Effects of a context awareness tool on students' cognition of their team-mates learning time in a distance learning project activity

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Abstract: Aiming to understand and enhance metacognition in Computer Supported Collaborative Learning (CSCL), we considered time management as one of students' major challenges in CSCL. In collaborative activities, students need to know and regulate their individual and collective time being aware about their own and their team-mates expected availabilities. Aiming to understand and enhance time awareness in distance learning context we introduced a methodology for the assessment of Group Time Awareness, based on the comparison of subjective and inter-subjective students' learning time perceptions.
Assuming that enhancing awareness will help the collaborative learning process (McCarthy and Garavan, 2008) we hypothesize that group awareness could be improved by enhancing the reflexive properties of the Computer Learning Environment. For this purpose, we conducted an experimental study introducing a context-awareness tool in order to evaluate its impact on group time awareness scores.

1. Introduction and aims

Collaborative learning involves not only cognition about one's own cognition, resources and learning strategies (metacognition) but also the awareness of team-mate's cognition, resources and learning strategies. This second type of metacognition has been considered by some authors as metacognition in social context (Salonen, Vauras & Efklides, 2005), as inter-subjective awareness (Pata, 2008) but also, from the point of view of distributed cognition, as socially shared metacognition (Iiskala, Vauras & Lehtinen, 2004). We would adopt the perspective of cognition and metacognition as an individual process occurring on a social context; we consider cognition and metacognition as individual processes, although these could be influenced by the social context, or even more, these cognitive and metacognitive processes could concern the awareness of other individual's cognition and metacognition.

Aiming to understand and enhance metacognition in Computer Supported Collaborative Learning (CSCL) from a learner-centered approach (O'Sullivan, 2004), we considered one of students' major challenges in CSCL, the collective time management. Learning activities' time in CSCL could be scripted (Dillenbourg, 2002) at different levels of detail. Project oriented learning activities are low time-scripted activities, which allows the team to organize and regulate their work within the time limits of the project. Sometimes intermediate milestones or events could be introduced; however, the project oriented learning activity requires an important amount of time devoted to self-regulated learning at individual and collective level. Accordingly, learners need to manage their individual and collective time, and for that reason, students need to know and regulate their time being aware about their own and their team-mates availabilities. In order to improve learning time awareness in collaborative contexts we propose a methodology for the assessment of Group Time Awareness, based on the comparison of subjective and inter-subjective time perceptions.

Assuming that enhancing awareness will help team learning process (McCarthy & Garavan, 2008) we test the hypothesis that group awareness could be developed enhancing the reflexive properties of the Computer Learning Environment. For this purpose, we conducted an experimental study introducing a context awareness tool (Time Awareness Tool) in order to evaluate its impact on group time awareness scores.

2. Method

2.1 Context and participants

The course chosen for studying Group Time Awareness (GTA) is an introductory course in the first-year of the academic year for incoming new learners of Limoges University Virtual Campus (http://www-tic.unilim.fr). Choosing this first course, we avoid that the observed students had already developed their learning time habits in this context. The course, named UE153, is a 7-weeks course aiming to introduce the enrolled students (n=49) to Internet uses and functionalities during the first 4 weeks, in an individual learning modality. The last 3 weeks of the course propose the students to work on their first collaborative activity in the virtual campus.

At the beginning of the collaborative period, students were grouped into 6 teams. These virtual groups are composed by an average of 8.16 students (sd = 1.16). At the same time, each student was invited to declare the number of hours he uses to spend working and learning weekly.

2.2. Time support capabilities of the Computer Learning Environment

In order to organize their collaborative work, students need to know the prospective time of their team-mates. Without forcing students to explicit their time availabilities, this personal information will not arise spontaneously in an efficient way, making the group organization a difficult task, especially in distance learning groups, where time availabilities could not be inferred by the contextual information available simply by Computer Mediated Communication (CMC). In distance learning all contextual information is provided by the Computer Learning Environment (CLE), depending on two elements: Firstly, by the elicitations the students do during their CMC (an example in the case of contextual time information is the information provided when talking about their availabilities for a next chat meeting). Secondly, contextual information could be transmitted by the mirroring properties (Jermann, Soller & Muehlenbrock, 2001). Limoges University Virtual Campus is supported by Moodle Learning Managament System (Dougiamas, 2001). Moodle has been developed in order to support collaborative activities, but does not integrate a special support to enhance group awareness, nor special mirroring functionalities. Despite mirroring nor group awareness capabilities were not explicitly focused on its design and development, Moodle provides some contextual information that could help to develop the group time awareness during the collaborative activities. In real time, Moodle could display the online users list and interact with them through a chat channel or the instant message tool. Retrospectively, Moodle could display student participation information (last connection, activities logs, posted messages …). With this information, students could infer learning time patterns of their team-mates in an indirect way. On the other hand, we assume that part of the difficulty of collective time management in distance learning context is due to the lack of explicit group contextual information, as the mirroring (for current and past times) and foresight of team-mates presence and activity, which allows to build reliable temporal patterns that could enhances team's capacity to plan and regulate the collective learning times.

2.3 Materials

The declaration of individual learning time was supported by a context-awareness tool called Individual Time Awareness Tool (I-TAT).

TAT proposes two timescales, one for the week and another for the week-end, assuming that learning and work time patterns of the participants would be different in these periods. In this line, Andreu and Jáuregui (2005) observed that adult e-learners in self-regulated learning context spend more hours learning when their workload is lower.

Individual Time Awareness Tool (I-TAT) is primarily used as a time declaration tool.

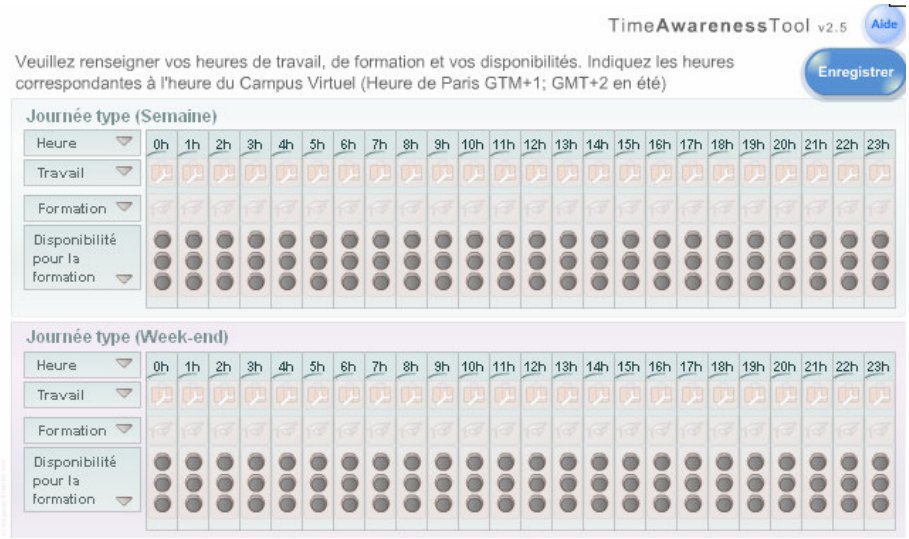

Figure 1. Students declare their work and learning times during the week and week-end in the Individual Time Awareness Tool (I-TAT)

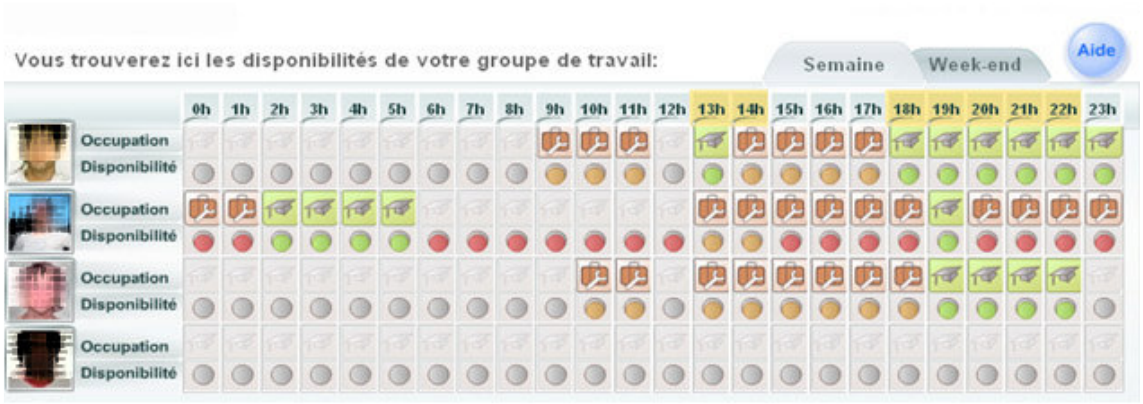

Figure 2. Group Time Awareness Tool (G-TAT) provides a social shared visualization of each team-mate work and learning time

Learners can view the prospective time statements that he and his team-mates have declared. This estimate defines the hours they will dedicate to their job (monkey wrench icon) and the hours they intend to devote to their collaborative learning activity (graduation cap icon). The color gauges indicates, for each hour, if the student intend to dedicate it to the learning activity (green), if they could invest it if necessary, even if they didn't planned it initially (orange), or, if it's impossible to devote their time to the learning activity in any case (red).

2.4 Hypothesis

We hypothesize that the enhancement of the context information through a group awareness tool (the Time Awareness Tool) during distance computer supported collaborative activities will help to increase the group awareness and, specifically in our case, the Group Time Awareness (GTA). Aiming to test this hypothesis, we provide half of the groups (n=3) with the collective time functionality of the Group Time Awareness Tool (G-TAT), allowing them both to declare and modify their individual time, but, also, to have a group shared visualization of each team-mate work and learning time availabilities. We suppose this shared perspective will improve Group Time Awareness. The 3 other groups were considered as control groups, and have not received any specific help.

2.5 Procedure

The Group Time Awareness Tool (G-TAT) was introduced at the end of the first week of the collaborative activity to 3 groups of a total of 6 groups. The homogeneity of the groups according to their experimental or control condition was tested both in terms of group size (m=8.16; sd=1.16) and some usual demographic variables (family structure and children, work status). Any statistically significant was observed. After two weeks, at the end of the activity, students send their estimation about their team-mates learning time during the activity. Later on, the Group Time Awareness was calculated for each individual.

The measurement of the effect of the Group Time Awareness Tool (G-TAT) on Group Time Awareness (GTA) was conducted on an individual basis, where the answer of 18 students on the experimental group and 19 students on the control group was considered. To be considered, the student' answer should include his own learning time, even if his team-mates learning times estimation is incomplete. Group Time Awareness (GTA) score takes into account the number of estimates sent by the student. The more accurate estimates the students would realize, the better would be his GTA score. Some students (6 on the experimental group and 6 on the control group) didn't send their answers on the expected time (up to one week after the end of the collaborative activity) and were not forced to answer after this period. In addition to their team-mates' learning time estimate, some students sent spontaneously comments on their difficulty on estimating their team-mate's time engagement.

2.6 Measures

A week after the beginning of the collaborative activity, students were asked to send to their tutors the number of hours they spent on the group work since the beginning of the collaborative activity, and their subjective

estimate of the number of hours invested by each of their team-mates, during the same period. From this data, was calculated the Group Time Awareness (GTA) for each individual.

Group Time Awareness (GTA) compares inter-subjective time awareness with the individual time declaration. GTA takes into account the individual student's perception on the number of hours per week his team-mates spent into the collaborative activity, which is compared to the number of hours per week declared by each team-mate. This comparison is operationalized through the mean of the standard deviations for each team-mate perception, divided by the number of team-mates perceptions sent by the student. Higher is the GTA score, the better is the awareness of other's team-mates learning times.

$$GTA = \frac{1}{(\frac{\bar{x}(\sigma)}{n})}$$

3. Results

A better Group Time Awareness was observed in the experimental group (m=1.31; sd=0.09) than in the control group (m=1.02; sd=0.09). Despite the higher GTA score in the experimental condition, this results is only slightly statistical significant. Having observed a non parametric distribution ion GTA scores, we conducted a U-Man Whitney test. As hypothesized, individuals having the Time Awareness Tool scored better than those which did not have it (U=106, p=0,049).

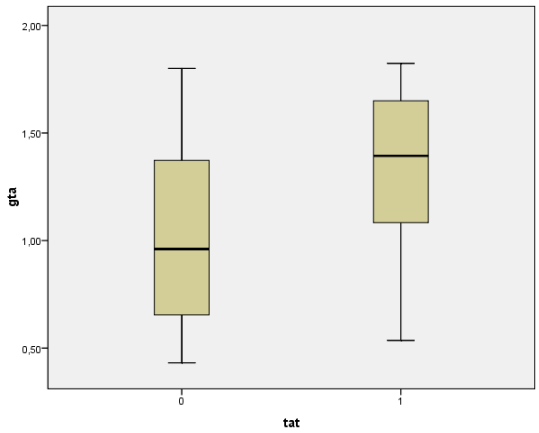

Figure 3. Group Time Awareness results distribution for students using the G-TAT (tat=1) or not (tat=0)

A closer observation of the data collected allows us to remark that students identify easily the team members who are not much involved or totally unengaged in the collaborative activity. Identification of inactive members occurs even for students who have a GTA score indicating a low perception of their team-mates learning time, or events, for students who have expressed spontaneously their difficulty in providing an estimate for the learning time spent by their team-mates.

We would also note an individual bias on the group learning time estimate. In general we observe that students who spent more time in the collaborative activity also estimate higher the time spent by their team-mates, a trend that is also observed in least invested learners, who tend to estimate the investment of their team-mates in a lower way, proportionally coherent with their own learning time.

4. Discussion: Time Awareness Tool influence on Group Time Awareness Index

A first limitation of this study is the low number of participants (n=49) and the high level of experimental mortality (12 participants did not send their team-mates learning time estimate). Further studies with larger samples are needed to verify the statistical significance of the group awareness improvements introduced by the Time Awareness Tool. Group size (m = 8.16, sd = 1.16) could had an influence in the collective time management and the group awareness evolution. It would be necessary to study the evolution of the Group Time Awareness (GTA) and the impact of G-TAT within different group sizes to consider the effect of the number of members of the group in the collective time management behavior, in general, and their GTA specifically.

The high level of experimental mortality is maybe a symptom of the poor usability or acceptability of G-TAT, or, at least, an indicator of the lack of the students' interest for collective time. G-TAT was not used by the student in the moment they were asked to declare the retrospective learning times of their team-mates. However, the quasi-experimental design we carried out didn't allow us to define the degree of influence of the use of G-TAT in the retrospective time estimations each student of the treatment group did. The impact of G-TAT on short or long-term Group Time Awarareness would need a deeper study to define the specific impact of this contextual awareness tool.

The contribution of this study could be considered on the suggested methodology for the assessment of students' cognition of their team-mates learning time during a collaborative activity. This methodology could be used in the field of peer evaluations and other collaborative learner-centered assessments. The second contribution could be considered at the level of the help tool (Time Awareness Tool) provided to the students in order to enhance their group awareness. The Time Awareness Tools was developed taking into account previous research in groupware and Human Computer Interaction, where some authors have already proposed contextual awareness tools aiming to improve the organization of working and learning groups (Ellis et al, 1990; Dourish & Belloti, 1992; Greenberg, 1996; Nova et al, 2003; Huang et al, 2008).

Further research will be conducted to better understand the effect of reflexive tools on the group time awareness, and understand the biases in the subjective perception of team-mates learning times that we observed in this study.

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