

# EMPIRICAL DATA COLLECTION AND ANALYSIS USING CAMTASIA AND TRANSANA

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## ABSTRACT

One of the possible techniques for collecting empirical data is video recordings of a computer screen with specific screen capture software. This method for collecting empirical data shows how students use the BSCWII (Be Smart Cooperate Worldwide - a web based collaboration / groupware environment) to coordinate their work and collaborate in developing their work.

In order to collect data and gain an understanding for using software Camtasia for collecting empirical data when students were using the BSCWII platform, in the Fiste Comenius 2.1 project (Future Innovative in-service Teacher Education), the author piloted the software. Using this remote observation software to make recordings of the screen allowed collection of a rich record of actual computer work activity in its natural work setting. The conclusions, from this pilot study could later be used to support action research based approach to improve in-service teacher education in Europe.

The nature of this remote observation tool made it easy to follow the users' activity in the Managed Learning setting of the BSCWII system. However, the invasiveness of seeing all of the user's interactions with and through the computer has raised ethical concerns about the privacy of the participants that have to agree to participate in this type of detailed study. Techniques needed to develop trust with researchers are considered. Advantages, disadvantages, and limitations of the data collection method are also discussed.

Keywords: Screen Recording, Remote Observation, Managed Learning Environment, Communication, .

## INTRODUCTION

The context of the project is the development of the Fiste Comenius 2.1 project (and the supporting BSCWII platform (BSCWII). The background was a curriculum development work aimed at improving in-service teacher education in Europe. The use of the BSCWII was developed and tested in the Fiste Comenius 2.1 (Figure 1).

The Fiste Comenius 2.1 project aims to improve in-service teacher training within the overall programme of curriculum development. It thus focuses on the use of the BSCWII managed learning environment for in-service teacher education. The BSCWII support Internet and database technologies, to facilitate Cooperative learning. The Fiste project uses the BSCWII platform as a tool to facilitate the way the participants work together. It is a continuous meeting place for them, a stable base to

work from and at the same time an easily accessible archive of the entire FISTE project teaching material all the

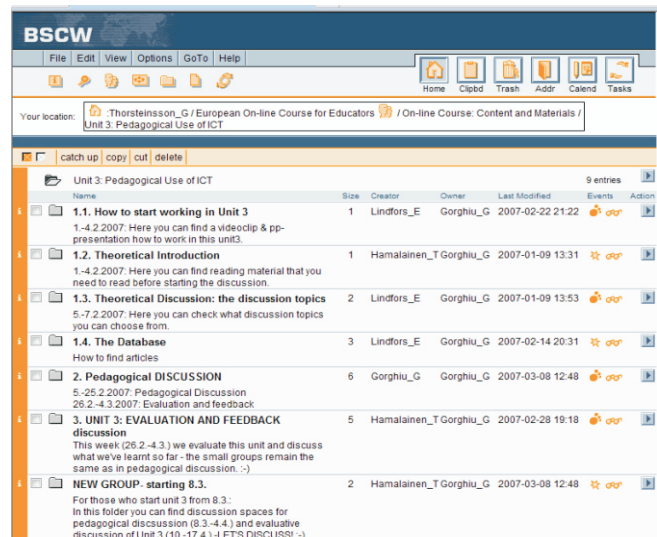


Figure 1. A BSCWII workspace including on-line course material.

undertaken activities are based on. This paper, firstly, explores the specific way of collecting data through remote observations explained above. Secondly, it reports on a pilot research project based on remote video observations using the Fiste BSCWII platform.

## 1. The BSCW

The BSCW platform is based on collaboration through shared workspaces over the Internet (Carmichael and Honour 2000). Shared workspaces permits storage of documents and sharing information within a group. It is integrated with an occasion mechanism to give each user an awareness of other activities within the platform. It consists of many possibilities, e.g., discussions forum, management of documents, group management, search for different features and numerous of others (the BSCW homepage 2007). The platform is first and foremost designed to sustain self-organising groups.

The development of the BSCW platform has mostly been funded by the European Union through the WWW project and the CESAR project of the EU's Telematics Applications Programme (Carmichael and Honour 2000). Collaborators of these projects helped to develop the platform.

The BSCW is based on the idea of a "shared workspace," which the members of a group set up for organising and manage their work (Figure 1.). A collective workspace in the BSCW is a database for shared information and accessible by the members of the group (The BSCW homepage 2007). They have to use a user name and password to enter the workspace. A BSCW server manages a many such workspaces for different groups, and users may be members of a numbers of workspaces (e.g., one workspace corresponding to each project a user is involved with). A workspace can hold information such as images, documents, links to Web pages or FTP sites, threaded discussions, member contact information, and more (Carmichael and Honour 2000). The contents of a workspace are shown as information objects arranged in a folder hierarchy (Figure 1).

Students and teachers can upload information from their computers to a workspace and set access privileges to

manage the visibility of the information and the manoeuvres that can be performed by others (Ellis, Gibbs, and Rein 1991). Participants can download, alter, and ask for more details on the information matter by clicking on HTML links to ask for workspace operations from the BSCW server (The BSCW homepage 2007). After each action the server returns a new HTML page demonstrating the new status of the workspace (Figure 1).

Permission to manage the workspace is given by the buttons at the top of the page and the text HTML appears under every item. The former function on the present folder is shown, so that "add URL" will return an HTML form for specifying the name and the URL of a URL link object to be added to the current folder, while the latter carry out functions on each object, such as "rename," "edit description,". As a shortcut, the check-boxes to the left of every object, in together with the buttons on top of the list of objects or below permit operations on various object selections.

## 2. Remote Observation through a computer network

In most case studies, students are directly observed. Remote observation (Ivory and Hearst, 2001) via networked computers, offers the advantages of accurately recording students actions on their computers and enabling the observer to be remote, so less likely to influence student behaviour. However, observing users remotely is an option explored by few authors. According to Hartson et.al remote observations can be defined as "evaluation wherein the evaluator, performing observation and analysis, is separated in space and/or time from the user".

Remote observations enable the observer act both in classroom settings and in the context of open and distance education in different ways. Firstly, observe students at the same time in the same place (STSP0). Secondly, observe students at the same time in different places (STDPO). It means the observing network administrator observes the users at the same time they are performing their work in different places from a remote location, usually by observing the users screen over the network (Figure 2). At the same time, software

such as Camtasia (<http://www.techsmith.com>) is used to record data. The observing network administrator can communicate with and listen to the user via computer microphone, or he can be 'invisible'. This type of live viewing of a remote site is what remote observations most commonly stand for. Thirdly, observations in a different time in different places (DTDPO) indicate that the network administrator observes the user's actions later, usually from some kind of recorded medium. Such data can be produced by software such as Camtasia by recording the activities on the screen. It offers both audio and video recordings. Different time in different places observations may rely on the users' ability to use specific software to record the data and send the results to the observing administrator. The observing administrator cannot directly observe and interact with users in different time and different places observations (DTDPO).

### 3. Observation based on video, captured from a computer screen

Capturing series of actions on a computer screen is equivalent to a traditional video. Since more and more computer users communicate in BSCW on a computer screen, it can be of big value to capture computer screen motions.

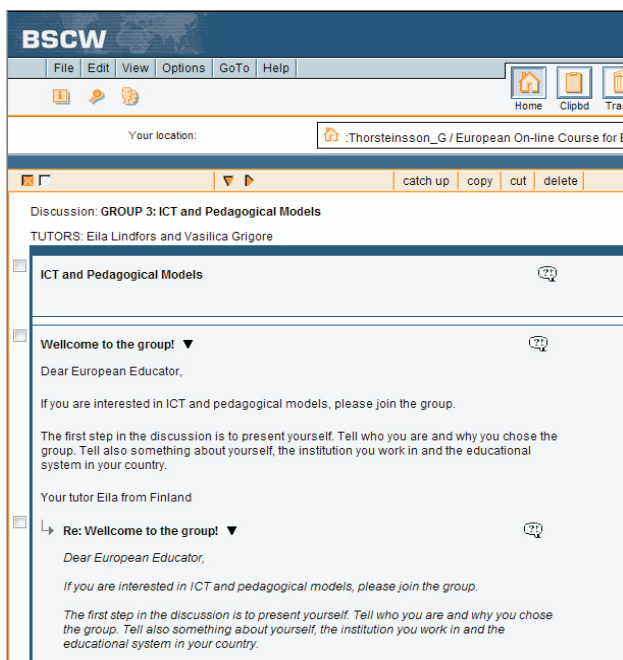


Figure 2. The BSCW on-line discussion forum.

One way of recording these activities in a BSCW is via video recording using traditional or digital technology. Video can produce very satisfying motion result for human eyes. One challenge can be the video film's huge file size, which makes it difficult for storage and bandwidth requirement if the video is used for teleconference streaming, or for download over the Internet.

The worth of a computer screen captured movie depends on two major components: display time interval and quality of each frame taken. Many commercial products and academic research results exist to compress screen capture video. Examples are Camtasia, PAL PC Spy (Allen and Jin, 2001) and Capture Cam-Pro. The majority of them are for either storage or real time desktop screen teleconferencing.

Conventional video makes records sceneries at some time intervals. The majority of the screen capture approaches are very alike to the traditional video production, which uses frame-by-frame recording. The differentiation between conventional videos and screen captured is the former use compression mechanism to reduce files the size interval of time but the other is software based.

Computer screens (to date) have very high resolution and colour depth, up to 1280 \* 1024 (1,310,720 pixels), or even higher. The captured screen frame image has the same colour depth as the screen itself, and use a lot of computer memory to store. Each frame image can be compressed and the complete video file size can be reduced. Most images contain some amount of redundancy and human eyes are very tolerant to a wide variety of information loss. The video re-screening will still be considered as high quality if the removed redundancy of each frame is not detectable by human eyes or does not contribute to degradation of the image. Hence, the final video file can be greatly compressed via changing the quality of each frame image by removing its redundancy data. This method might depend on performance settings and produce slow or jerky motion at high computer screen resolution. The next approach is to analyse the complete video file at certain time intervals and look for the least amount of frame image needed to

store during that interval. Presentations on computer screen usually have high temporal and spatial redundancy.

#### 4. Computer screen movements recorded with Camtasia

The authors used Camtasia to record video of the computer screen activity (Figure 3). They also used a camcorder to make video recording showing both individuals working in the classroom and their work in the BSCWII. Using a camcorder is probably the simplest method to record screen activities. The camcorder is set up on a tripod, pointed at the screen and record is made. Although simple, the resulting video is usually unclear and hard to read. This technique is useful for getting an idea of what the user did, but it can be difficult (sometimes impossible) to read small text (Goodwin, 2005). Sometimes the frequency of the screen does not match the video camcorder when it is recorded and the images of the computer screen movement are unclear.

Camtasia is a software solution or a program that runs in the background, silently capturing everything that appears on the screen and saving it to a video file. The result is recording with no loss of detail. Each frame of the resulting video can serve as a screenshot and allows seeing the video at different speed. The software is not

intended to facilitate live interaction between multiple computers or many users. As the name implies, Camtasia mimics the behaviour of a video camera. As a result, it shares many of the benefits of videotaping while avoiding several of the pitfalls (Goodwin, 2005).

Camtasia consists of three pieces of software: the Recorder, the Player, and the Producer. The Recorder must be set up on the computer to be used. Before the video recording begins, a test administrator sets the software to record. From that time onwards Camtasia records all activities on the screen. Recordings are saved in avi file format. It may also record the sound.

The Camtasia Recorder can record the whole screen or a particular window. It can also be set to highlight the mouse clicks. For instance, a highly visible red circle appears around the mouse pointer as it clicks, making it easy for the observer to see essential actions on the screen. On the other hand, these highlights occur on the user's computer as they are applying it. It may be too disruptive to use this feature while attempting to test a user in a natural situation (Goodwin, 2005).

The recorded file is explored with the Player. The capture plays back in real-time, but the player includes standard controls to pause, fast forward, and rewind the recording. The quality of the playback can vary depending on how well the recording software is set up for the computer. Without any configuration, the recorded image can be rather degraded and the cursor travels jumpy. After configuration, the quality becomes quite satisfactory.

The Producer enables the observer to edit the video taking the most important sessions out according to his findings. This work can be saved in different formats and set up as a part of a power point presentation. The observer can then set it up on the Internet as an online presentation of the research.

#### 5. The value of video records research based computer activities

A part of the case study was to observe the usefulness and the quality of the BSCWII for innovative collaborative work amongst students. Researchers use video to study human-computer interaction and collaborative work. In

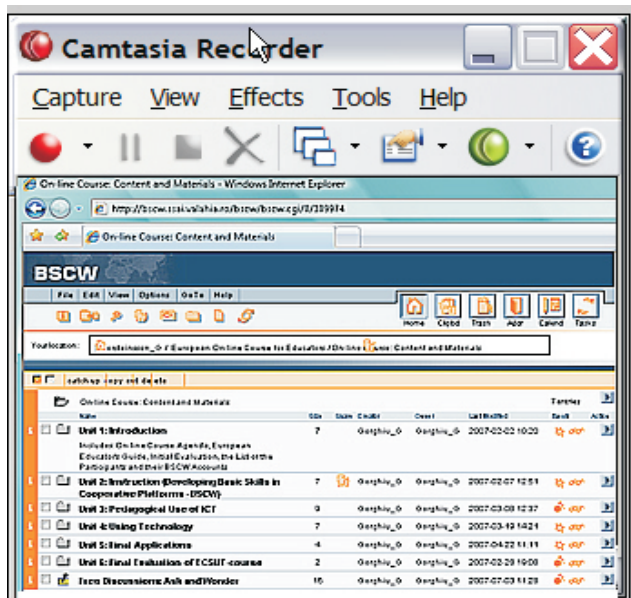


Figure 3. Using Camtasia enables the researcher to collect rich data.



the commercial world, human factors consultants use it to identify problems with hardware and software products and to convince developers to make appropriate changes. Software designers use it to demonstrate future uses of new software. Managers use it to record and analyse teleconferenced meetings with participants from remote sites.

Video recordings can be very useful as data but very time-consuming to analyse and cumbersome to edit. As the information is recorded serially in real time, video has traditionally required real-time analysis. Without computer support, creating a 15-minute videotape demonstration or analysing a one-hour session can require day's or more work. Another, more subtle, problem is the difficulty associated with publishing video data. We do not have the equivalent of statistical methods that provide verifiable and agreed-upon summaries of video-based results. The very richness of the data makes it difficult to compress it in meaningful ways. However, researchers have begun developing computer-assisted tools and techniques for capturing and analysing video data that attempt to address these problems.

Video is also often used to record and analyse classroom based activities and human computer interaction in educational settings. To avoid the problem of misinterpreting events, the researcher does not passively observe sessions. Instead, the researcher works with the subject to reach a shared understanding of the events. This helps to shorten subsequent analysis of the session and increases the probability of understanding what actually occurred.

Video is important when examining the interactions among users of software based on innovative or design activities. An individual researcher cannot possibly observe all the individuals in the group and the interactions among them. Video can capture the overall process more broadly and can help trace the genesis, development, and resolution, for example, of reflections among individuals discussing design decisions. This analysis can also identify breakdowns that arise specifically at the team level. Video-based records can be triangulated with other data, such as observer's notes,

to evaluate the benefits of new technologies.

## 6. Screen captures from case studies inside the BSCWII

The authors collected screen capture videos with Camtasia and based analysis on grounded theory. Grounded theory consists of a systematic inductive strategy for collecting and analysing data in order to construct theoretical frameworks that describe the collected data. This enables the researcher to identify emerging categories in a set of data and then to develop initial hypotheses which can be tested iteratively. It focuses on obtaining an abstract analytical schema of a phenomenon related to a particular situation (Creswell, 1998).

Codes and categories are sorted, compared, and contrasted until all the data are accounted for in the core categories of the grounded theory model, and no new codes or categories can be formed, i.e. saturation is reached (Creswell, 1998). The researcher also needs to write analytic and self-reflective memoranda to document and enrich the analytical procedure, to make understood thoughts clear, and to expand the data quantity. Analytical memoranda consist of questions and speculation about the data and emerging theory.

Group of four English in-service teachers took part in three case studies in order to observe their ability to work together cooperatively inside the BSCWII. The teachers were from a secondary school in England and randomly chosen from a group of few volunteers. The BSCWII was set up as a collaborative communication-learning tool to support the teachers work.

The authors used the software Camtasia to collect data from teachers' activities inside BSCWII, when they were working together. They used two computers in order to capture videos from different angles and to ensure the amount of the data. In order to triangulate the data they also conducted semi-structured interviews with the teachers. By observing the video recorded with Camtasia it was possible to gain a pedagogical understanding for the value of using the BSCWII as a computer collaborative tool to support the in-service teachers' work. The interviews with the teachers informed about their working

experiences. The observer used the data to answer the following questions:

1. What are the advantages of using Camtasia as a data collection tool?
2. What are the ethical issues, disadvantages, and limitations of using Camtasia as a data collection tool?

## 7. Transana to analyse the video

The specific software Transana was used to analyse the video (Figure 4). By using the software it was possible to analyse the video and see the ongoing cooperation. Transana (Fassnact & Woods, 2005) is a qualitative computer-based analysis tool, which allows the researcher to work with large collections of video. It provides various tools and metaphors for organizing, analyzing, and retrieving videos, segments of videos, and transcriptions of videos.

Transana is a very user-friendly tool that can be easily learned through its embedded tutorial. For the purposes of this study the first author had also the opportunity to attend a two day (free) training course for Transana by its designer, at the University of Wisconsin. There is also much support through the Transana users' list-serve. The programme has been designed for educational research, but used in a wide variety of fields. It is designed to handle large video collections and to facilitate the management of those. Its major benefit is the combination of both audio and video with text analysis (transcripts). Therefore, it is complementary to the written text of the semi-structured observation schedule (Sylva et al., 1980), used for data collection in this study. The

different transcripts of an observation schedule can be transferred to different Transana transcript windows.

Then transcripts can time-coded and synchronized with the same piece of video. As a result, application of coding schemes for different observations (in this case verbal and non-verbal interaction) corresponds to pieces of transcripts, as well as to the particular video and audio sections. In other words, with the software the researcher had the opportunity to synchronize the video footage with corresponding pieces of transcripts and get all text, image and sound for each behaviour and event. Therefore, after establishing coding structures, protocols were derived directly from videos, along with the particular parts of the transcripts and segmented into clips. This obviously facilitated documentation of analysis and the interpretation of data.

## 8. Findings from the pilot study and discussion

### 8.1 Advantages

Remote screen recordings enabled us to collect detailed recordings on students' collaborations through their computers while working in a natural conventional class setting. This can be undertaken from a computer screen without disturbing students. At the same time it allows collecting rich, empirical data on users' interactions with their computers. This is achievable without physical video equipment in participants' work environments that interrupt their normal work practices and interactions with others (Tang e tal., 2006). Dissimilar to direct observations, there is no physical presence of an observer that can be disturbing for the students (appear like a shadow) in the classroom. Remote observations create permanent data that can be analysed later and does not rely on real-time note taking that is inevitably selective. It also gives a more detailed record of the user's interactions than a diary or literature based study and with less user effort (Tang e tal., 2006). The video data recorded by Camtasia can also be viewed by using standard software included in the windows system and the file format does not require modification.

Camtasia gives visible feedback on the computer screen when it is recording and offers an easy interface for

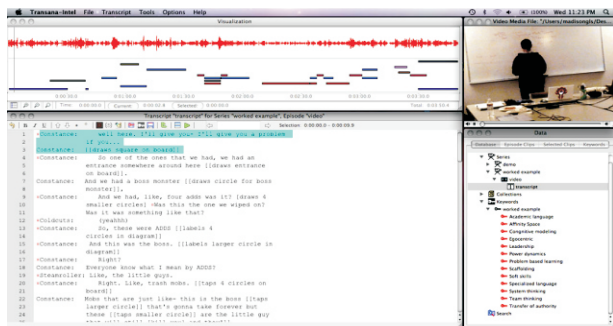


Figure 4. Transana Screen Capture showing (clockwise from top right) the video frame, the coding frame, the transcript, and the waveform of the audio.

pausing, restarting, and ending recording using computer hotkeys. If the screen recordings are made on individual computers it allows the participant to control what is being recorded and enables the establishment of trust between the administering observer and the students.

## **8.2 Ethical issues, disadvantages, and limitations**

It is important to build trust between the observer and the students before the remote screen-recording tool is used. The observer should set up a contract between him and the participants or their legal guardian. This contract should include clauses about personal protection of the participants, how the data will be used and who will be allowed to use it (Smith and Benjamin, 1989). If trust is not established in the beginning of the enquiry, the participants might not act confidently and this might affect the value of the collected data.

Using remote screen recordings is an invasion to the users' computer. The software generates an exact copy of what the participants see on their screen and the observer can replay his record for others. It therefore important for the participants to understand their privacies limitations or they are not just exposing their own activities, but also interacting with the people with whom they collaborate via their computers (Tang et al., 2006).

Sometimes video observation would be less of a concern if it would not capture a detailed record of the information. These kinds of rich empirical recording studies are difficult since it increase the awareness of digital privacy and surveillance implications. Most institutions have some kind of common monitor to detect unwanted uses of the computing infrastructure. However, this has been recognised as a source of workplace stress (Smith and Benjamin, 1989).

Tang et al. (Tang et al., 2006) research on remote computer screen recordings showed evidences that observation with such a technology can alter the participants' behaviour. This would also occur with other observation methods such as video-based observation, and shadowing (Redish and Wixon, 2003). The recordings enclosed some isolated instances, such as a warning in a

personal expressions, "can't be goofy, I'm being taped". A number of self-reports of changing their behaviour emerged in the post-interviews, such as one participant who consciously limited the amount of time viewing a particular shared workspace due to the business-confidential information that it contained.

One of the screen recording method limitations is that it only captures the interactions participants have with their computers and excludes other surrounding context. As this author undertook his enquiry in a conventional classroom, he framed direct observation and video-based observation to capture offline work and collaboration activities outside of the computer. This enabled him to see the worth of the BSCWII collaboration support inside or the IE conventional class.

Recording audio with the screen recording software at the same time can give some data of the interactions external to the computer. This is when participants in the same room speak together wearing their headsets. However, the main data record is from the movements on the computer screen and limited to what happens within the computer.

One possible disadvantage of using screen recording concerns the installation of the specific software. If the researcher has no control over the participants' computer in the field this might raise practical issues. Sometimes he might have to get licence from an administrator in the institution to install it or ask him to do it. He might as well have to upgrade some of the system's utility, as the DirectX drivers for the graphic card. The ability to run the screen-recording software also depends on the capability and limitations of the participant's computer, such as its processing performance, available hard disk space, and access rights. Few of the computers used in this enquiry were on the limits to be able to run Camtasia and it slowed down when it was used. This affected students' work and was disturbing. Another problem faced was that after recording for more than 15-20 minutes the audio went out of synchrony with the video.

## **Conclusions**

This pilot research has examined the possibilities of using

the software Camtasia and Transana for remote observation to collect and analyse empirical data. This project and other recent research projects have shown the value of collecting rich empirical data of collaborative work through remote screen recording observations (Ruhleder & Jordan, 1997). Using such an observation method was also useful for collecting data of the activities inside the BSCWII to gain clear ideas of the pedagogical values of using it in the context of in-service teacher education.

The remote software can provide this rich data. In order to understand the values of the collaborative activities, when the BSCWII was used, recordings of the in-service teachers' working process are necessary. This requires access to all their work including conversations and emails and other computer-mediated interactions needed for the study.

Privacy concerns around video-based observation are not new (Wendy, 1995). Screen recording technology should be used with respect to avoid abuses. Obtaining records of users' computer activities relies on negotiating a sense of trust with the participants. The invasive nature of recording the user's interactions on their computer was a critical issue in the study. The researchers had to establish trust between them, the teacher, the participants, and their families.

This research shows that remote screen recording is a valuable method for unobtrusively collecting rich, empirical data on actual computer usage in the field. The approach enabled the researchers to focus on the users' interactions with and through their computers with minimal modification to their computers, apparently without disturbing their work or affecting the BSCWII activities. It also created a record that could be reviewed with the participants to see their reactions. The screen recordings helped to investigate how in-service teachers accomplish their collaborations, what problems they encounter, and how the whole process affected their skills for using on-line platform.

## References

[1]. Allen, J. G. and Jin, J. S., (2001). Enhancing Screen

Teleconferencing with Streaming SIMD Extensions. Pan-Sydney Workshop on Visual Information Processing, Sydney, Australia, 11: 143-149, ACS.

[2]. Carmichael P. and Honour L. (2000). Open Source as appropriate technology for global education. *International Journal of Educational Development* 22 (2002) 47-53.

[3]. Crook C. (1994). *Computers and the collaborative experience of learning*. London: Routledge.

[4]. Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage.

[5]. Denzin, N. K., & Lincoln, Y. S. (1994). (Eds). *Handbook of Qualitative Research*. Thousand Oaks, CA: Sage Publications, Inc.

[6]. Ellis, C. A., S. J. Gibbs, and G. L. Rein (1991): Groupware: Some issues and experiences. *Communications of the ACM*, Vol. 34, No. 1, January 1991, pp. 38-58.

[7]. Goodwin S., (2005). Using screen capture software for web site usability and redesign buy-in. *Library Hi Tech* Vol. 23 No. 4, 2005 pp. 610-621. Emerald Group Publishing Limited, Texas University.

[8]. Ivory J. Y., Hearst M. A. (2001). "The State of the Art in Automating Usability Evaluation of User Interfaces." *ACM Computing Surveys* 33, no. 4 (Dec. 2001): 470-516.

[9]. Janice, R. & Dennis D., W., (2003). "Task Analysis", chapter in *The Human Computer Interaction Handbook*, Jacko J. A. and Sears A. (Eds.), Mahwah, NJ: Lawrence Erlbaum Associates, pp. 922-940. ISBN: 0-8058-4468-6.

[10]. Redish J. & Wixon D. (2003). "Task Analysis", in *The Human Computer Interaction Handbook*, Jacko J. A. and Sears A. (Eds.), Mahwah, NJ: Lawrence Erlbaum Associates, 2003, pp. 922-940.

[11]. Ruhleder, K., & Jordan B. (1997) "Capturing Complex, Distributed Activities: Video-Based Interaction Analysis as a Component of Workplace Ethnography", in *Information Systems and Qualitative Research*, A.S. Lee, J. Liebenau, and J.I. DeGross (Eds.), London: Chapman and Hall, 1997, pp. 246-275.



[12]. Smith M., & Benjamin C. A. (1989). "Electronic monitoring at the Workplace: Implications for Employee Control and Job Stress," in *Job Control and Work Health*, L. Sauter et al. (Eds.), Wiley, 1989, pp 275-289.

[13]. Tang J. C., Liu S., Muller M., Drews C., (2006). Lin J. Unobtrusive but Invasive: Using Screen Recording to Collect Field Data on Computer-Mediated Interaction. CSCW 2006 - Computer-Supported Cooperative Work.

ACM, May 2006.

[14]. The Camtasia producer's homepage (2007). Camtasia Screen Capture SDK. <http://www.techsmith.com> (18.March, 2007).

[15]. Wendy M., (1995). "Ethics, Lies, and Videotape", *Proc. of the Conference on Human Factors in Computing Systems (CHI '95)*, Denver, May 1995, pp.138-145.

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