

# Synchronizing asynchronous collaborative learners

Johan Lundin

Mobile Informatics Group, Viktoria Institute, Sweden  
*johan.lundin@viktoria.se*

**Abstract.** This paper addresses the issue of different levels of progress in asynchronous collaborative learning activities. The context for this research is organizations of distributed and mobile practitioners. When introducing collaborative learning parallel to daily work tasks we cannot assume that all participants have the same possibility to actively engage. Therefore the learners can be at different levels of progress in the collaborative learning activity. To facilitate collaborative activity the progress of the participants has to be synchronized in some way. The main problem addressed in this paper is the difficulty for participants to keep a common progress, to enable discussions, in asynchronous collaborative learning. To address this problem three methods for synchronization (synchronization points) are suggested: *locked scenes*, *written instruction* and *collaborative production*. The three methods were implemented and evaluated in an organization using a Net-scenario, the Net-scenario as a system and a methodology based on role-playing to initiate collaborative learning. This system was suitable to use in the evaluation since it can be used asynchronously as well as synchronously, supports distributed participants and is dependent on collaborative discussion concerning the content presented.

## Introduction

The use of IT to support learning activities is widely adopted. The focus has traditionally been on making courses available for distributed students and using the computer individually and collaboratively in the classroom (e.g. Laurillard, 1993; Leidner & Jarvenpaa, 1995), thereby taking a school perspective on learning. However, “Learning can no longer be dichotomized into a place and a time to acquire knowledge (school) and a place and a time to apply knowledge (the workplace).” (Fisher, 2000).

Wenger (1998) describes learning as dependent on collaboration in communities of practice. Further on social participation is a process of learning and knowing which includes four interconnected and mutually defining components; meaning (learning as experience), practice (learning as doing), community (learning as belonging) and identity (learning as becoming). These four components depend on collaborative activities. Social processes are essential in learning, shaping our identities and what we do as well as what we know (Berger & Luckman, 1966). However, in distributed work the engagement in social processes with colleagues becomes problematic.

Knowledge workers, defined by Drucker (1959) as workers using knowledge as their main tool, learn continuously and their work often tend to take on a mobile character thus requiring flexible and mobile systems supporting learning.

The context for this research is organizations of distributed and mobile practitioners who can be seen as knowledge workers, using Drucker's definition.

Collaborative learning activities that take place parallel to daily work tasks must be handled and understood differently than learning activities introduced within a school setting. In school the students' main task is participating in (or at least attend) various learning activities. When introducing computer supported collaborative learning as a concurrent activity to daily work tasks we cannot assume that all participants have the same possibilities to take part in the activities due to, for example, differences in their daily workload. This means that participants can be at different levels of progress (concerning what tasks and content each of them has been introduced to) in the learning activity. In collaborative learning this is problematic because participants who are not synchronized are introduced to different tasks and different content. This decreases the possibility for collaborative activities concerning the issues presented. To enable group discussions concerning a certain issue, the task and content has to be known and current to the whole group at the time of the discussion. The participants have to be presented to new tasks as a group to make the activity collaborative and to enable discussions. This means that the group has to collaboratively progress through the learning activity. To support this, three methods (synchronization points) is introduced in this paper.

To be able to evaluate the three synchronization points with mobile and distributed practitioners engaged in collaborative learning the Net-Scenario (Lundin & Nulden, 2003) was used. The Net-scenario applies collaborative role-playing based on a multimedia enhanced story as the structuring activity. The Net-Scenario is mediated and supports asynchronous use, technologically and methodologically, and are thereby adjusted to the context of distributed participants. In this paper the term scenario is used as the story in the Net-scenario around which role-playing is organized.

This paper describes methods that have to be provided to create a possibility for vivid and structured discussions in computer supported distributed and asynchronous collaborative learning. The main problem addressed in this paper is the difficulty for participants to keep a common progress to enable collaboration in computer supported collaborative learning activities.

The research question addressed in this paper is:

*How can computer support for synchronization in collaborative and asynchronous learning activities be designed?*

In collaborative learning the discussions among the participants are essential. When collaborative learners are distributed, tools for mediating these discussions are needed. This means tools for synchronous communication such as text chat, voice or video chat, as well as tools for asynchronous communication, such as text forums, video recordings or e-mails. The effects that these mediums have on the communication in distributed groups will not be further elaborated in this paper. The area of communication in collaborative systems has been extensively examined in research (e.g. Ehrlich 1987; Ellis *et al.* 1991; Orlikowski 1992).

Following this introduction is a presentation of the Net-scenario. In the next section the methods for synchronizing is described. Then a description of the system deployment and the research method is given. This is followed by the results and the analysis. Finally a discussion and the conclusions are presented.

## The Net-Scenario

The Net-scenario is based on a stationary learning activity; the Multimedia Scenarios, which was designed to initiate a collaborative learning process structured around a set issue. It is based on a multimedia-enhanced story, which structures and supports collaborative role-playing as a learning activity.

In the Multimedia Scenario a group of five to eight participants are engaged in role-playing. The basic setting is a group of participants gathered around a table, following the scenario on a big screen and aided by a facilitator. During this time the participants experience a problematic situation presented in the scenario. The Multimedia Scenario was first implemented in undergraduate education (Nulden & Scheepers, 1998). It also proved its potential in primary school education (Nulden & Ward, 2002). The transfer into workplace learning was made with successful results (Hardless *et al.* 2001).

Role-plays can be described as dramas in which a number of participants are asked to portray a particular character, but no lines are provided, as for actors (Steinert 1993). The purpose of the role-play in the Multimedia Scenarios is to initiate reflection and discussions on issues directly related to a group of professionals. Role-playing in Multimedia Scenarios is based around a story, which is constructed of acts that each consists of a number of scenes. Each scenario focus on a main issue, each act brings up different aspects of that issue and each scene in the acts gives different background information contextualizing that aspect. The group is guided through the scenario and is, at certain points, encouraged to interact as a group, with the scenario.

However, the Multimedia scenario is designed for use in a stationary setting and is therefore not suitable for continuous learning parallel to mobile and

distributed work. This is the reason for the development of the Net-scenario. The Net-scenario is web based and can be accessed from the users' laptops as long as they have internet access. Each scene is represented by a web page that gives the participants information relevant to the current act. It is constructed using a server for the multimedia files. The system keeps track of the group's activities to make sure that, at each new use-session the scenario would continue in the same place as where the participant was in the scenario when they logged out. This way the system keeps track of each participant's progress in the story. It was not possible to move to previous scenes in the scenario. It was also important that the system kept track of the progress to maintain a low effort to facilitate fragmented participation in the Net-scenario.

## Synchronizing collaborative learners

Using distributed collaborative learning introduces challenges when the participants are not only dispersed in space, but also in time. Given that the participants will access the online activities in an asynchronous manner they will soon end up at different levels of progress. Since the goal is collaborative learning, this creates a problem. To be able to have vivid discussions concerning the content and tasks presented all participants have to be introduced to the same content prior to the discussion. Different levels of progress would mean that different things would be relevant for discussion. Thus it is important that the asynchronous use in some sense is synchronized.

This could be solved by giving the participants deadlines that tells them how far they are expected to have reached at a certain time. However, the use of deadlines has two main disadvantages. Firstly, if forcing the participants to reach a deadline they are less likely to feel in control of the progress and to feel responsible for the outcome. Secondly, in collaborative learning that is used parallel to daily work tasks, the idea is that the participants themselves should decide when, where and to what extent they are to engage in the role-play. A deadline would make this impossible.

To address the problem of users scattered in the online activity a method for synchronizing the participants' progress was developed: synchronization points. The purpose of these is to bring the group together to make the discussions, the basis for the collaborative learning, possible. The function of the synchronization points in the Net-scenario is shown in figure 1.

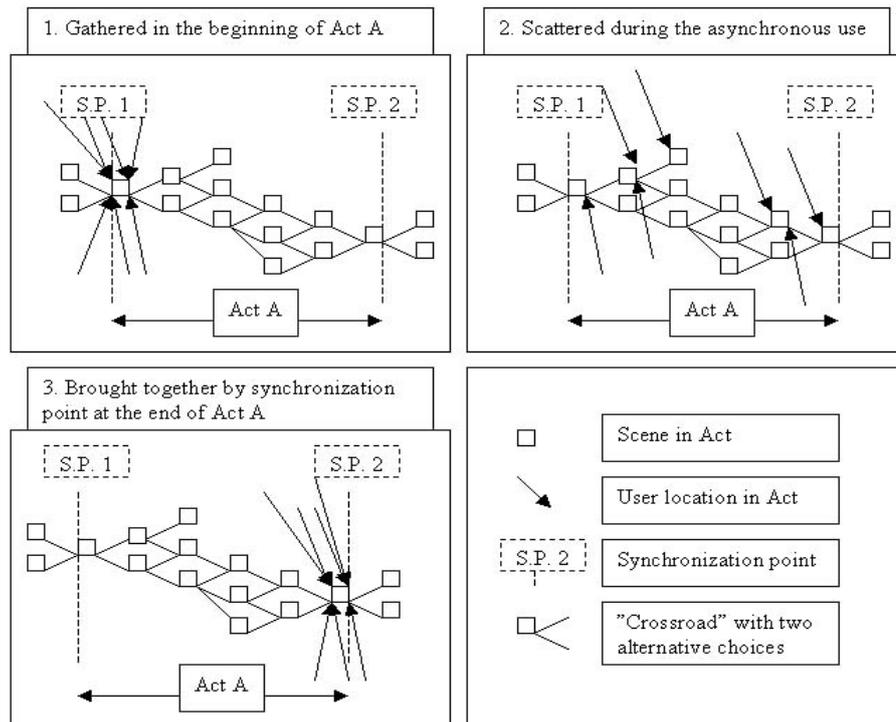


Figure 1: The function of the synchronization points in the Net-scenario

Three different synchronization points were developed to guide the participants' progress in the Net-scenario.

- Locked scenes

By controlling the information available, the users are held together in the same part of the learning activity to stimulate discussions. In the Net-scenario this is implemented by, at the decision crossroads, all participants have to agree before the group could continue, meaning that the system will not let them continue until an agreement is reached.

When the first participant reaches the *locked scene* she is encouraged to remind the others to proceed in the Net-scenario. This is done by making the participants' progress visible at the locked scene. Next to each participant name the system provides direct links for prompted e-mail and creating text message delivered to the specific participant's cell-phone. The aim of this is to motivate the other participants to be more active. The possibility to remind participants is available until everyone reaches the *locked scene*, then the continuation of the Net-scenario is unlocked. This way all participants who are gathered at the end of the act have a common responsibility to engage the other participants.

- Providing written instructions

This is done by instructing the group to make sure that all participants are gathered before continuing. It is implemented by providing an instructional text at a set scene in the Net-scenario, the text instructs the participants to work with a

given task as a group and to reach a unanimous decision before they continue. With this synchronization point it is possible for the group to oppose to the instruction, *i.e.* proceed without all participants, the system has no control of this.

- Collaborative production

This type of synchronization is done by instructing the group to produce something collaboratively. The group is given a certain task to work with, the outcome can be of various types (for example a written document) and the organization of the work is left up to the participants. The progress can at this point either be locked (by using *locked scenes*) or by providing the group with a *written instruction* saying that they cannot continue until they have completed the task.

No claim is made that these three methods are in any way revolutionary. To stop the progress of a groups work until certain tasks is completed (as in locking scenes) has been used previously as a tool for organizing collaborative work. Abbot and Sarin (1994) describe the use from a workflow management perspective; when a task is approved as completed this will unlock the next task in the process. To instruct learners concerning the organization of work and to give tasks, such as *collaborative production*, are generally parts of collaborative learning. Systems supporting this are frequent in the computer supported collaborative learning area (e.g. Kienle & Herrmann, 2003). However, in this case the functions are used specifically to support a group of learners' collaborative progress in a learning activity. It is argued in this paper that this is particularly important in learning parallel to work, when the participation in the collaborative learning is not the main activity of the participants. Hence, what are added to the previous body of research are evaluated methods for supporting the collaborative progress in asynchronous learning used in a work context.

## Method

This section contains a description of the experiment site and of the actual content of the Net-Scenario deployed at this site. It also presents the research methods used in the evaluation of the synchronization points.

### Evaluation setting

To be able to evaluate the use of synchronization points in asynchronous learning, we introduced the Net-scenarios in an organization where many of the employees worked in a mobile and distributed way. The net-scenario was suitable since it is dependent on the groups discussions concerning the presented content, these discussions is in turn dependent on the collaborative progress of the group.

The company where the Net-Scenario was deployed has around 300 employees who are based in one large office building. The practitioners within the organization are to a large extent distributed depending on the tasks at hand. They

use much of their day attending meetings, at conferences, visiting customers or suppliers and so on. The organization's goal with the use of the Net-Scenario was to support a learning process concerning a large organizational change. The management wanted to let the employees reflect on how the changes would affect their work and specifically encourage collaborative learning concerning customer relations. The organization's objective was also to introduce new forms of distributed and asynchronous communication in project work.

The content of the learning activity described in this paper concerns customer relations. The organization experienced that textbooks and courses could not provide the only source for their learning activities. They also experienced that knowledge concerning customer relations was not shared within the organization to a desirable extent.

The group involved in the construction of the Net-scenario consisted of four persons from the organization and one researcher. This work included constructing the actual system, identifying key issues for discussion as well as writing the actual scenario that the role-play was based upon. This group selected six people from the organization to take part in the study. Three males and three females participated. They all varied in roles in the organization as well as in experience on the job. However, they all dealt with customers regular in their work. The researcher acted as a facilitator, being present in the groups' asynchronous activities.

The duration of the evaluation was limited (for practical reasons) so that the group did not have more than 16 weeks to complete the Net-scenario (from week 36 until week 51 in 2001). However, each participant's accumulated time of using the Net-scenario was impossible to determine since it is totally dependent on the engagement and activity of the group and each individual.

## Research method

The evaluation of the synchronization points is based on the online activity in the Net-scenario. In addition interviews and use diaries were collected to provide a deeper understanding of the participants' activities. The online progress was followed by examining use logs, and text forums. The participants also had access to synchronous communication channels, such as text and video chat.

Four methods for data collection were used:

- Online observations

The groups' online progress in the discussion forums was followed continuously and recorded. A researcher acted as a facilitator in the online activities. Throughout the evaluation the researcher/facilitator documented his thoughts on the online activities. In this study files from text forums are used (Silverman, 1993) in combination with other methods for analyzing the use of the synchronization points. Guribye and Wasson (2002) discuss the question of doing ethnographic studies of distributed collaborative learners. They point to the fact that users' online actions cannot be separated from the offline (or rather all-the-

time) actions. This study is based on online observations accompanied by other data collection techniques.

In the analysis, the postings in the discussion forums were read through repeatedly and instances of particular interest were highlighted. These instances were then grouped and categorized. The notes of the researcher were then brought into the process and used to gain further understanding of the categories.

- Collected use logs

The usage was logged by recording the total number of times that a user had logged into the Net-scenario. The log file also showed where users were in the Net-scenario as well as how the users acted in choice situations within the Net-scenario. The logs were used to compare the actual use and the usage reported in the log books.

- Log books

Each participant was given a log book to document their use. The log books had pre-printed fields for time of usage, place of usage, how many other people was physically present at the time of usage, what activity they engaged in and additional comments. This type of diary inspired method has been used in workplace research (Hinds & Kiesler 1995, Adler *et al.* 1998, Brown *et al.* 2000), research concerning learning (Rieman 1996), as well as in studies of mobile work (Perry *et al.* 2001). The strengths of using log books that is particularly interesting to this research are the ability to capture activities where the researcher cannot be present (Rieman 1996) and the possibility to get a picture of in what manner the participants want to portray their use. So the notes in the diaries should in no way be considered objective, but "...the sources of 'bias' are, looked at from another perspective, data in themselves." (Hammersley & Atkinson 1995, p160). The log books were also used by the participants as a memory support when they were retelling their use of the Net-scenario in the interviews.

- Semi-structured interviews subsequent to the participation

All the participants were interviewed as close as possible to their final day of use. The interview method chosen was long qualitative interview (McCracken 1988). The interviews were audio recorded and transcribed. The interviewer was equipped with an interview guide to ensure that the discussion was held in a similar order with each participant and that the areas relevant to the study are brought up in each interview.

## Results

This section opens with a summary of the overall activity of the participants and then a description of the activity around the first four of the synchronization points.

The online activity is described in figure 2. The figure shows the logins reported in the log books, the postings on the text forums as well as the adjusted

number of logins. The adjusted number is the number of logins reported in the log books adjusted to the total number of logins the participants made. This is done since the individual logins of each participant were not recorded in the system. The participants reported 49% of their actual logins in the log books.

The boxes marked SP # shows where the group continued on from each synchronization point. The time between the first participant's arrival at each synchronization point and the last is various as the descriptions below will show. One of the participants did not complete the Net-scenario due to personal reasons.

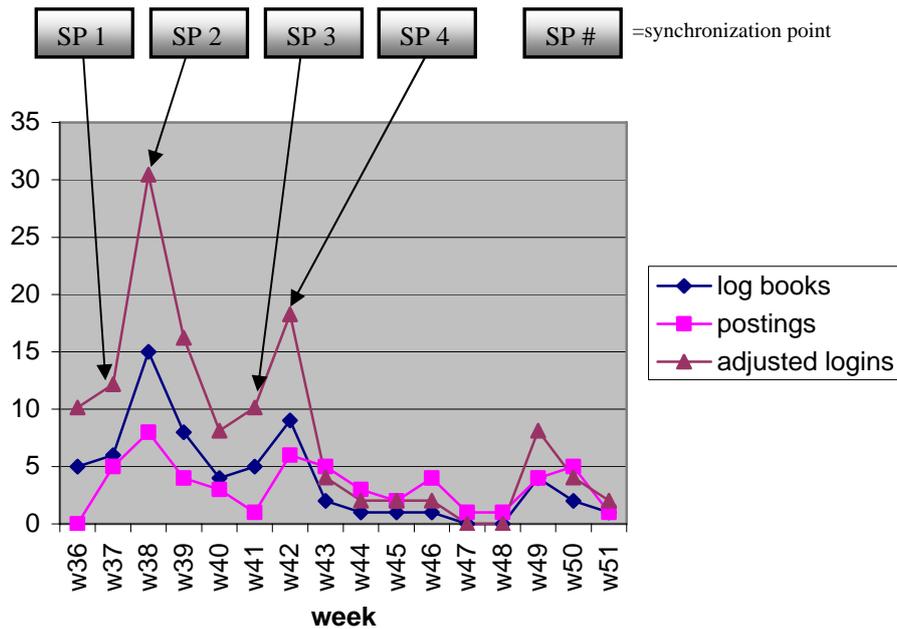


Figure 2: The synchronization points

### Summary of the online activity

At the start of the Net-scenario all participants were at the same level of progress in the role-play. The activity was fairly high and the participants report in the interviews that they at this point were motivated and engaged in the activities. However, at week 38 a majority of the participants reached a synchronization point using a *locked scene* (SP 2). The group couldn't continue because one participant hadn't logged into the Net-scenario. During the time they waited for this sixth participant activity declined. However, after finally passing SP2 the active part of the group eventually regained some motivation and continued in the Net-scenario in a quite active manner. SP 3 was a *written instruction* and did not

slow the active participants down (as described below). The next drop, after week 42 (SP 4) is due to both waiting for a participant and also that one participant had to leave the Net-scenario. The activity was only rising again at the end of the evaluation period when they wanted to finish before the interviews were to be held. However, some of the participants did not finish the Net-scenario anyhow.

## The activity around the synchronization points

Synchronization Point One - The first synchronization point is of the type *collaborative production*. The task in the current act in the Net-scenario concerned reflection upon experiences with customer relations and to create a document summarizing these reflections. The purpose with this first task is mainly to get the group accustomed with the system. The task inspired discussions both concerning the participants' experiences with projects as well as the organization of the production of the document. In the interviews we were also informed that the group engaged in two video mediated meetings where they discussed their experiences.

One of the participants had not logged into the Net-scenario at this point. The group created the document without the involvement of this participant.

Synchronization Point Two - The second synchronization point was of the type *locked scenes*. The group is working with a question concerning how to man the project that the scenario is based around. The participant who had not started his use at the first synchronization point, as described above, still has not logged into the Net-scenario. The active group cannot continue in the Net-scenario until he has given his opinion on how to man the project in the scenario. This waiting causes the activity to decrease. Several participants send reminders saying that they are waiting at the synchronization point, both through e-mail and through SMS. One of the participants comments on this in the interviews:

“The group reminded him several times... I think that he had to much to do and he shouldn't have decided to join [the Net-scenario] from the start”

The other participants phone him and leave messages on his voicemail saying that they are waiting for him. The participants use the text forums to discuss how to act in the scenario. Finally the group agrees on how to proceed without the sixth participant. At the start of week 40 the continuation of the Net-scenario is manually unlocked by the facilitator even though one participant has not reached the synchronization point. The participant who did not log in comments:

”Well I got the stuff [web camera and headset] pretty late and then I got help from [person in charge of technical support] to have it installed. I don't think it was until October to be honest, mid October. Then I had a short period of problems with my [communication platform] and [text forums]. That's how it was... but then I think I got started.”

Synchronization Point Three - This synchronization point was a *written instruction*. The participants were instructed to wait at a certain scene until they all have received and discussed a contract that played an important role in the Net-scenario. The activity is rising after the unlocking of synchronization point two. A few of the other participants suggest that the sixth participant should leave the Net-scenario because he is slowing the activity in the group. At this point the sixth participant logs in for the first time and he tries to catch up with the rest of the group. However, he chooses not to add to the discussions in the text forums that have been going on earlier.

The group obliges with the *written instruction* and they all wait until everyone has received and had a chance to discuss the contract. However, all participants get the contract but the level of participation in the discussions is varying.

Synchronization Point Four - This is *locked scenes* synchronization. The group is working with the planning of the project according to the contract that they were given at synchronization point three. At this point five of the participants have to wait for some days for the last one to reach the synchronization point, so most participants reached the synchronization point at almost the same time. There is discussion concerning how to vote but not as extensive as before. One of the participants says:

“Well we all just voted at that point. There wasn’t much discussion”

After this point the activity did not rise notably again. The active participants reported in the interviews that they did not feel that it was any use logging in to the Net-scenario because at most times nothing had happened since the last time they used it and they could not continue because of the *locked scenes*.

One participant comments:

“You logged on and looked around and, like, nothing had happened. And it isn’t like I don’t have anything else to do.”

One important aspect is that one of the most active participants decreased her engagement and finally had to leave the Net-scenario due to personal reasons.

## Analysis

In this section the use of the three different methods for synchronization is analyzed.

## Locked scenes

The use of *locked scenes* worked well in the aspect that all participants are gathered at the synchronization point. However, as described in the previous section there is a problem if the group has to wait for participants for an extended time. This makes the activity decline and has a negative impact on the motivation of the group. This means that this type of synchronization point is specifically useful when a group is moving at a relatively common pace. Concerning the use of the reminders provided in the system one of the participants comment:

“One problem is that you cannot reply to the reminder that you get by SMS, I’m not sure if that is possible to do”

Meaning that the participant cannot tell the rest of the group why they have not been able to log in and continue, as well as when they will be able to catch up with the rest of the group. This problem can be addressed by giving the participants the ability to send SMS-messages to a group of people in the next version of the net-scenario.

The reminders also created stress among the reminded users. One participant says:

“It felt pretty awkward, really! Especially when I was reminded. I guess I had like three or four voice messages on my cell phone saying like: “Come on now!” Then you feel that you don’t want that to happen again.”

So if a participant is not able to work with the Net-scenario due to, for example a heavy work load, the participant is not only stressed by having much to do in his regular work. But he is also constantly reminded that the rest of the group is waiting. This created a use pattern among some of the participants, where they logged on to the activity only a few times and went through the scenes until they reached the next synchronization point. They then left the Net-scenario and did not involve themselves in any discussions. Two of the participants who adopted this use pattern comment:

“After that [going through the Net-scenario quickly until the next synchronization point] I guess I sort of waited for someone else to take charge, like ok now its time to have a video meeting concerning this... I think... I was not too involved in the project.”

“You log in when you’re behind in the progress of the group and work as far as you can. I think I use it for an hour at the time”

Using *locked scenes* surely brought the participants together, but it also created unwanted use patterns among the passive participants as well as frustration among the active participants. One possible way, suggested by the participants, is to give the group the possibility to exclude inactive participants.

## Providing written instructions

The use of *written instructions* worked well to collect the active part of the group. If one participant did not engage in the collaborative work the group completed the task anyhow. This means that the *written instructions* worked as a synchronization of the active users but that it left out the non-active ones. This in turn left the inactive more excluded from the discussion than when using the *locked scenes* but it sustained the motivation of the active participants. One participant commented on the exclusion of inactive participants:

“It does not feel too good that... we cannot collaborate better than that we have to wait for three weeks for one person to cast their vote.

In the *written instructions* the participants were not explicitly encouraged to remind the less active participants. The possibility for the group to decide whom to wait for and whom to leave behind empowers the active participants. The use of instructions was successful in the sense that the motivation of the active participants was kept high. However, the main idea of the synchronization points was to make the whole group proceed through the Net-scenario together and the *written instructions* failed to do this. One suggestion would be to more strongly encourage the group to keep together. One other possibility is to state more clearly when introducing the activity to the group that it is possible to be left behind if you do not participate. Making it clear to all participants that it is their responsibility to be active in the collaborative activities and that they cannot rely on the system or other participants to remind them.

## Collaborative production

The *collaborative production* was effective in engaging and gathering active participants. The main difference from the *written instructions* was that the less active participants were in some cases given tasks to perform individually. The outcome was then brought into the discussions of the active participants and incorporated in their collaboratively produced result.

However, in many cases the active part of the group completed the assignments given in the Net-scenario without reminding or asking the inactive participants to take part. One of the more active says:

“I think that [specific participant] should have done that [logged in to the Net-scenario] immediately. You have to take responsibility yourself, as a project member.”

This type of synchronization also gave the group the possibility to organize their work to their own liking. The group was mainly positive to have received this power of the progress in the Net-scenario. However, during the interviews many of them showed that they expected other participants to take responsibility for the

organization. One of the participants was assigned the role of the project manager in the Net-scenario. The other participants often looked to him for organizing:

“I expected a web meeting [this is what the group called their use of the video chat function] when we were about to finish [one of the assignments]. However, I got no indication of this”

The project manager on the other hand felt that he did not get much response on his attempts to organize the work:

“When it comes to leading the meetings I took some responsibility, since I was the project manager... I have tried to push the group and so on, but in some cases it did not help at all”

The use of *collaborative production* managed to create collaborative activity among the active participants as well as engage the less active individually in the Net-scenario. This means that the *collaborative production* was fairly successful in comparison to the other methods for synchronization. However in the collaborative learning not all activities can result in a production of some kind.

## Discussion

When evaluating the use of IT-supported collaborative learning in a professional setting it is difficult to isolate what benefits can be connected to the introduced activity and what is due to other activities that the practitioners are involved in. This is even more relevant when the learning activity is conducted parallel to daily work during a longer period, such as in this case. However, the participants were positive concerning the use of the Net-scenario and felt that they have benefited from the participation. The results indicate that the mutual engagement of the participants is a key matter. The pressure that collaborating in a group creates on each individual was not enough to motivate all participants to actively engage in the Net-scenario. Not only the engagement but also the factual possibility to put aside time to participate is important. The less active participants claim that they were committed to participating but that they just did not have the time. The stress that the reminders created can be seen as proof of this. As mentioned, deadlines were not used because this could create stress and reduce the participants' control of the progress. However, the reminders created stress among the participants who did not keep up with the groups' progress as well as made the active group halt their progress and by that controlling the progress. In further development of the Net-scenario the possibility for the majority of the active group to decide on exclusion of inactive participants should be further examined. It should also be possible for participants to more easily choose to leave the Net-scenario if they feel that they do not have the possibility to contribute.

It should be noted that the three methods for synchronization were tested in sequence with the same group of participants. This could imply that the experiences from one method would influence the participants' perception of the next. However, our data does not indicate this.

## Conclusions

In this paper problems concerning participants collaborative progress in asynchronous computer supported collaborative learning is discussed. The research question in this paper is:

*How can computer support for synchronization in collaborative and asynchronous learning activities be designed?*

In collaborative learning parallel to work, the possibility to engage will be different depending on the daily workload of each participating individual. However, collaborative activities rely on the participants' mutual understanding of the task at hand. This means that to create collaborative activities participants need to keep a common progress through the activity. Synchronization points were developed and their use was evaluated. These are points in the collaborative activity that are intended to gather the participants in terms of progress in the online activity. Three different methods for synchronization were suggested: *locked scenes*, *written instructions* and *collaborative production*. The *locked scenes* were effective in synchronizing all participants but slowed down the groups' progress and did therefore make the most active participants lose motivation. The *written instructions* were successful in gathering the active group but failed to engage the less active participants. The *collaborative production* was successful in gathering the active group in collaborative activities and to engage the less active participants individually.

## Acknowledgments

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