and had the roles explained just prior to the exercise. The exercise was performed with seven groups of three students and one group of four students. In the group of four students, two students acted as meta-observers

(this meant that the observer obtained feedback from two students). In the observation learning context every student had the opportunity to play each role by rotating the roles within their group at the end of each session, with users selecting a different web site for the same task to remove the transfer of knowledge of how to perform the task. The exercise ended with a follow-up class discussion. The aim of this follow-up class discussion was to transfer knowledge between groups.

In each group the three roles: user, observer and meta-observer were represented. The users of the group were given a defined task of seeking specific information on a university web site. Examples of the user tasks was to find information about different masters programs and to answer questions such as "what is the structure of the program?", "how do you apply to the program?" and "can you do the program full time or part time?". The observer used an observation protocol, which required them to take notes of the user's success or failure when performing the task (see table 1).

Name of screen document: Stock Control	
IT-function	Updating the stock level
Observation	The user could not find the function for updating the stock
Cause	There was too much information on the form (information overload)
Effect	The stock was not updated.

Table 1. Example of Observation Protocol (Eliason & Ågerfalk, 2003)

The meta-observer role was to observe the observer. Before the exercise started the meta-observer was provided with oral and written instructions. The instructions consisted of several recommendations and the meta-observer was instructed to take notes about:

- Before the observation process started:
  - o   listen to how the observer introduced the observation session to the user
- During the observation process:
  - o   watch the observer's behaviour during the session
  - o   listen to how the observer encouraged the user to 'think aloud'
  - o   check if the observer intervened in the process or not
- After the observation process:
  - o   provide feedback to the observer consisting of how the observer communicated with the user

These instructions are generated from discussions between the authors of this paper. They are not theoretically or empirically grounded. After this study, we hope that the instructions (or parts of them) can be empirically grounded and viewed as useable. The aim of the role of a meta-observer was to provide feedback to the observer and to learn about observation from watching another person being an observer. The idea of introducing a meta-observer can therefore be seen as a peer-review system. By reviewing other student's work, the reviewer can potentially learn and improve on their own subsequent work.

Testing the idea means that we as teachers have to collect and analyse data about how observation has been learnt from the meta-observer role. We have collected data from studying the meta-observer. This is done by analyzing the students' written experiences (worksheets), observing the context, a follow-up session and a questionnaire. The questionnaire was divided into three parts; before, during and after the meta-observation.

The analysis of the data can be characterized as qualitative. According to Kvale (1989) and Strauss & Corbin (1998) you should use qualitative approaches when you are interested in this knowledge that answers the questions of why and what. Kvale (1989) claims, "the aim of qualitative approaches is to achieve a deeper understanding of a phenomenon". We have induced categories from the student's experiences. Each category is viewed either as strength or as a problem and classified according to the division of "before", "during" and "after".

Finally, the third step in the research process was to propose improvements for the original idea. The findings have acted as a basis for proposing improvements. We have preserved identified strengths and added new proposals for identified problems. The research approach has been basically inductive but there have also been deductive elements in the way that comparisons have been made to established theories.

FINDINGS

The data analysis revealed several interesting findings. To address the findings we will first present the strengths identified and secondly the problems identified. This section ends with suggestions for improvements corresponding to the problems identified.

Strengths

The majority of the students thought that the instructions for acting as a meta-observer were clear enough. The instructions consisted of a lecture concerning 'think aloud' and a written document containing instructions (see Research Approach section). Most of the students thought that they did understand the role of the meta-observer, i.e. observing the observer and provide feedback to the observer after the session.

Condition	Consequence
Instructions were clear enough	Conditions to act as a meta-observer existed

Table 2. Strengths related to before the session started

One of the most important findings by including the role of meta-observer is that the students were offered an ability to look at the whole picture. This ability is related to "Learning from watching observation" which is one of the main reasons for introducing a meta-observer. Another strength identified is that the students were offered a possibility to analyse the behaviour of an observer. This strength relates to the main reason "Learning by understanding" (see Introduction section). The third strength identified relates to the physical position of the meta-observer. A good position was taken when the meta-observer could hear and watch both the observer and the user and in the same time be able to follow user interactions on the computer screen. If the meta-observer had a good position in relation to the observer, the user and the computer screen, the ability to provide feedback to the observer increased. This strength can be viewed as simple, but it is important in order to more effectively record the observer's behaviour.

Condition	Consequence
Acting as meta-observer	Ability to look at the whole picture
Acting as meta-observer	Analysing behaviour of the observer
A good position was taken	Easy to see and hear the observer → High quality on feedback

Table 3. Strengths related to during the session

To be able to reflect on the role of the observer is an important part of learning how to be an observer in line with the constructivist perspective (Berger & Luckmann, 1966). Through reflection the students were offered a potential to discover a deeper interaction between the observer and the user. During the follow up discussion, the comments made by the students indicated that the process had positive learning outcomes. The exercise gave the students a different perspective and a first hand understanding of what would negatively impact on the objectives of this usability testing mechanism.

Condition	Consequence
Reflecting over the observer role	A potential to discover a deeper interaction between the observer and the user
Follow-up discussion	Learning by sharing experiences

Table 4. Strengths related to after the session

Problems

The issue of the instructions given were identified as a strength (see above), but it is also identified as a problem. Some students thought that the instructions for acting as a meta-observer were not clear enough. It is obvious that several students understood the instructions and that some didn't. Even though students were given (what we thought were) clear instructions about each role, one student was overheard berating the user for the way they were performing their task. Another student observer felt it was their job to tell the user at the end how they should perform their task.

It seems that providing only oral and written instructions for acting as a meta-observer is not enough. Several of the problems occurring during or after the session can be related to either the instructions not being clear enough or to the students not paying enough attention to them.

Condition	Consequence
Instructions were not clear enough	Failure to fully act as a meta-observer

Table 5. Problems related to before the session started

One problem that occurred during the session was that the meta-observer did not take enough notes and thereby the basis for feedback was weak. Another problem that occurred was the meta-observer gave comments during the session. This means that the observer was disturbed and that the user was interrupted while performing the task. A third problem identified was that the meta-observer took a position that was less favourable for observing. A more favourable position would mean an increase in the quality of feedback.

A fourth problem during the session was that users felt quite inhibited and restricted because they were being observed – somebody watching over them or "looking over their shoulder". One person especially noticed that an observer was sitting in very close proximity to the user, thereby possibly intimidating them. A comment was also made that they as a user felt they could not work as efficiently with someone looking over their shoulder. It was also mentioned that the 'think aloud' observation mechanism created a very artificial setting which could possibly result in incorrect feedback.

Condition	Consequence
Not enough notes were taken	Low quality of feedback to the observer
Feedback was given during the session	The meta-observer intervened in the process
The position was not optimal for observation	Decreased possibilities to see and hear the observer → low quality of feedback
The artificial nature of the context	Users felt inhibited

Table 6. Problems related to during the session

One major problem, relating to after the session, was lack of feedback to the meta-observer. A consequence of this was that the meta-observer felt unsure of his/her performance and if the feedback they provided was useful. A follow-up session was done but no individual feedback was provided to the meta-observer. Due to resources, it was hard to monitor each individual meta-observer's behaviour.

Another problem identified was that several meta-observers felt an uneasiness when criticising the observer. One explanation can be that the class consisted of students with different cultural background. Another explanation might be that some students were not experienced enough in providing constructive criticism.

Condition	Consequence
Feedback to the meta-observers behaviour was not given	The meta-observer felt unsure if he/she made any mistakes
Criticising the observer	Feeling of uneasiness
Misconceptions about the role of observer	Failure to fully act as a meta-observer

Table 7. Problems related to after the session

Suggestions for improvements

In order to minimize the problems identified we suggest improved and clearer instructions for being a meta-observer. Some meta-observers had problems with taking enough and appropriate notes. As part of the instructions we provided a list of recommendations of what to look for concerning the observer's behaviour. From the data it is clear that this was not enough for all the students. Another problem was that the meta-observer interrupted the observation process and a third problem related to the position of the meta-observer.

In addition to the written and oral instructions we suggest the students also view a role-play or demonstration of the three roles: user, observer and meta-observer. Bolton (2002) claims, "the role-play approach incorporates complexity and emotion into a simulation". The role-play should embrace both common strengths and problems that can occur in an observation learning context (see figure 3). The role-play should emphasize both the observer role and the meta-observer role. One possibility is to pre-record the role-play in order to allow replay to each group of students before performing the activity. The aim of this role-play is to clarify the written instructions and to increase the conditions for acting as a meta-observer and thereby increase the conditions for learning observation. According to Bandura (1986), students must have a chance to observe and model the behaviour that leads to positive reinforcement.

For the problem where users felt inhibited we propose the improvement suggested by van den Haak & Jong (2005). The suggestion is that two users perform the task. In that way the 'think aloud' technique is enhanced in a natural way (because of a need to communicate between the users) and the feeling of being watched is reduced. Adding a user will also balance the number of people watching and being watched. That means a shared situation could overcome or reduce the feeling of being watched.

In order to reduce the problem of individual feedback to the meta-observer we suggest that more attention should be focused on the follow-up session. Instead of a general summary the follow-up session should be used as group

sharing activity for providing feedback to the meta-observer. In this way the meta-observer could achieve additional feedback through sharing experiences from other meta-observers.

The problem of the meta-observer feeling uneasy when criticising the observer is harder to deal with. One explanation can be that this behaviour is related to culture, which is not easily changed. Our suggestion is to further clarify the goal of the session and emphasize that acceptance of criticism, in the academic learning context, is something good. Providing criticism can thereby be legitimate.

CONCLUSION AND DISCUSSION

Earlier findings demonstrate that observation can be learnt by simulating real life situations. Our findings demonstrate that by introducing the role of a meta-observer, another perspective and depth of learning was added. Involving this third role, has changed the dynamics of learning observation, which means that the possibilities for learning observation are increased, compared to when only two roles are used.

Organising the exercise with different groups where the students rotated the roles within their group at the end of each session added to the learning. Bandura (1986) claims "Educators must encourage collaborative learning, since much of learning happens within important social and environmental contexts". Also, it can be hard for one lecturer to provide sufficient feedback to the observer. Including the role of the meta-observer means that a way of providing feedback to the observer is introduced, thereby maximizing the opportunity of learning from the exercise.

One of the most important findings is that the role of meta-observer serves dual aims. One aim is to provide feedback to the observer and the other aim is that the meta-observer learns observation from observing an observer. Including the role of the meta-observer means that both the observer and the meta-observer learn at the same time. Some of the findings were considered as strengths and as problems at the same time. We think that these opposed understandings depend on each students pre-knowledge, experiences and attitudes towards the exercise. It is difficult to maintain a single interpretation when it is clear that participants will construe ideas and concepts differently.

According to Bandura (1986) learning by observation involves four separate processes: *attention, retention, production* and *motivation*. By introducing the role of a meta-observer we believe that we created a context where all four processes are met. Bandura claims "Observers cannot learn unless they pay attention to what is happening around them". The observation learning context was organised in a way that the meta-observer had to pay attention to the observer's behaviour.

Second, retention means that the meta-observer must not only recognize the observed behaviour but also recall it later when providing feedback both to the observer and the group. In this context the students are trained to code or structure the information in an easily remembered form or to mentally or physically rehearse the model's actions. Retention is also affected by the reflection that was offered during the meta-observer role.

Third, production means that the meta-observers must be capable of producing the act. Bandura (1986) means, "reproducing the model's actions may involve skills the observer has not yet acquired. It is one thing to carefully watch a circus juggler, but it is quite another to go home and repeat those acts". In the observation learning context (see figure 3) every student had the opportunity to play each role by rotating the roles within their group. This means we have formed a learning context for learning from feedback, learning from watching, and learning by understanding. The last process is motivation. We believe that the students were highly motivated from both the feedback after the exercise, which indicated that the students thought that it was fun and useful and by this technique being freely chosen in later assessment. One reason could be that observation is one of the most important ways of collecting data from user interaction. Another reason could be that that we simulated a real life situation and that the students were given the opportunity to act as an observer.

The findings in this paper can be viewed as a hypothesis. A hypothesis that can be further tested and compared (see figure 2). The findings are based on a qualitative approach consisting of categories that are grounded in data. Arthur (1983) claims that many theories that have been developed have been tested by irrelevant hypotheses. The hypothesis that we have generated is grounded in empirical data through the students' experiences.

FUTURE RESEARCH

This paper draws heavily on empirical qualitative data from students´ experiences. Only one iteration was completed in this research (see figure 2). A recommended direction to further develop the knowledge generated is to refine the original idea of introducing a meta-observer. The idea should be refined according to the suggestions for improvements.

A well-known limitation with practical use of qualitative data is the lack of statistical measures and the possibilities to make statistical generalisations based on the results. The results in this paper can be viewed as a

hypothesis that can be further tested in a broader study with the objective to reach statistical generalisation. The result can also be further grounded in theories of learning and observation.

The effect on learning based on the order in which students performed the various roles (user, observer and meta-observer) was not analysed. This could provide further insight into the roles in the observation technique using this simulated observation scenario.

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