

Facilitator's invisible expertise and supra-situational activities in a telelearning environment

Ulf Hedestig, Victor Kaptelinin
 Department of Informatics,
 Umeå University,
 901 87 Umeå, SWEDEN
 {uhstig, vklinin}@informatik.umu.se

Abstract

The paper reports a study of a videoconference-based environment in decentralized university education and factors determining the success of teaching and learning in the environment. The focus of the paper is on the role of a person having the formal responsibilities of a technician. An ethnographic study conducted over the course of a year revealed that the contribution of this person far exceeded the scope of formal responsibilities. The person, who was acting in the setting as a facilitator, was found to possess expertise, which was critically important for supporting interaction between remote participants at several levels, such as attention management, time management, acquisition of setting-specific skills, and coordination within a larger institutional context. The findings suggest that "supra-situational" activities can be an important factor of successful functioning and development of emerging learning environments.

1. Introduction

Telelearning environments requiring immersive presence aim at supporting cognitive, social, emotional, and perceptual engagement of geographically distributed participants in collaborative learning activities. New information and communication technologies open up possibilities for providing new types of access to learning that can dramatically increase the number and the diversity of potential students, as well as the range of learning activities, in which the students can take part. However, making the potential benefits of technology-supported immersive learning environments come true is associated with serious challenges. According to existing literature on the topic, many attempts to implement these types of environments have not been particularly successful, and a substantial fraction can be considered downright failures, see [19, 26]

The future development of immersive environments for computer-supported collaborative learning (CSCL) is

expected to be directed towards two main goals: (a) design of technologically advanced environments, which will capitalize upon state-of-the-art hardware, software, and communication infrastructure to make collaboration more fast, reliable, rich, and intelligent, and (b) design of learning activities, that is, creating new collaborative learning contexts, which would help to make the full use of the potential provided by technology. In terms of Jean Piaget's genetic epistemology [21] these two interrelated directions of development can be described as, respectively, assimilation and accommodation, that is, changing technologies to make them better serve the goals of education and changing teaching and learning to meet the challenges presented by new technologies.

This paper mainly deals with the second aspect, that is, design of learning activities and settings. This aspect appears to be relatively underdeveloped in current research comparing to technology-related issues, even though creating appropriate educational and social contexts is apparently no less important than creating advanced technologies.

High-end virtual realities can provide a remarkable perceptual presence but little or no social, cognitive, and emotional engagement. On the other hand, the use of very basic technologies, such as simple chat facilities or instant messaging systems, can result in intensive immersion experience sustained for many hours.

This does not mean, of course, that sophisticated technologies should not be used in education but rather that technological design of educational settings should be complimented with design of individual and group activities that the setting is intended to support. Undoubtedly, there are new and potentially important possibilities associated with more advanced technologies. However, these possibilities can only be utilized and result in educationally beneficial immersive environments if they fit into the structure of teaching and learning. A similar claim is made by Harrison and Dourish [8] who refer to the limitations of purely spatial models in the design of virtual environments and suggest a metaphor of "place" instead of "space". The latter is a

cultural phenomenon supporting an appropriate behavioral framing.

The use and development of technology cannot be the main goal in creating learning environments, computer-supported or not. The only criterion, according to which an learning environment can be considered successful (or otherwise) is whether or not it helps people and organizations involved to reach their meaningful goals, which goals are essentially the same in all types of environments. Therefore, it can be concluded that design of computer support for learning should be subordinated to design of teaching and learning.

The above conclusion, however, cannot be interpreted as a claim for a straightforward “waterfall” model of educational technology design, that is, an arrangement, according to which educators would compile a list of requirements and hand it over to system developers to be implemented, somewhere “down the river”, in a system meeting these requirements. As already mentioned, successful technology-supported learning environments can only emerge as a result of bridging the gap between technology and learning activities through their mutual adjustments, see also [13]. In our view, one of the most important objectives of research in the area of Computer Support for Collaborative Learning (CSCL) should be providing an insight into how technological affordances and limitations are related to the specifics of teaching and learning. Such a research can contribute to bridging the above gap at two levels. At a more specific level, the positive and negative aspects of the use of technology in a setting can be identified and made explicit. These findings can be used to improve the setting by capitalizing upon the apparent successes and trying to eliminate the causes of discovered breakdowns. At a more general level, such a research can result in developing a concrete framework or a model helping to reach a general understanding of how educational design and technological designs are related to each other.

The study reported in this paper aims to contribute to bridging educational and technological issues by focusing on one specific aspect of this general problem. In this study we analyzed the use of videoconference learning settings in decentralized undergraduate programs delivered by a university in northern Sweden. Videoconferences is, perhaps, the most common type of immersive learning environments, actually used in everyday practice of distance education. Experiences with this technology appear to be potentially valuable for design of new types of immersive technologies.

A detailed analysis of both educational and technological issues within this context, including their development over time, combined with occasional interventions, was selected as a long-term research strategy underlying a series of related studies. In a recent

study we analyzed videoconference settings within the decentralized program from the point of view of breakdowns caused by recurrent attempts of teachers to apply educational expertise acquired in regular classrooms in another context [10]. In the present paper we report another study conducted in the same setting but focussing on factors of success rather than on breakdowns. More specifically, the paper deals with the work practice of a technician, whose responsibilities formally consisted of making sure the equipment was in working order and properly set during videoconference sessions. However, the results of an earlier pilot study¹ conducted in another videoconference setting [7] suggested that the role actually played by a technician can be quite different from its formal description. The findings of that preliminary study indicated that a smooth functioning of the videoconference setting was only possible because the technician assumed a number of extra responsibilities, not formally required of him. The aim of the present study is to collect more conclusive data about the actual work practice of a videoconference setting technician in the context of a learning environment as a whole.

The rest of the paper is organized as follows. The next section places the study in a larger-scale research context, that is, analysis of everyday work practices of people using technology in real-life settings. Besides, the section contrasts two perspectives on studying technology in work contexts: activity theory and distributed cognition. After that a detailed description of the method and the settings analyzed in the study is given. Then the findings are presented, describing the various roles of the facilitator. The paper concludes with introducing the notion of supra-situational activities in the context of emerging learning environments and a discussion of design implications of the study.

2. Theoretical foundations and research objectives

In recent 10-15 years most of the research in the area of Human-Computer Interaction (HCI) and related areas has undergone a radical conceptual shift. Previously, the primary focus of researchers was on cognitive phenomena related to human interaction with technology, such as mental models, cognitive skills, or knowledge needed to complete certain tasks. This approach resulted in numerous experimental studies of human-computer interaction and a number of analytical tools for design and evaluation, such as task analysis, cognitive walkthroughs, and usability heuristics [24].

¹ A diploma project supervised by the authors of this paper

Now it is widely accepted that the cognitive perspective in HCI does not provide enough support for understanding everyday practices of people who are using technology in real-life social settings [4]. The current conceptual trend, especially in Computer Supported Cooperative Work (CSCW), emphasizes the situated, contextualized, social, intentional nature of interaction with technology [2].

This trend is not associated with one concrete theory. It is represented by a variety of theoretical frameworks, including (but not limited to) ethnomethodology, actor-network theory, activity theory, and distributed cognition [11, 12, 17, 18, 25]. Even though these frameworks differ from each other, they share some key concerns. All of them are trying to provide an alternative to purely rational, explicit, normative, and pragmatic approach to understanding work and other types of human activities, e.g. [22]. Numerous studies demonstrated that detailed analyses of what people are actually doing when carrying out their everyday activities can reveal tacit but critically important aspects of the use of technology. If these aspects are not taken into account, which is often the case, a system is likely to be difficult or even impossible to use [1].

The study reported in this paper deals with everyday practices in a videoconference-based learning environment. The main approach used in the study was ethnography. The choice of this approach was determined by the nature of the main issue addressed in the study, that is, mutual relations between educational and technological factors in a real-life setting. We intended to provide an insight into this issue by bringing both learning and technology into the focus of a detailed analysis.

The study also addressed a more general theoretical issue. The mixture of contextual, situational approaches currently dominating HCI and CSCW research have extended the scope of analysis to include many phenomena, which were essentially ignored by the cognitivist approach. At the same time, however, contextual approaches are often rather abstract, vague, and contradictory comparing to cognitivist models, which are typically concrete, structured, and easy to apply in systems design. In our view, contextual approaches need to be elaborated upon to inform and support system design more effectively, and it is important to make explicit and discuss the differences between these approaches. Some of these differences have been discussed in an earlier paper [10]. That analysis have identified two theoretical frameworks, most suitable for analysis of technology-supported learning environments:. In this paper we continue that analysis by contrasting activity theory and distributed cognition accounts of a multi-actor technology-supported setting.

According to activity theory, collective activities are characterized by conflicts between individual and collective subjects. Individuals are attaining their goals, while at the same time contributing to goal-oriented activities of a collective subject, for instance, a team or an organization. The goals of a collective activity and of participating individuals can (and often do) come into conflict. The dynamics of collective activities, according to activity theory, are essentially determined by continuous processes of conflict resolution between individual and collective goals, e.g. [14]. The distributed cognition approach gives a different account of collective activities, such as ship navigation [11]. According to this approach, the scope of analysis should be extended to include the system as a whole. Various components of the system, such as human beings and artifacts, contribute to functioning of the system but none (or nothing) except the system itself can be considered as having control of the collective activity.

Concerning potential factors underlying the success of teaching and learning in a videoconference setting, activity theory and distributed cognition point out to two different sets of critical issues. According to activity theory, it is not possible to avoid contradictions between individual and collective activities. The success or failure of a system depends on the success or failure of the ongoing process of resolving the above contradictions, as well as on mutual transformations of individual and collective activities. The distributed cognition approach, on the other hand, postulates that a successful system can have no contradictions at all. Individuals and artifacts can be "concerned" only with their respective subtasks, while the structure of the system as a whole can provide a coordination of these subtasks in order to attain the overall goal.

Therefore, the objectives of the study can be summarized as follows. First, the study aimed at understanding teaching and learning mediated by technology in case of a videoconference-based learning setting. The focus of the study was on factors underlying a successful integration of technology into teaching and learning. The roles, strategies, and practices of a technician/ facilitator, who was directly dealing with technology, were of special interest. Second, the study intended to compare two theoretical approaches, activity theory and distributed cognition, and find out which approach gives a more suitable account of teaching, learning, and their technological support, in the videoconference-based setting.

3. The object and method of the study

The videoconference settings analyzed in the study were set up to support distance and decentralized education delivered by a university in northern Sweden. For this purpose the university had several video studios located on campus. They had different equipment and were intended to be used for different purposes. The studios varied from a small room admitting only a teacher and a technician to a large lecture hall where not only a teacher and a technician, but also a group of on campus students could be present.

Typically, during the videoconference sessions analyzed in the study a teacher and a technician were present in a small on campus studio connected to one or more student sites, mostly located at “study centers” in other towns in the same area, that is, northern Sweden. The formats of learning sessions included traditional lectures, seminars, and small group discussions, typically related to group projects.

The study employed ethnography as its main data collection method. It was conducted by one of the authors (Ulf Hedestig) during one year, in 1999 – 2000. The data was collected from several sources:

- (a) Field observations of over 100 hours of learning and teaching at three different video studio settings. The technician was the same during all the sessions, while the teachers were different, coming from different departments. The field notes taken during and after the observations were dealing mostly with interaction between teachers, students, and the technician.
- (b) Interviews with the technician conducted both at work and home. At work the interviews took place before and after video sessions. Besides, numerous interviews and observations were conducted at home, which proved to be helpful in eliminating a communication barrier and reaching a better understanding of the technician, his opinions, reflections, and personality.
- (c) “Guided tours” given by the technicians each time when observations were taking place in a new setting. During the tours the technician was explaining and showing how he was working in each setting.
- (d) Interviews with other participants in the setting, that is, teachers and students, as well as managers.

Conducting field observations was often associated with a conflict between being a participant and an observer. Even though researcher’s goal was to act as an observer, occasionally he was involved as an active participant. Situations of that type could occur haphazardly, for instance, the technician would receive a phone call in the middle of a videoconference session and without any notice hand the remote controls over to the researcher. Those situations gave the researcher an opportunity to get a direct experience of being a

technician and a better understanding of interactions in the setting.

The technician we have been observing had been working at the university for about six years. During these years he was assigned to different organizational units within the university. Due to uncertainty of university policy regarding videoconference services, the technician’s job was not permanent. It was of a type that could be described as “seasonal”: he received hourly salary and had no job during vacations.

Data has been analyzed by observing different actor’s actions, such as turn taking and breakdowns. We followed an approach to breakdown analysis proposed by Schrivener et al [23]. According to this approach, four types of breakdowns can be identified: 1) user-task, 2) user-tool, 3) user-environment, and 4) user-user breakdowns. Special attention was paid to user-user breakdowns.

In this paper we focus mostly on how the facilitator, together with other actors in the setting, repaired different types of breakdowns. An analysis of breakdowns in a videoconference environment from a teacher’s perspective can be found elsewhere [9, 10].

4. Results

The technician was regarded by the management as a person carrying out simple equipment maintenance tasks and his work description and responsibilities were defined accordingly. However, the teachers involved in videoconference sessions often saw him as a partner in the educational setting. In interviews with the teachers it transpired that the technician could play important roles at different points of time: (a) before a videoconference, when teachers were planning a session, (b) during the videoconference session itself, or (c) after a session. Many of these activities were situated and transient, they were difficult to observe because they quickly disappeared from the setting and from participants’ memories.

There were several reasons why the teachers were interested in involving the technician into educational activities. Most of the teachers we interviewed considered themselves novices regarding videoconference technology and its use in education. Therefore, they often felt they did not have enough control of the setting and in some cases they just delegated to the technician the responsibility for coordinating and supervising the lecture. Emerging roles of that type, resulted from explicit or implicit negotiations with the technician and a teacher, created new idiosyncratic work practices of the technician. In our study we identified the following roles that the technician assumed in the setting: a technician, a

coach, a coordinator, an administrator, a teacher assistant, and a supervisor.

It should be noted that the specific roles played by the technician, as well as the degree of his intervention into the setting were highly situational and changed on the moment-to-moment basis. Generally, the technician contributed more if he thought the teacher needed help, but when a teacher was apparently able to manage all tasks on his or her own, technician's participation in a session was kept to a minimum.

On the basis of empirical data collected within the study we have identified the following roles actually played in the setting by the facilitator.

A technician

The most obvious responsibility of the technician was taking care of the technology in a video studio. It involved maintenance of the equipment and adjusting cameras and audio devices before and during sessions. Besides, the technician occasionally had to make special arrangements for teachers who had special requirements, for instance, to conduct a video session in a regular classroom. In such cases the technician moved cameras, microphones and other equipment from the studio, and established a connection between the classroom and the studio, from which the session was transmitted to student sites.

During videoconference sessions the technician continuously worked with the equipment changing camera angles, zooming, and adjusting audio volume. His role in the setting was especially evident in cases of technical breakdowns. The breakdowns were difficult to anticipate, they could happen anytime. They could be local, that is, caused by a problem at the teacher site, or external, that is, resulting from a technical problem with the communication network or equipment at a student site. Usually the technician could only solve local breakdowns. He apparently approached them on the basis of his past experiences with similar types of problems. In case of new types of breakdowns he followed a trial-and-error approach. When external breakdowns occurred the technician communicated with telecommunication operators or study center personnel. Such communications were characterized by a noticeable switch to technical vocabulary.

Even though there was usually a close collaboration and understanding between a teacher and the technician, it was obvious that sometimes their goals were conflicting. From his own experience the technician knew that many technical breakdowns were caused by the lack of careful planning on the side of teachers. He tried therefore to encourage teachers to make careful plans before they entered the setting and this recommendation

was substantiated with references to videoconference literature, which mentions careful planning as one of the most common guidelines [5, 15]. However, some of the teachers, especially those who had an experience with videoconference settings, had a rather negative attitude towards these recommendations. Their experience was that plans were seldom followed in dynamic and unpredictable videoconference settings. Problems that could happen include students forgetting the schedule, delayed breaks, or technical breakdowns that could make it necessary to revise a plan and improvise. It should be noted that despite being an advocate of thorough planning, the technician was often indispensable when something unexpectedly went wrong and helped the teacher to make an appropriate decision, for instance, to cancel the session, change the medium, or try to fix the problem right away.

A coach

Most of the teachers we studied were not frequent users of videoconference technology. For the most part, they used it only once or twice a year. Only 20% of the teachers used videoconferences more often. Therefore, it is not surprising that the technician took a larger responsibility and acted as a support person or a coach for those who did not have enough experience and skills necessary to teach in a videoconference setting. This role was manifested, for instance, in the technician's initiative to try the equipment in advance together with a teacher, pay a visit to the teacher's department and discuss possible ways of conducting a videoconference session, and encourage the teacher to think about an appropriate pedagogical strategy. Numerous examples of coaching could be observed during videoconference sessions, when it was not uncommon for the technician to whisper hints or advices to the teacher. Here are several examples from the study:

A teacher new to videoconference settings was delivering a lecture to three student sites. After a while the teacher started to ask questions to the students. No one answered. The technician told the teacher that one always has to address a question to a specific person (a course on the Swedish Law, May 15 2000)

During a videoconference seminar students and the teacher were interrupting each other because of time delays in audio and video transmission. The technician stopped the participants and explained what the teacher and students should do to avoid breakdowns in turn taking (a course on Gender Studies, April 20, 2000)

Technician's recommendations and guidelines came from his own experiences of managing videoconference sessions. When he was asked why he wanted to visit teachers personally and have discussions with them before sessions, the technician answered that he believed it was the only way of getting an understanding of what a teacher really wanted to do in the studio.

There are so many ways we can misunderstand each other and especially with teachers who have never used the technology. If they do not have right expectations of the technology and how they can use it, I won't have any job in the future (Interview with the technician)

A coordinator

Another contribution of the technician was his engagement in coordination of the activities connected to the videoconference setting. For instance, it was the technician who handled reservation of both videoconference studios on campus and remote facilities at study centers.

Reservation is usually seen as a trivial and routine procedure but in regard to making a reservation for a videoconference session it is definitely not the case. Such a reservation required contacts with different organizations, which had their own reservation procedures and policies. The technician had to call study centers and find out which time slots were available. Since he did not know in advance at what times remote facilities could be used he could not make a suggestion to the teacher before getting information from a study center. Then the technician would contact the teacher and ask if the suggested schedule was appropriate for him or her, otherwise negotiations had to be started over again. This activity could take days to accomplish since it involved many actors, some of which were not always available.

Making reservations was not included into the formal work description of the technician and therefore he was not paid for that. However, the technician thought it was sensible for him to do that anyway. He argued that he made reservation faster than the teachers because he knew everyone at study centers, had the knowledge of what the facilities they had, and could match them to teachers' requirements.

Coordination was sometimes related to coaching, described above. In some cases the facilitator helped to coordinate a session by making a recommendation of the order, in which different activities should take place. Such recommendations were especially helpful for teachers who used many different types of technology during videoconference sessions. To decrease time delays or probability of breakdowns the technician discussed

with teachers the order in which they should use tools and devices, such as power-point slides, videotape recorder, electronic whiteboard etc. Such discussions helped a teacher and the technician to coordinate their efforts during a session and avoid possible breakdowns.

The technician also helped teachers coordinate various components of their presentations, for instance, by changing slides or overheads at appropriate times. To do it the technician had to listen carefully to the teacher and understand the content. It was found that the technician made practically no mistakes when making his own decisions concerning the time and the content a slide or an overhead.

An administrator

Making reservations for videoconference sessions required keeping track of on campus video studios. The technician could not use the university classroom reservation system for this purpose because the studios were not integrated into the system. To deal with this problem the facilitator developed his own simple reservation tool (a Microsoft Word table). This reservation tool was stored on a computer in a videoconference studio, and was used exclusively by the technician

The reservation tool supported the technician in performing one more role, the one of an administrator. He used the information that he managed with the tool for calculating how much the departments had to pay for renting video studios. On the basis of this data and information about transmission costs, faxed to the technician by telecommunication operators, he prepared reports, which passed to his managers, who would, in their turn, send invoices to departments.

A teacher assistant

A role of the technician that could be clearly seen in our observations was his direct involvement in teaching. In decentralized undergraduate programs, where teachers and course topics changed all the time, the technician was the only permanent link between the students and the university. Since the technician was present during all sessions, he was in a position to develop knowledge about the students and the courses. He learned names of the students, their communication patterns, and interpersonal relation styles in student groups. He used this knowledge to help the teacher to engage the students in educational activities. It was not uncommon for the technician to talk to students in the beginning of a session, before the session was formally started by the teacher.

Since the technician knew the names of the students he could personally address them questions either connected to previous videoconference sessions or to

events taking place in their town. Most of teachers were not particularly comfortable with the media and they, especially those who participated for the first time, thought that such a small talk was a good way to create an informal and relaxed atmosphere.

Courses were often delivered by teacher teams rather than individual teachers, that is, different parts of a course were given by different persons. The technician's contribution was also important for maintaining coherence within a teacher team. For instance, when a teacher team shared a course he informed each teacher what happened during previous sessions. We regularly observed the technician explaining a teacher that his or her colleague changed the deadline for examinations, the course schedule, etc. It often turned out that the teacher was not aware of the changes before the technician informed about them.

One of the reasons why the technician became directly engaged in teaching was because many inexperienced teachers had difficulties with managing the contact with the students in videoconference settings. Comparing to a traditional classroom, where the teacher has a full control and awareness of the environment, videoconference settings usually require that teacher's attention is divided, for instance between different monitors. Many teachers ended up concentrating only on the content of a session and images sent to the students, while essentially ignoring the audience. Observation of what was happening at the student sites was therefore delegated to the technician.

The technician developed highly effective skills of recognizing potential communication problems on the basis of students' body movements and gestures. On the basis of these non-verbal clues he would, for instance, call teacher's attention to the fact that a student had a question, or did not hear what the teacher said, or wanted to participate in a discussion, etc. Monitoring of what was happening at the student site was also of importance from a technical perspective. If in a multi-point session (when a teacher site was connected to more than one student site) communication with one of the sites was lost, the technician could quickly detect the problem by keeping an eye on monitors for incoming images.

Another way of technician's participation in a session could be observed when a teacher wanted to initiate a dialogue. Sometimes the teacher began with asking the technician questions about the content, e.g., Was it difficult to understand? Is it clear how to apply the ideas?, before addressing the questions to the students. It gave the students time to reflect and formulate their thoughts.

A supervisor

Finally, we also observed the technician acting in the role that we call "a supervisor". In most cases there were no technicians or assistants at student sites. This meant that the technician, located on campus, was the only person in a virtual learning setting, who had enough expertise to handle equipment located at other sites. Our observations revealed that the technician regularly instructed the students how to adjust audio and video to achieve optimal quality. Also, he asked students questions about technical breakdowns and gave them advice on how they could solve the problem. If a technical problem could not be fixed at the student site the technician usually took charge of the session

During a session the technician noticed color squares started to appear on the screen and a strange echo. He realized they were the symptoms of the so-called "bit rate problem" with the communication network and immediately stopped the session and interrupted the teacher, who was not aware of the problem. The technician explained to the teacher and the students that they were going to have a technical breakdown soon and they had to follow his instructions. He told the students to re-boot the system and checked if they had his phone number in case they had any problems. Then he re-booted his system and gave the teacher a detailed explanation why he was forced to do that. (Decentralized course in Sociology March 22, 2000)

5. Conclusions

5.1. The contribution of the facilitator as a success factor

In our previous study [10] it was shown that re-contextualization of traditional teaching and learning activities in a videoconference setting is associated with numerous and diverse breakdowns, both actual and potential. Even when all technological prerequisites are in place, it is not uncommon for remote participants to have no genuine collaboration. Many students reported that they experienced a videoconference setting as a TV broadcast.

The focus of the present study, as mentioned above, was on factors underlying a successful integration of technologies into teaching and learning practices. The evidence provided by the study demonstrates that in real-life educational activities many possible obstacles to immersion and collaboration can be avoided. The findings described above show that successful teacher-student and student-student interactions in a videoconference setting critically depended on the expertise of a facilitator.

The facilitator was the only person in the setting possessing knowledge and skills necessary to manage the attention of the students through controlling the equipment, so that the important information could be conveyed and highlighted. The facilitator understood the specific time management problems associated with videoconference-based learning and unobtrusively intervened, when necessary, to avoid such problems. The facilitator also maintained a memory of the setting. He typically was in a better position than most of the teachers to get to know the students, their communication styles in the setting, most common communication problems and the ways they can be alleviated, etc.

In other words, the facilitator's contribution to the session can be interpreted as acting out a variety of roles, from a cameraman to an administrator and from a teacher assistant to a supervisor. These roles were critically important for supporting interaction between remote participants at several levels: attention management, time management, acquisition of setting-specific skills, and coordination within a larger institutional context

The highly advanced, broad, and sophisticated expertise manifested by the facilitator was not the only remarkable characteristic of his work practice. There were two other aspects, which are worth mentioning. First, most of the contributions of the facilitator to teaching and learning in the setting were beyond his formal work responsibilities. The latter basically consisted of making sure that if a videoconference studio reservation was made for a certain time, then during that time the room must be unlocked, and the equipment checked and switched on. The facilitator had every right to leave to the teacher all the problems with switching between images, time management, discussion coordination, and so forth. However, as it was revealed in the study, the facilitator did not limit himself to his formal responsibilities.

Second, the contribution of the facilitator was largely unnoticed by other participants in the setting. When the skills and efforts of the facilitator resulted in a smooth, uninterrupted communication, the teacher and the students had the luxury of being immersed in educational activities and they practically did not pay attention to how the communication was made possible. However, they became aware of the facilitator in cases when something went wrong. In other words, the better, more expert job was done by the facilitator, the less it was recognized by the participants.

The lack of recognition of the facilitator's importance for successful functioning of the setting was especially obvious among the management. Attempts to raise the status of the facilitator and make his position permanent (which was important, in particular, for maintaining the

"memory" of the setting) were initially rejected on the grounds that the job only included simple servicing of the equipment and did not require any special skills.

This study provides an in-depth analysis of practices of one videoconference facilitator. Our experience and informal observations suggest that some of the conclusions based on the evidence collected in the study can be generalized to other cases, as well. However, the extent to which the phenomena we discovered are common to other technologies, individuals, and cultures, can only be established in further research.

5.2. Theoretical implications

As mentioned before, a theoretical rationale behind the study was to compare two potential perspectives on collective activities in a videoconference-based learning environment, the one of activity theory and the one of distributed cognition. According to a distributed cognition model it would be possible to consider the facilitator as a system component with a scope of control limited to a predetermined set of functions/responsibilities. However, our data indicate that such a description would not be accurate. What looked like a system that could be represented by a distributed cognition – style model was in fact a result of an individual actor voluntarily taking the initiative of acting beyond the limits determined by the system.

In our view, an application of the distributed cognition approach to emerging types -- or genres -- of collective activities can be problematic. In collective activities that have an established tradition, such as team navigation or surgery, one can easily identify cases where rules, norms, artifacts, and the structure of a setting can be considered as taking care of some communication, coordination, or integration problems. For instance, the layout of the physical space of an on-campus education provides an affordance for the students to spend breaks in areas just outside lecture halls. Therefore, when the teacher is coming back to a lecture hall after a break he or she is immediately noticed by the students, and it sends a signal that it is time for the students to return to the lecture hall, too. The teacher and the students may have no awareness of establishing a communication related to informing the students that the break is over. The historical evolution of the setting resulted in a design that takes care of that particular coordination problem. However, educational genres that have a limited history may have serious problems with dealing with coordination problems even of the trivial type described above [10].

Therefore, the findings of our study present a challenge to the distributed cognition approach. However, they cannot be easily interpreted within an

activity theory framework, either. Currently activity theory-based research is focussing on either individual activities and paying only peripheral attention to “collective subjects”, e.g. [16], or on collective activities and considering individual contributions only as subordinated actions [6]. Interactions between individual and collective activities have been considered mostly from the point of view of learning taking place within the cycles of internalization/ externalization, e.g. [3]. Mutual transformations of individual and collective activities have rarely become an object of study, cf. [14].

The findings reported in this paper indicate that individuals participating in a collective activity may appropriate and strive to attain certain goals that transcend the scope of responsibilities assigned to them within the structure of the collective activity as a whole. These phenomena have not become an important object of activity theory-based research in the west, while in Russian psychology the concept of *supra-situational* activities has been playing a key role in both fundamental and applied research for several decades [20]. The ability to transcend the immediate requirements of a situation at hand and carry out supra-situational activities is considered a basic prerequisite for personal development, not limited to acquisition of knowledge and skills. In our study supra-situational activities played a more concrete and pragmatic role, preventing breakdowns in a videoconference learning environments and making collaboration possible.

Therefore, for both theoretical and practical reasons the concept of supra-situational activities is worth to be explored in future activity-theory based research. Extending the scope of the conceptual framework of activity theory currently being applied in the area of CSCL by incorporating this concept can make this framework powerful enough to provide a theoretical foundation of studies of the phenomena described in this paper.

As mentioned above, activity theory focuses on contradictions in activities and activity systems to provide an insight into the dynamics and developmental transformations of the object of study. Such an analysis can place the phenomena of supra-situational activities into a larger-scale context of activity systems by relating supra-situational activities to contradictions in activity systems, which the former help to resolve. Supra-situational activities can be considered as a necessary but temporary stage in the development of an activity system. When the activity system underlying a certain practice is not completely supported by tools, rules, and the division of labor [6], it is supra-situational activities that hold the activity system together. However, the functions served by these activities can be expected to be gradually transformed into artifacts, environments, and norms of

the setting. Therefore, supra-situational activities are critically important during the initial phase when an emerging activity system is not yet crystallized in the material and organizational structure of a setting and occasionally, when unexpected changes occur, which might require a re-adjustment of the activity system. At the same time, by keeping an activity system afloat supra-situational activities provide a basis for improvements and developments that can ultimately make them unnecessary.

5.3. Design implications

Our study did not intend to produce an evaluation of a concrete educational technology or a set of design guidelines for developing such a technology. However, the findings, in our view, have implications for design of videoconference learning environments

These implications can be summarized as follows. First, the importance of supra-situational activities, especially for avoiding collaboration breakdowns in emerging types of learning environments, should be recognized and supported by system developers. For instance, the design of environments can provide individual participants in a collective activity with a representation of the structure of the activity as a whole, so that they can more easily appropriate goals transcending their immediate situations and coordinate these goals among each other.

Second, the invisible expertise and supra-individual activities of people whose contributions make successful functioning of a setting possible should become an object of detailed analysis. Understanding these phenomena can, on the one hand, anticipate problems that are likely to occur when these resources are not available and, on the other hand, orient system development towards implementing some of the functions currently supported by supra-situational activities.

For instance, many current videoconference technologies such as desktop video, which is supposed to be used without a designated facilitator, is being increasingly employed as an educational technology. Apparently, the problems of time management, attention management, etc., can present a serious challenge to both teachers and students using these technologies. Understanding the problems and the ways they are being dealt with by facilitators, can inform the design of videoconference-based educational technologies by drawing designers' attention to important issues and providing hints of possible design solutions.

It should be noted that the current attempts to either automate and integrate videoconference environments (for instance, to make it possible for the teacher to use

one remote control instead of several ones) or make the technology “invisible” by hiding it in the building/classroom do not solve the existing problems. Those design solutions are merely focusing on how to make the participants feel more comfortable about the technology. However, they can in fact decrease participant's awareness/attention of what actually happens in the environment. The design model has to take into account a broader perspective.

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7. References

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