Graphs, charts and notifications in mobile devices as a coordination support tool for forum mediators

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Abstract: In an education environment, a forum provides a valuable tool that can be used to foster reflection on the subjects being discussed. To ensure that its objective is reached, the course's mediators must pay close attention to the coordination of learners' activities. This requires that the mediators frequently check up on how the discussion is going, in order to intervene when necessary. Mediators also need to process forum data to analyze the discussion and identify if it is happening an off-pattern situation. In this work, an investigation regarding graphs, charts, statistical data and notifications about forums activities is presented. These mechanisms, based on mobile devices, are used to help mediators to keep track of the discussion forum, identifying potential problems when it deviates from known patterns.

INTRODUCTION

In a forum, messages may be posted at any time and at any rate throughout its duration. As a consequence, the forum can either be inactive for a long period of time or suddenly receive a burst of messages. In order to know how a discussion is unfolding, mediators need to connect frequently to the environment to verify the course of the discussion and intervene promptly when necessary. It is also hard to collect and analyze data to follow participants' activities. This study investigates the use of coordination support tools for forum mediators based on graphs, charts, statistical data and notifications presented via mobile devices in order to reduce the need of accessing the environment and monitoring the messages.

This paper is organized as follows. In section 2, coordination is approached as an element of collaboration. Section 3 presents the research problem and method. In section 4, tools for forum coordination support are described and analyzed. Section 5 concludes the paper.

COORDINATION FOR COLLABORATION

In order to collaborate, members of a group must communicate, coordinate themselves and cooperate (Ellis et al., 1991). While communicating, they negotiate and make decisions. While coordinating, they deal with conflicts and organize the group in a manner that prevents the loss of communication and cooperation efforts. While cooperating, they work together in a shared space, seeking to complete tasks, and generating and handling cooperation objects. Finally, members of a group need to be aware of the status of activities through awareness information offered by the environment. These 3 dimensions of collaboration are schematized in the 3C Collaboration model (Figure 1).

This paper focuses on the improvement of coordination dimension of educational forums. Coordination is needed so tasks are carried out in the correct order, at the right time and in compliance with existing restrictions and objectives (Raposo & Fuks, 2002). In case of lack of coordination, there is a risk of misunderstandings, disorientation, conflict and duplication of tasks.

In order to have coordination in a group, it is necessary that the collaborative system make available awareness information (Dourish & Belloti, 1992) through which participants get updates on the progress of the group's work, contextualize their own work in relation to that of their colleagues and redirect their activities. Coordinators in particular need to identify eventual problems as soon as possible. In an educational discussion forum, it is relevant to know, e.g., if new messages have already been sent, how the discussion is unfolding, who is participating, if there are messages harming the discussion and if deadlines are being met.

Most of the awareness information has some type of importance. However, a non-manageable quantity of information makes the organization of members of a group more difficult, causing misunderstandings and

communication breakdowns (Fussell et al., 1998). In order to avoid overload, it is necessary to balance the need to supply information with the care to protect the resources destined for work. The supply of information in an asynchronous, structured, filtered and summarized form facilitates this task (Kraut & Attewell, 1997).

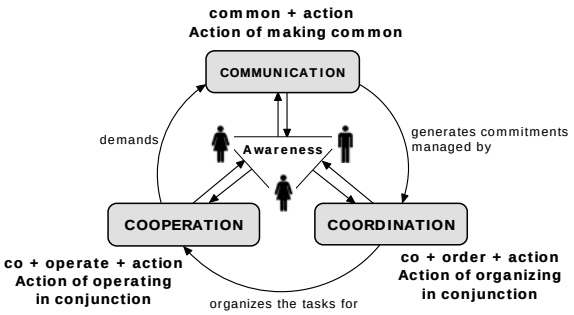


Figure 1. The 3C Collaboration Model

In collaborative learning environments, reports of activities and individual learner participation history are tools available in several LMSs such as AulaNet (2009), Moodle (2009) and Sakai (2009) to follow the activities of participants. These bits of information are usually presented in an inadequate tabular form and are difficult to understand (Mazza and Dimitrova, 2004). The use of information visualization techniques allows new forms of presentation which makes available, e.g., graphs and charts on the interactions among participants in mail and forum services, learner participation in terms of the number of messages sent, of accesses to the environment and of threads initiated, and performance in quizzes and tasks (Bratitisis and Dimitracopoulou, 2006; Mazza and Botturi, 2007).

Besides graphs, charts and reports, some collaborative systems offer the possibility to notify participants of what it is taking place while they are disconnected from the environment, freeing them from the task of constantly check the environment to monitor new contributions. Some collaborative systems send notifications via e-mail and popup windows (Appelt, 2001; Gmail, 2009). The widespread use of cellular phones has given rise to several applications that make use of notifications: in the educational area, there have been investigations on notifications informing about deadlines, tutorship requests and forum unfolding through SMS messages (Nonyongo et al., 2005)(Chiu and Choi, 2005) or cell phone wallpapers (Nakahara et al., 2005).

This research focuses on the investigation of coordination support tools that make available graphs, charts and notifications specifically for educational forums rather than on meeting the needs of a range of services in the distance education environment. It is relevant to mention that the tools investigated do not make use of the learning environment's desktop web interface: PDAs and cell phones are used instead. Moreover, in this research the tools inform about the forum itself, detailing, for example, the message tree structure and number of messages posted per category, and not in providing information about each learner.

REAL ENVIRONMENT, METHOD AND RESEARCH PROBLEM

This research project have been carried out within the Information Technology Applied to Education (ITAE) Course, which has been offered online by the Catholic University of Rio de Janeiro (PUC-Rio) through the AulaNet since 1998 (Gerosa et al., 2005). The AulaNet Environment is a Learning Management System being developed since 1997 by the Software Engineering Laboratory of PUC-Rio. Action research is the research method used in this investigation.

Figure 2. Snapshot of an ITAE conference and its graphical tree representation

In ITAE course, the AulaNet Conference service (forum) is used to carry out the “seminar” activity, in which a learner sends a text on the week’s topic (the seminar) and 3 messages with questions that are discussed by learners for 50 hours. The messages must be categorized as “Seminar”, “Question”, “Argument” or “Counter-argument” and the discussion develops in a tree structure (Figure 1). Learners must send at least 4

messages, 2 of them by the 25th hour. Mediators do not post messages: feedback to learners is conducted through the evaluation of all messages and by means of advice provided through the AulaNet communication services. Eventually, it is necessary to remove a message erroneously located in the chaining of the discussion or to modify the category of a message.

The problem in the ITAE course that originated this research is the fact that mediators have difficulties to keep informed about the unfolding of the forum. There are situations in which they do not have the appropriate technology (network, computer, software) to access the environment in the moment they consider it is necessary. There are other situations in which the mediators, despite having access to a desktop computer, has to make the effort of remembering to check the forum and interrupting another activity. Another difficulty is when they need to process message data to identify whether the forum needs its intervention or not.

TOOLS FOR FORUM COORDINATION

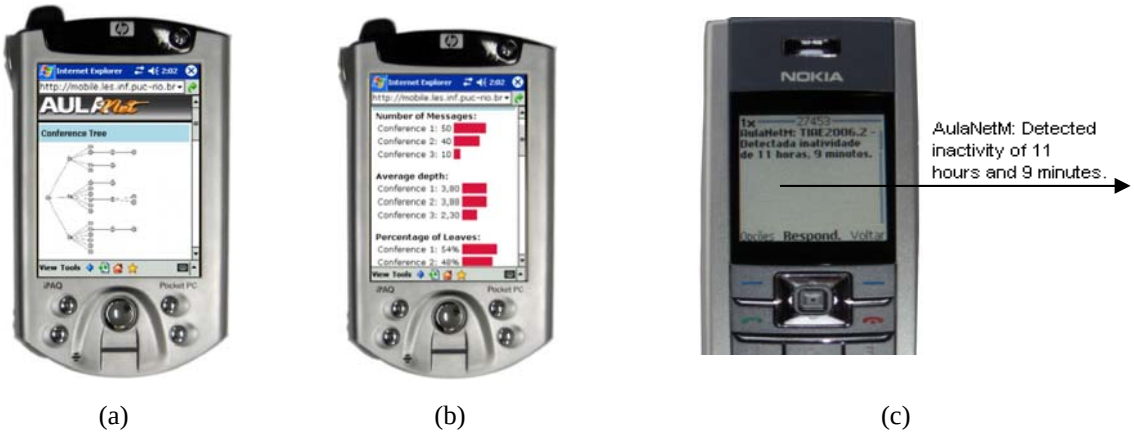
Gerosa et al. (2005) propose the use of the presentation of the forum structure in a fully visual manner and graphs and charts presenting statistical data about the conference in order to better support for coordination. That way, one can have a visual indicator of the direction a discussion is taking. Depending upon the characteristics of the structure formed by the chaining of messages, mediators can evaluate at a glance if an excessive deepening of a certain topic of the discussion is taking place, lack of dialogue among learners and difficulty in debating a subject. Charts with information based on message size, date and category also aid mediators in evaluating the development of the conference. For instance, a graph that shows a very high number of messages classified as "counterargument" indicates that a strong confrontation of ideas is taking place in the conference. A graph that reports the number of messages sent by learners reveals which ones are not participating frequently enough. Even without reading the messages, mediators identify, through the structure of the conference and the graphs, if there are potentially problematic situations that demand their intervention.

A version of the AulaNet Conference service for PDAs was investigated. It offered mediators the visualization of conference tree structure (Figure 3a), charts and statistical data about the conference. The use of wirelessly connected PDAs presenting data in a statistical and visual form increases the number of opportunities for mediators to access the environment to verify whether they have to intervene in the conference. This concise and summarized information is suitable for quick consultation checks during short periods of time, such as a coffee break or while waiting for a meeting.

The choice of graphs and statistical data to be offered was based on the proposal by Gerosa et al. (2005) and on the graphics and statistical data already available in AulaNet. Information was made available regarding a conference, the conferences in a course edition and the same conference in different course editions. A web page with the following conference data was implemented: total number of messages, average number of characters per message, average number of words per message, average tree depth level, tree leaf percentage, number of messages posted by category, number of messages posted by participant, the number of messages posted per day hour and the number of messages posted in each of the 50 hours of the seminar. A second page presents 3 charts: number of messages, average tree depth level and leaf percentage per conference in a specific edition course (Figure 3b). A third page also presents a charts with the number of messages, the average tree depth level and the average leaf percentage, but cross-referencing the data of a specific conference with the same conference of the 8 previous course editions. This page is useful in a course as ITAE, where structure of its dynamics remains fixed during different editions.

The PDA version of the Conference service was investigated in 3 action research cycles, each one conducted in one ITAE semester. Three sources of data were used: navigation records, interviews using open question and the service's login page questionnaire to identify in which situations the mediators accessed the environment: which wireless network they were connected to, if the access had been planned or opportunistic, and if a desktop computer was available at the moment they accessed the service through PDAs

Considering the ability of the SMS service available through cell phones to send short invasive text messages, this type of notifications were also investigated as a coordination tool. The objective was to inform mediators about off-pattern situations that potentially demand their attention and action (Figure 3c). Among the different situations to which mediators must be attentive, 6 were chosen to trigger notifications: conference inactivity (learners are not posting messages), low or high participation of a learner, low or high number of replies to a message categorized as "Question", low or high percentage of tree leaves (few or many non-replied messages), uncategorized messages and incorrectly chained messages (messages posted in levels 0 and 1 of the conference, which are reserved for the seminar and for the 3 questions). These notifications were all based on data related to the forum tree structure and to the categorization, data and author of the messages. Using a cell phone, the difficulty of mediators in keeping informed on the unfolding of the conference when they do not have a computer is potentially reduced. Using a push service as SMS, mediators keep informed without having to check the forum. These tools were investigated in 2 action research cycles. The following data sources were used: survey on cell phone usage profile, LMS navigation records, statement of SMS messages sent supplied by the phone company and interviews using open questions.



(a) (b) (c)

Figure 3. (a) conference tree structure; (b) graphics on 3 conferences of a course edition; (c) off-pattern situation notification

The results of the qualitative interviews conducted with the two ITAE mediators and their activity logs showed that they identified opportunities and effectively used the PDAs in typical situations where they would be useful, such as in a restaurant queue or at a moment when all laboratory computers were busy. Their use in opportunistic and emergency situations was also identified as advantageous for the work of mediation.

The possibility to use the information in the tree structure for coordination purposes was spontaneously reported by one of the mediators in the first week, describing a situation in which the two mediators, physically close, needed to define urgently the share of messages to be evaluated, but did not have access to a computer at that moment. The PDA was used to access the conference and the decision was based on the information obtained directly from the conference tree structure. In the interview the same mediator summarized the relevance of this tool to support coordination when he said "I found it very useful to see the tree through the PDA. It is a synthesis of the conference. This makes the PDA very useful, for instance, to decide if I have to rush to a computer to evaluate messages or if I can wait a little longer".

Regarding the use of the charts and statistics data made available in AulaNet PDA version, the two mediators considered them important and relevant to be offered, but they used them occasionally. One mediator considered that they were not decisive, and the other stated that these graphs were useful as a pos-course evaluation tool. It was identified that some parameters – such as average tree depth level and number of characters in a message - are unusual, making it difficult for the mediator to evaluate from them if the conference is unfolding in a sound way or if it demands any action on their part. These parameters demand from the mediator longer experience with seminar mediation and observation of their variability.

The results obtained in the two action research cycles with the use of a SMS notification service indicated that mediators were effectively assisted in their conference coordination work, keeping informed on what was going on and having less need and lower stress to check the conference constantly. The use of SMS notifications changed the mediators' routines. Both stated that they do not need to check the conference frequently anymore, reducing the pressure involved in the conference mediation. One of the mediators reported that "with SMS I can logon only when the cell phone rings" and that notifications let her remain "tranquiller". For the other mediator, SMS prevented him from having a bad surprise when he checked a conference and identify an off-pattern situation. According to him, "if I'm aware that a problem is happening, I can prepare myself to act. I can organize myself and act immediately, or I know I can act in one hour… depending on the problem".

The notifications that demanded immediate action such as miscategorized or wrongly chained messages were considered by mediators as being the most useful for their activities. Notifications on messages conference inactivity, level of participation of a learner and insufficiently answered questions were useful to keep mediators aware of what was taking place in the conference, once these situations did not necessarily demand any action.

Notifications on the percentage of tree leaves (non replied message percentage) were not well received by mediators: besides this type of notification had been sent too often, it provided information about a conference parameter they were not very familiar with. This type of notifications was also considered not very relevant because the actions they were supposed to trigger were not well defined and could vary according to the context. The problem with the non replied message percentage notification indicates that precise characterization by mediator is important to prevent useless notifications, sub-notifications or over-notifications. When that happens, the notification is ignored. It should be noticed that the configuration of a situation off-

pattern becomes difficult to figure out when one is not familiar with associating a certain parameter value with an unusual situation. This is the same problem mediators had analyzing unusual parameters presented in charts.

CONCLUSION

The use of the coordination tools investigated in four editions of the ITAE course indicated that they provide support to mediators in their task to coordinate the forums, reducing difficulties regarding the need to follow the forum when a computer or network is not available, to frequently check the forum and to process message data to identify off-pattern situations. The forum structure presented graphically is a relevant tool for mediators, as it is notifications that demands prompter interventions in the forum. Some notifications are more useful to follow the conference, once the actions that should be taken after their arrival depends on the context. Graphs are relevant both to pos-course analysis and to follow the forum. Its use demands more investigation regarding the analysis of some parameters that are less usual to mediators. In these cases, it is more difficult for the mediator to interpret how the conference is unfolding. This same difficulty also happens when the mediator have to configure a less usual parameter choosing a value to trigger notifications.

A well-coordinated forum provides a valuable tool that can be used to foster reflection in a paced learning, to share information and points of view and to interconnect the group. There is no ideal visual and statistical outcome that teachers should steer their course towards. The statistics and analysis presented in this paper help to better mediate the discussion process and to identify uncommon situations, which does not necessarily means problems; it requires the teacher to check them out, inspecting the content of the discussion. The information also helps to analyze and understand the complex cognitive and social phenomena that may occur in a forum discussion. The teacher should interpret the statistical and visual information taking into consideration the course's and participants' characteristics. Final decision and judgment are still up to them.

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