Learning by Collaborative Analysis of Digital Video in Distributed Groups

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Abstract: Video is taken advantage of in different educational settings. In the simplest cases, teachers might present movies on video to their students in the classroom. In more advanced cases, videos might be made during exercise and training in order to provide visual and dynamic feedback to the trainees, for example. In educational settings, very often videos are watched, commented on and analyzed in face-to-face groups. Since more and more frequently educational settings involve learning in distributed groups, the question comes up, how one could take advantage of video in groups in which the members communicate and cooperate by means of networked computers. In this paper we describe v-share, an Internet-based software package that allows for the sharing of digital videos in distributed groups. By means of v-share, members of distributed groups are able to interactively select sequences of digital videos for collaborative annotation, analysis and reflection.

Keywords: Collaborative learning, distributed groups, video analysis, teacher training.

Introduction

Video is taken advantage of in a number of educational settings. In the most obvious application, teachers might present documentaries, reportages or movies on video to their students in the classroom. In many cases, such an application of video in the classroom is structured by means of at least three different phases. In the first phase, teachers and students cooperatively develop and formulate questions which aim at guiding the students’ perception and processing of the video. In the second phase, the video is watched in the classroom. In the third phase, the video is commented on, analyzed and discussed in the classroom with respect to initially formulated questions.

In more advanced applications, videos might be made while certain skills are trained or exercised in order to provide visual and dynamic feedback to the trainees. For instance, videos might be made while students train their presentation skills in the classroom. In the context of teacher training, videos might be made while pre-service or in-service teachers exercise or further develop their teaching skills. In order to make these applications of video effective and efficient, they are frequently structured by means of phases comparable to those described above. Initially, teachers and students might cooperatively decide to focus their analysis on a certain sub-skill. With respect to these applications of video, however, such a focus might not only guide the students’ perception and processing of the video but also the recording of the video. After the video has been made, it might jointly be watched in the classroom. Finally, the video is commented on, analyzed and discussed by the participating students and teachers.

In all of these educational settings various questions may arise. After watching the video in the classroom, the video’s analysis and discussion largely rely on the participants’ memories of the video’s content. As the participants will most probably not only have incomplete but also different memories of the video, the question arises, whether certain parts of the video should be played back during the discussion in order to make the missing information accessible. Furthermore, different participants might refer in their analyses to different parts of the video which might impede the discussion or even result in misunderstandings. Again, the question arises, whether the video should be played back in order to clarify to which parts of the video the participants refer. A further question is how the analyses and discussions of the video can be documented in such a way that they remain unambiguously related to those video recordings which gave rise to them. Furthermore, because more and more frequently educational settings involve learning in distributed groups, the question comes up, how one could take advantage of video in groups in which the participants communicate and cooperate by means of networked computers.

In this paper we describe v-share (www.v-share.de), a program that is fully integrated into the World Wide Web and that allows for sharing digital videos in groups. By means of v-share, group members are able to interactively select sequences of digital videos for collaborative annotation, analysis and reflection. Although v-share might well be employed in face-to-face groups, it primarily aims at supporting video-based analysis, discussion and reflection in distributed groups.

In the first part of this paper, we describe the main elements of v-share’s user interface. In the second part, we delineate the pedagogical design of v-share, which is...
made up of three components: (1) the use of digital video (2) for asynchronous and collaborative analysis, discussion und reflection (3) structured by a moderator. In the third part, the technical realization of v-share is put forward. In the fourth part, it is described how v-share is employed for collaborative analysis and reflection in teacher training at the University of Education in Freiburg. An outlook on future developments of v-share concludes the paper.

The v-share Workspace

The program v-share is fully integrated into the World Wide Web and is thus accessible by means of standard browsers. Figure 1 shows a screenshot of a workspace in v-share. The workspace is made up of four main areas. A small area at the very top of the workspace comprises buttons for logging in and out as well as for managing a personal profile. The area on the left hand side comprises an overview of a course. It might contain active links referring to themes to be addressed and materials to be used during the course, for example. Navigation within the course mainly takes place by making use of the links provided by this overview.

The video display is located in the middle area of the workspace. It allows for playing, stopping and rewinding video-sequences as well as for determining sub-sequences of videos by choosing in- and outpoints. This makes it possible to select specific sequences of videos for commenting. The area on the right hand side contains a bulletin board. After a sub-sequence of a video has been determined by choosing an in- and outpoint and a comment has been provided, the comment is listed in the bulletin board. Every comment submitted to the bulletin board includes a button to show the video-sequence the comment refers to, enabling the users to refer back to these sequences. Furthermore, users may reply to each other’s comments and quote comments of their peers. All comments are organized in tree-like diagrams with comments as roots and replies as branches of the trees. The bulletin board offers the possibility of expanding certain trees of interest and collapsing all other trees. Every comment has the author’s name and photo attached to it in order to personalize the comment at first sight. Furthermore, video and bulletin board may be used in synchronization-mode. In synchronization-mode, the comments that refer to a displayed video sequence are highlighted while playing the video. This supports users in gaining a first overview of the comments written with respect to a certain video sequence.

Pedagogical Design

Using Video

The program v-share aims at supporting the collaborative analysis of video in distributed groups. However, making videos during exercise and training, for example, has its own challenges. Unless a 360-degree video camera is available (cf. Pea, Mills, Rosen, Dauber, Effelsberg & Hoffert, 2004), very often video cameras can only capture a limited region of the whole setting. Therefore, events taking place outside this region cannot be displayed during the video analysis. This clipping can be minimized, however, by instructing the video grapher on the basis of a screenplay that describes which parts of a setting are to be captured in which period of time. Although it might be very difficult to capture all important objects, events and interactions in real time, analyses of video recordings have several significant advantages in comparison to discussions of direct observations. For instance, without video recordings the actors as well as the observers have to rely exclusively on their written notes and memories. Furthermore, video offers the possibility to replay interesting scenes several times and to focus each time on different aspects of a scene. This allows for the adoption of multiple perspectives on a scene (Van Es & Sherin, 2002). Video recordings also make it possible to participate in the analysis of and reflection on an event without the need to participate in the event itself. According to Clark’s (1996) theory on achieving common ground in communication, video recordings may also serve as a shared external reference for discussion. Instead of verbally circumscribing objects, events or interactions, they can easily be referred to by showing the corresponding video sequence.

Asynchronous Collaboration in Distributed Groups

Collaborative analysis of video results in different perspectives on one and the same event. According to the socio-constructivist theory of learning (e.g., Doise & Mugny, 1984), students learn from different perspectives when they identify and resolve them, present alternative views as well as provide and ask for explanations. Furthermore, the theory of cognitive dissonance (Festinger, 1957) states that different perspectives among the members of a group induce cognitive dissonance in the individual participants. This encourages the individual students to reduce dissonance by
communicating with their peers and by revising their points of view. For instance, Stevens (1997) was able to support this theoretical view and further underline the importance of the collaborative use of video by making use of the video analysis tool “Video Traces”. Although v-share might be employed for analyzing video in face-to-face meetings, it primarily aims at supporting asynchronous collaboration in distributed groups. While in synchronous face-to-face meetings only one student can contribute to an analysis at a time, v-share allows for asynchronous communication as well as for several contributions to an analysis at a time. This might be of special importance during phases in which ideas need to be generated and collected and cognitive blocking of contributions due to waiting times is to be avoided (e.g., Diehl & Stroebe, 1991). In addition, Quinn et al. (1983) observed that contributions to asynchronous discussions are more detailed and elaborate than contributions to synchronous discussions due to the lower frequency of turn-taking. Features such as the permanency of written contributions, the reversibility of contributions and the lack of time pressure during the formulation of contributions might further increase the quality of contributions (cf. Clark & Brennan, 1991). Furthermore, cognitive resources bound to para-verbal and non-verbal behavior in face-to-face communication are freed and can be allocated to writing contributions in computer-mediated communication (cf. Matheson & Zanna, 1988).

**Moderation**

While computer-mediated communication has several advantages in comparison to face-to-face communication, there are also specific difficulties related to it. The missing synchronicity in computer-mediated communication can easily lead to contributions, replies to contributions and the creation of new threads that result in a complex discussion structure. Students might have severe difficulties in constructing a coherent view of such a discussion and in reaching shared understanding (e.g., Hron, Hesse, Cress & Giovis, 2000; Levin et al., 1990). Therefore, the use of v-share in a distributed group should be combined with having a moderator. She or he assigns tasks to students, encourages students to resolve and to integrate different perspectives, raises stimulating questions when the discussion makes no further progress and provides summaries in order to foster coherence-building, for example.

**Technical Realization**

v-share has been realized as an extension of the open source application Typo3 (www.typo3.org). Typo3 allows for the creation of complex document structures on the basis of HTML-templates. Different types of content elements such as text elements and picture elements may be included in documents without the need to make use of HTML or programming languages. Typo3 relies on the open source database MySQL and the scripting language PHP. It provides a pre-built administration environment – the backend – for the creation and distribution of content. For instance, like any other content element that is available within Typo3, the v-share bulletin board may be included in any document. Installation and configuration of the v-share extension is completely handled by the backend, which simplifies the use of a v-share workspace. By default, Typo3 supports user and group authorization as well as authentication. Furthermore, these authorization and authentication methods can easily be used in extensions such as the v-share workspace. A wide range of already developed extensions can be seamlessly integrated in any Typo3-based document structure. For instance, in v-share we took advantage of extensions for synchronous and asynchronous communication as well as for workspace awareness. Different configurations of the v-share workspace are also possible. For example, different groups of users with different rights may be specified and different videos can be selected to be displayed in the workspace. The center of the v-share workspace is formed by the combination of the video display and the bulletin board. Its realization relies on various Internet technologies. For instance, JavaScript is used to determine the actual time stamp of the video-playhead when the user selects the in- and outpost of the sequence she or he wants to refer to. When a comment is typed into the workspace, the subject, the text, the attached files, information about the user and the selected in- and outpost are passed to the MySQL database using PHP as a scripting language. These data are again retrieved from the database when the bulletin board is displayed in the workspace. Videos are encoded in the RealPlayer-format for delivery over the Internet. Real is one of the most popular media codecs and players are available for all major operating systems. The surestream technology provided by Real allows for the delivery of videos that fit the bandwidth available to the user. When the server detects a high-bandwidth connection like DSL it automatically delivers high-quality video while at the same time giving other users the possibility of receiving low-quality video over low-bandwidth connections such as ISDN or modern connections. To distribute surestream-videos, the use of the Helix DNA server is obligatory. It is available under open source license. RealPlayer also supports the Synchronized Multimedia Integration Language (SMIL). This language offers various possibilities to combine audio, video, text and graphics in real time and to control dynamic documents on the Internet. In v-share, SMIL is used to synchronize the playing of video sequences and the highlighting of comments which refer to the displayed sequences.
An Example Application: Using v-share for Analysis and Reflection in Teacher Training

Theoretical Background

Successful teacher education links methodological theory and teaching practice. Research further indicates that student teachers’ acquisition of pedagogical knowledge and skills can be fostered if they are supported in reflecting on their teaching practices individually. Reflection on teaching practices is of importance because it enables practitioners to assess, understand and learn through their experiences. A process of reflection that reviews, analyses and evaluates experiences should be tightly connected to theoretical concepts and previous learning experiences and provide a plan for the shaping of future experiences (Kemmis, 1985).

Examples of instructional measures that foster student teachers’ reflection skills are the teaching of self-regulatory strategies such as planning, self-monitoring and self-assessment, as well as the encouragement to share experiences and reflective thoughts with lecturers and fellow student teachers (Dewey, 1938/1986; Schön, 1987). In addition, the lecturer’s role is essential in focusing student teachers’ reflection processes on teaching situations which may pass by without the student teachers’ awareness (Hovelynck, 2000). Furthermore, several learning-to-teach studies indicate that student teachers who are required to structure and verbalize the pedagogical knowledge underlying their teaching practices are more successful in distancing themselves from their practices and therefore are more able to reflect on these practices. The development of the ability of reflection-on-action (Schön, 1987) seems to be further enhanced by having student teachers carry out classroom research projects.

Over the last ten years, time and location independent pre- and in-service teacher training in distributed groups has gained importance. However, the analysis of and reflection on teaching practices cannot be realized in distributed groups with the same means available in traditional face-to-face teacher education. What lacks most of all in distributed groups is the possibility to reflect cooperatively on shared teaching experiences by engaging in a focused inquiry dialogue with lecturers and peers.

The Use of v-share

Since the summer term 2004 v-share is being employed in teacher training seminars at the University of Education, Freiburg. During the seminar, various teaching methods are discussed while taking student teachers’ learning biographies into account. Student teachers develop criteria for specific teaching methods such as the sequence of teaching activities and the role of the teacher as well as the role of the learners. Based on these criteria student teachers develop lesson plans. They individually select a focus of observation and reflection for their lesson. This focus might be derived from teaching theory, methodological concepts or personal interests. Subsequently, the lecturer and the student teachers jointly develop observation sheets, which help to focus the observation in the classroom as well as the analysis of the video-recorded lesson.

The student teachers teach their lessons individually or in pairs. In accord with the selected focus of observation, specific parts of the lesson are recorded by means of a digital camera and are made available in v-share. The student teachers are supported by a tutor who is skilled in using software for video encoding, video cutting and video streaming. Different video sequences are time-stamped to make clear when a scene took place in the lesson.

At the beginning of a course, student teachers register in the v-share workspace by entering their personal data (e.g., name, e-mail address and photo). After registration, the student teachers are able to access the workspace. All material created by the student teachers is now personalized with the data they provided during the registration process, which increases the degree of environmental and personal presence (Sadovski & Stanny, 2002). The student teachers use v-share to publish and distribute the documents they are creating throughout the course. This includes writings on their learning biographies, summaries of theoretical articles, observation sheets, lesson plans and synopses. Documents might be created in the v-share workspace or uploaded as attachments. The creation of documents in the v-share workspace is supported by means of a rich text editor, which enables the student teachers to make use of different fonts, colors, listings, etc. Published documents may be re-edited by the authors. On the basis of theory-based feedback, first the student teacher, then his/her fellow student teachers comment on the selected video sequences. Before the student teachers have to comment on the video sequences for a second time, the lecturer focuses the reflection process on points of relevance. The reflective process concludes with a synopsis written by the student teacher who taught the lesson in question. In v-share not only comments may be linked to video-sequences but also synopses written by student teachers as conclusions of the reflection processes. This makes it easy for fellow student teachers to refer back to those parts of a lesson mentioned in a student teacher’s synopsis. Finally, the integrated organization of documents on teaching theories and methodologies, lesson plans, video-linked comments and synopses in one workspace enable “third-party-students” to “replay” the process of development.

Empirical Study

Making use of v-share as a research tool, we empirically investigate the use of v-share for analysis and reflection in teacher training. The main goals of the study are (1) to gather experiences with v-share, (2) to adjust v-share’s design, and (3) to enable the development and testing of
criteria which allow us to assess the student teachers’ reflections. We also aim at evaluating the impact of video recordings on the student teachers’ analysis and reflection processes. Despite the high attractiveness of video for teacher education only few empirical findings confirm its assumed beneficial effects on teacher training (e.g., Brophy, 2004; Krammer & Reusser, 2004).

In order to assess the video recordings’ impact on students’ reflection processes, in a first field study the first half of the students’ online discussions took place without making use of video whereas the second half of the students’ online discussions took place by making use of video. While the contributions of the first half are termed “standard discussions”, the contributions of the second half are termed “video-based discussions”.

An analysis of the student teachers’ written contributions to the online discussions indicates that the video recordings have positive effects on the student teachers’ analysis and reflection processes. With respect to various dimensions the standard discussions differed considerably from the video discussions.

One dimension along which the discussions differed concerns the number of topics student teachers addressed in their contributions and whether or not their fellow students drew on these topics in their replies. In standard discussions more topics – sometimes up to eight different topics (6.08 on average) – were addressed than in video discussions – usually only one or two topics (1.60 on average). In most of the cases, less than half of the aspects students mentioned in standard discussions were taken up by their fellow students. In contrast to this, almost all of the aspects brought up by students in the video discussions were further discussed by the other students. This might be due to several factors. One factor might be that in video discussions students were asked to link a contribution to a video sequence which demonstrated their point of view. This requirement probably made them concentrate on only a few aspects. In turn, for their fellow students the video sequence illustrated the meaning of the author’s contribution and thereby helped them to reply meaningfully.

A further difference was length of discussions. In standard discussions students wrote longer but fewer contributions than in video discussions (see Table 1).

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<th>Standard discussions</th>
<th>Video-based discussions</th>
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<tr>
<td>Average number of words per comment</td>
<td>128</td>
<td>73</td>
</tr>
<tr>
<td>Average number of comments per discussion</td>
<td>17</td>
<td>31</td>
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Overall the standard discussions tended to be slightly longer than the video discussions (3055 words on average in standard discussions vs. 2834 words on average in video discussions), but the contributions varied considerably according to their descriptive or analytic orientation. In standard discussions, the contributions were mostly descriptive and comprised only few analytic elements. In video discussions, it was rather the other way round. The video recordings obviously helped the student who taught the lesson as well as the observing students to analyze the lesson more deeply. Furthermore, the video discussions were mostly organized around pedagogical, didactical or methodological topics, whereas standard discussions very often described classroom events in a chronological order.

Accordingly, in interviews and questionnaires student teachers argued that being able to watch the video recordings several times allowed them to adopt multiple perspectives on the lesson. They emphasized that this made it easier for them not only to realize their own mistakes but to also notice positive aspects that went by unnoticed during the actual teaching. The student teachers felt that this had an effect on their learning. They pointed out that with the help of the video they were able to learn from their fellow students’ and their lecturer’s perspectives on their teaching recordings, when they provided and asked for explanations.

The questionnaires and interviews brought to light further interesting characteristics of the v-share learning setting in students’ eyes. The student teachers pointed out that the video recordings of their own and fellow students’ teaching helped them to relate to the videos whereas recordings of a stranger’s lesson would not have had the same effect. They were convinced that the authenticity of the recordings increased their motivation to reflect on the lesson. This supports our approach of using student teachers’ own lesson recordings instead of relying only on best-practice examples, an approach favored by other researchers.

Future Developments

In the future, we intend to employ v-share in further educational settings. For instance, we intend to use v-share as a tool for analyzing movies in the classroom and for supporting students’ acquisition of presentation skills. A further development will be to take advantage of v-share in order to systematically collect, annotate, retrieve, display and analyze videos of short teaching episodes which are interesting to teachers and trainers of teachers from a theoretical, methodological or practical point of view (e.g., Derry, Seymour, Lee & Siegel, in press; Hiebert et al., 2003).
References


