

# Leadership and Conflict Management Support in a Cooperative Telelearning Environment

RICHARD HOTTE & SAMUEL PIERRE

*One of the main characteristics of telelearning is the spatial and temporal distance between the instructors and their learners. The latter – many of which are adults – are subject to professional, family and other social obligations that limit their availability and mobility. Communication networks can contribute to efficient solutions in dealing with these limitations (Bates, 1986; Buchanan, Rush, Krockover, & Lehman, 1993). The implementation of a computer-aided tutoring system transforms the telelearning environment into a dialogue system. This allows groups of learners to enter into discussions among themselves, learn and be productive through a communication network. Such an environment not only makes possible the creation of continuous relationships between learners located in different sites and available at different moments, but also permits the formation of communication networks among groups of learners. This is the basis of the concept of cooperative telelearning, defined here as a process of acquisition of knowledge, know-how and abilities through interactions between peers scattered in space and time (Pierre and Hotte, 1996; Hiltz, 1988; Keagan, 1990; Slavin, 1990).*

In a typical telelearning environment, learners are virtually regrouped in workshops, where they exchange information and cooperate in accomplishing joint tasks. These tasks require collective decision-making for the achievement of general, as well as specific, learning objectives (Harasim, 1987, 1990). These workshops are virtual teams within which natural leaders can emerge and possibly compete against the appointed tutors that are assigned to assist learners. Whether they are institutional or natural, these actors play the role of interaction facilitators (Viller, 1991) in their capacity as cooperation agents. In a problem-solving situation, these agents are identified by the generic term *leader* (Pierre and Hotte, 1996; Kerr, 1986).

In the telelearning environment, the *leaders* can be one instance of the following types of interveners in the learning process: (i) the tutors that are appointed by a teaching institution to manage a group of learners; (ii) the experts that share knowledge – theoretical, practical or technical – with a group, and to whom the learners resort for understanding specific elements of content; (iii) the learners who take responsibility for the group to which they belong – because of their professional background in a field, advanced learning in relation to the others, or strength of personality. Thus, one can become a leader by appointment, as in the case of institutional tutors, by mandate like an expert, or by aptitude, as in the case of a student within a group of students. Then, the problem is to determine the type of support and assistance that should be supplied to these leaders in a way in which they can efficiently contribute to the project of the student groups with which they are

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RICHARD HOTTE, TÉLÉ-UNIVERSITÉ, UNIVERSITÉ DU QUÉBEC, QUÉBEC, CANADA  
E-MAIL: rhotte@teluq.quebec.ca

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SAMUEL PIERRE, DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING,  
ÉCOLE POLYTECHNIQUE DE MONTRÉAL, MONTRÉAL (QUÉBEC) CANADA  
E-MAIL: Samuel.Pierre@polymtl.ca

associated. In this perspective, how can one favor the participation and cooperation of students in group activities, maintain their interest, satisfy their training demands and requests for information, intensify the dialog within groups, render dynamic communications among groups and resolve eventual conflicts?

This article presents some methodological and conceptual aspects of cooperation in a telelearning environment to develop and implement a multi-expert assistance system dedicated to leaders who emerge within groups that constitute this environment. First, this analysis is inspired by preliminary work that led to the first design of a telematic scenario of computer-aided pedagogical management (Hotte, 1993). This scenario resulted in a computer-supported pedagogical management model called EPAO, developed and implemented at Télé-université (Québec). Second, other objectives aimed to model the multi-expert assistance system, SAME, defined as a network of cooperative agents capable of assisting the leader who intervenes within student groups. This system is still under development, but the first prototype has been implemented and is currently available. Work undertaken in this context was oriented towards establishing the links among humans represented by the group and the leader, and the computerized assistance of SAME.

The following section clarifies the context of emergence of these group leaders. Following this, we highlight the main aspects of SAME, dedicated to the generic leader and taking the form of a set of mechanisms within which the telelearning environment cooperates to solve specific problems. Then, we characterize the users of this environment within a perspective of defining the areas of cooperation and anticipating conflicting situations. In conclusion, we present and illustrate potential conflict resolution cooperation strategies.

## **ELEMENTS OF DESIGN RATIONALE**

The ideal strategy to identify typical cases of leadership exercise and circumstances of potential conflicts to be managed is the analysis of concrete situations of cooperative telelearning. The observation of these situations allows one to specify the type of assistance needed by the participants whose formal and informal task is to facilitate learning.

## **PRELIMINARY EMPIRICAL WORK**

In February 1991, an experiment conducted at Télé-université (Quebec) allowed for the testing of a computer-supported, pedagogical management system. This experiment involved 104 participants, including students and tutors distributed throughout Quebec. This system aimed at supporting students in a distant learning situa-

tion. All the students were taking a computer networking course. This support was provided through the use of a computer-supported conferencing system, CONFERE, which incorporates an e-mail subsystem called POSTE. Access to other resources – directories, computerized exams and useful addresses – was also provided.

Our experiments have allowed observation of the integration of different actors' interventions during the training; the formation guided sub-groups that stimulate learning among peers; clear identification of different participants' roles (content tutors, animation tutors, students, network animators); and a form of quality control in the pedagogical assistance provided to students by taking advantage of the trace left in the exchange between the tutors and the learners through diverse teleconferences (Hotte 1993; Bates 1986; Harasim 1990; Hiltz 1988). In light of these findings, other experiments were conducted through the progressive definition and implementation of a more complex computer-supported pedagogical management system. This system is not exclusively made for students of one course. Rather, it is intended for an entire study program serving approximately 1,000 students per academic year.

Apart from students, the other main actors in this environment are professors, tutors, tutor administrators and networked community animators. The role of the tutors essentially consists of pedagogically managing the students under their control. Generally, each group is formed of approximately 15 students and is supported by a management teleconference called *GROUPE*. In this context, the role of the tutor tends more towards the leading or animation of learning groups rather than towards the supervision of learners. In this sense, the tutor resolves the problems related to function, evaluation and content that face the learners. The tutor advises the learners in the organization and management of their learning time. Finally, the tutors can serve as a support to a student who is animating a learning cell.

## **EMERGENCE OF THE LEADER'S ROLE**

Our observation of relationships within a group reveals the existence of two categories of individuals: the followers and the leaders. The leader is at the center of the interactions between group members. Generally, the leader is more active than the rest of the group members and whose interventions are more vital to the group than the interventions of the rest. The leader represents the group's ideal that conforms to a collective value system constructed upon expressions of behaviors and attitudes, which are continuously reassessed and reevaluated by the group. Individuals who are, according to the group, closer to this ideal would exercise more

influence and, thereby, assume leadership in the group (Tessier and Turcotte, 1994).

Figure 1 presents a classification of different types of leaders observed during the experiment reported in the previous section. In effect, we can identify two different types of leaders: the positive and the negative. The negative leader essentially emits negative feedback to attract the attention of the other community members. This kind of leadership will be illustrated in the case study described later.

The positive leader contributes to the improvement of learning conditions. This type of leadership can be exercised in either functional tasks or social/emotional relations between group members. However, it should be noted that both functional and social/emotional leaderships are different from the official leadership that a teaching institution assigns to a person. Indeed, leaders are considered functional simply because their interventions are necessary for the accomplishment of precise tasks within a group. The social/emotional leader is a group member who facilitates dialogue within a group. Moreover and generally, the actions of the leader aim at establishing both objective and subjective solidarity within a group of learners (Johnson & Johnson, 1990; Renaud, 1993). Leadership exercised at a social/emotional level is complementary to functional leadership because the two forms of leadership are necessary for cooperative telelearning.

Leadership in this context originates in behavior, regardless of the functional role assigned to a person. Leaders can therefore be a tutor, a learner, an expert, as well as any intervener in the telelearning environment capable of facilitating the groups' activities (Kerr, 1986; Viller, 1991).

The leader corresponds to a set of behaviors being able to have a positive influence on a group. The leader must respond to the group's expectations that are aimed at production, solidarity and self-regulation.

## COOPERATION WITH A MULTI-AGENT ASSISTANCE SYSTEM

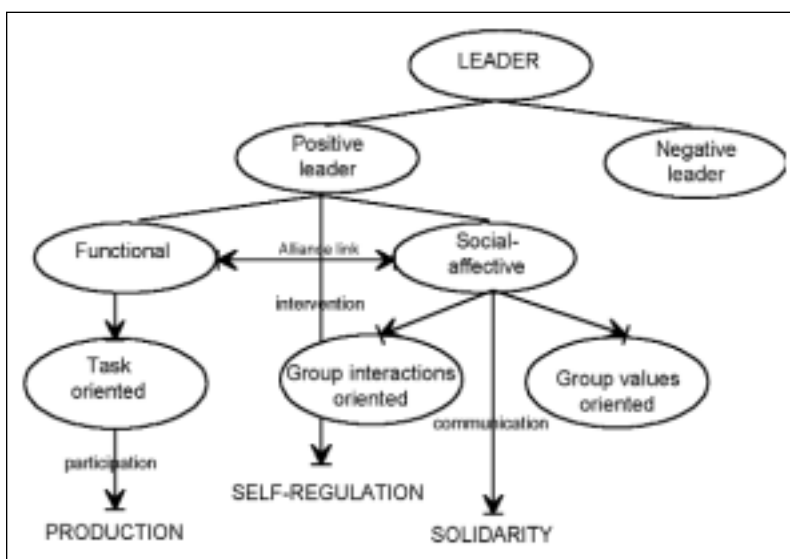
The diversity of both tasks and human resources allocated to pedagogical management in telelearning is such that answering a request or solving a problem – submitted by a learner, or a group of learners – often requires recourse to several institutional resources. In this context, the required intervention necessitates the identification, search and filtering of diverse information located in databases which are often different in content as well as in structure. Nevertheless, no enlightened leadership can be exercised without an efficient use of diverse information and expertise sources. For that reason, we propose a cooperation between the basic telelearning environment and a multi-agent system called SAME (Pierre and Hotte, 1996).

### SAME'S Functional Description

The computer configuration of SAME is supported by the multi-agent system methodology, where each agent is an artificial actor that assumes one or several assistance tasks for the benefit of the leader. The agents are numerous, form a network and can communicate among themselves. They are not necessarily learning assistance experts. This opens the possibility of an interaction among the agents to cooperate in the resolution of problems submitted to them. Thus, SAME explores a more flexible aspect of expert systems. In effect, tasks of a certain cognitive level are achieved through systems whose knowledge base is considered as an expert source to which any participant in a situation of a leader has access.

In the phase of design and modeling of SAME (Hotte, 1998), the level of definition required by the design of a multi-agent system has been followed. The first level concerns the different agents (typology and structuration) active in the system, which can be done only through the analysis of the activity devoted to the system. The second level, *communication model*, clarifies the manner in which exchanges are undertaken. The third is called *cooperation model*, which specifies the cooperation mechanisms among the different agents to implement the functions of the system.

There 10 basic functions provided by SAME: F-Welcome, F-Repair, F-Group, F-Animate, F-Leader, F-Conflict, F-Decide, F-Root, F-Inform and F-Experts. These functions aim to respond to needs such as welcoming, training, technical assistance, learning



**Figure 1.** Classification of different types of leadership

group animation, leadership exercise, conflict resolution, assistance to collective decision-making, advice on program progress, access to databases and sources of expertise (Pierre & Hotte, 1996). These functions are considered as super-tasks, and can be split up in several standard tasks performed by special agents.

The different uses of SAME that are specific to the leadership in a self-asserted virtual community correspond to the following four functions:

1. *F-Animate*: relative to the principles and techniques related to group leading;
2. *F-Conflict*: aims to assist the resolution of diverse types of conflict within a group through means such as voting strategies;
3. *F-Group*: refers to the requests related to the management of teleconferences by the leader; and
4. *F-Leader*: allows designation or confirmation by a leader in function of the common objective pursued by the group.

Figure 2 illustrates the configuration of SAME, congruent to the clarification of the leader's role and primarily oriented towards the *F-Animate*, *F-Conflict*, *F-Group* and *F-Leader*. These functions define the assistance system – from now on called SAME-LEADER – and give access in the form of permissions granted by SAME, to management services, techniques and tools essential to leaders in an autonomous exercise of leadership.

### ASSISTANCE TO THE LEADER

SAME supports leaders by replying to some requests called *operating requests*. These latter requests are addressed to SAME to realise an activity directly related to the exercise of leadership. A request is a function request when it addresses an access request for a service or an assistance aiming at autonomous management of a group.

Figure 3 synthesizes these operating requests. In general, these requests facilitate the performance of an activity by preserving the necessary autonomy of the leader. For example, requests such as opening a conference or excluding a member from a conference are requests that the leader can exercise in an autonomous way. Other requests seek to optimize group performance. This category of requests includes *group animation*, voting and scheduling of activities. These requests are not demands for access. Rather, they are requests for means of performance or management. They are similar to the tools that Niederman, Beise and Beranek (1996) have tried to develop. Here is an example of a request from a functional leader to SAME, as well as its related response.

### Example

#### Request

First: Open a private computer teleconference; and

Second: Give an access to decision-making tools.

#### Response

SAME gives an access through some functions of the system to:

- a management teleconference system with a list of students names, allowing the leader to invite or exclude some students; and
- the group support tools, such as collective agenda and delphi's techniques to help the group in handling data, structuring activities, or modelling decisions.

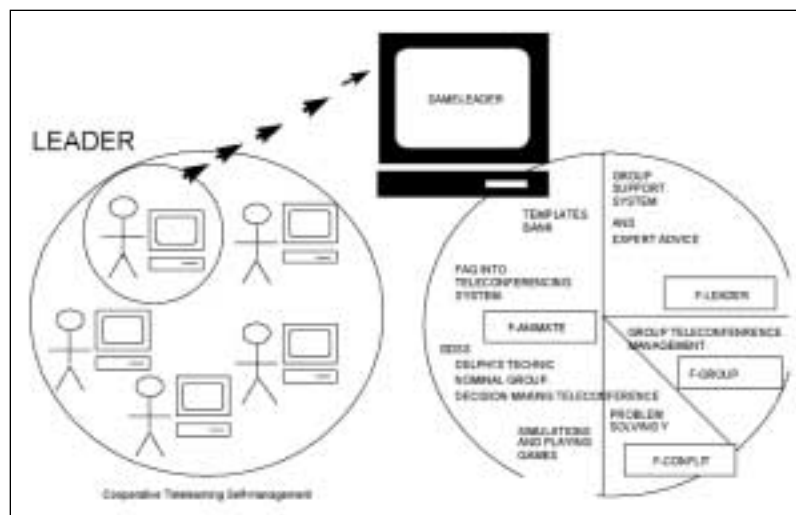


Figure 2. SAME-Leader configuration

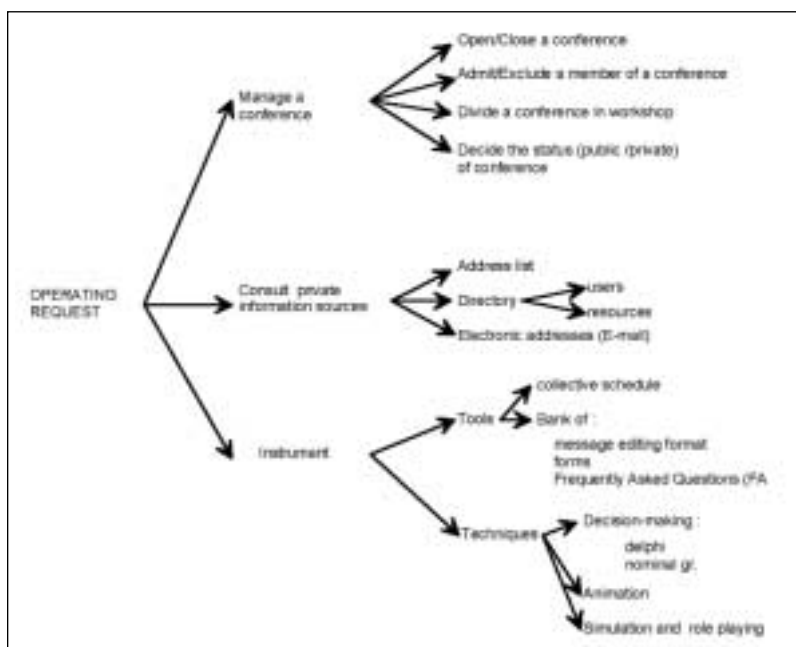


Figure 3. Operating requests

We have described the *leader* as a participant endowed with a set of behaviors –  $C = \{C_1, C_2, \dots, C_N\}$  – completed by an expression of a particular attitude in the form of specific requests –  $R_s = \{R_{s_1}, R_{s_2}, \dots, R_{s_n}\}$ . In the context of SAME, these specific requests refer to operating requests. The answers to requests by a leader (through SAME) take the form of granted permissions, in other words, access to specific assistance functions such as management, consulting and instrumentation.

As soon as SAME receives a request, it guarantees the caller permission to open or close a conference, include or exclude a member, grant a member private or public status and so forth. It divides the request into several tasks allocated to different workshops. A consulting request enables a leader to use phonebooks and a list of electronic addresses. A request for instruments is a demand for a set of tools and techniques meant for use by a leader. These tools include collective programs and baskets containing, among other things, message-editing formats, follow-up forms, a set of frequently asked questions (FAQ) and indexed responses with a consulting interface. Consulting and group animation techniques are added to these tools.

### CHARACTERIZING USERS IN A TELELEARNING ENVIRONMENT

One of the objectives of SAME is to make accessible the human resources expertise devoted to the pedagogical management of students and to any person in a situation of leadership within a cooperative telelearning context. Therefore, it is important to identify and classify these resources according to a typology that characterizes different users and various utilizations (Cluzeau & Ciry, 1988). Such a typology is useful for characterizing the types of assistance that SAME must offer.

### TYOLOGY OF USERS IN A CONTEXT OF ASSISTANCE

The typology of SAME users is undertaken from the marking out of diverse resources allocated to the assistance activities for the benefit of the learner. The global activity is practiced through

tasks specific to the three processes of the distant teaching system: the planning of teaching, achievement of learning and management of student files. More precisely, in the practice of assistance related to the process of realization of learning, the actors intervene in a macro-context, the program, and in a micro-context, the course. Thus, the assistance is expressed under different forms, according to the activities and the actors involved in these activities.

### User Classes

In our approach to defining a global support system in the process of achievement of learning, we have identified seven classes of actors who intervene in the macro-context as well as in the micro-context of learning. First, a regrouping was carried out according to both the nature of participation and the context within which the participation takes place. Through this regrouping, we have identified a first category of actors. These actors are classified as expert, because they can fulfill the following positions: junior managers, technicians, programs coordinators, tutors' administrators, networked community animators and delivery agents.

The junior manager and the technician are management resources. The junior manager updates and implements the rules of the teaching institution, while the management technician is responsible for diverse services such as the processing of learners' complaints or supervision of exams. The program coordinator, the tutors' administrator and the delivery agent are resources allocated to teaching units. The programs coordinator and delivery agent deal directly with the learner. While the coordinator is concerned with the learners' progress, the delivery agent takes the responsibility for the delivery of courses.

The tutors' administrator participates in the recruitment and selection of tutors, sees to their training, insures the pedagogical follow-up and evaluates the quality of tutor's intervention. The networked community animators assist the virtual community of learners through the management of (electronic) conferences. They also direct call signals emitted by users and provide information for the entire virtual community. We have categorized all these actors as being in *institutional intervener* because the teaching institution appoints them. Figure 4 places them in the category EXPERT.

A second regrouping was carried out during a pedagogical activity. For this purpose, two variables were considered: the micro-context of a course, and the objective of the learning process. Two actors interact in the course: the tutor and the learner. However, in the context of SAME-aided assistance, the learner contributes to the

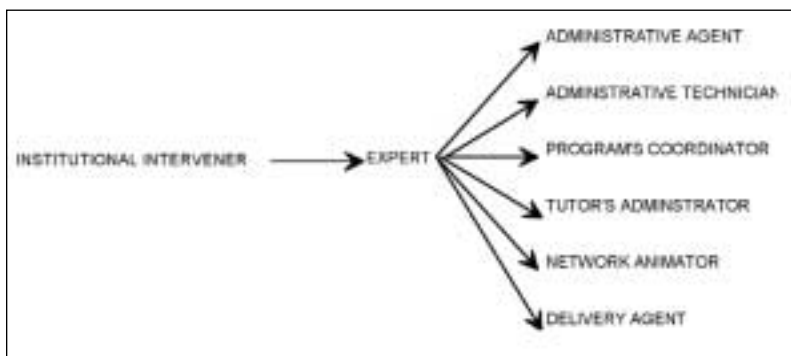


Figure 4. The EXPERT Category

self-management of the group. This situation has led us to create two other categories of users:

- the INSTRUCTOR category (Figure 5) is oriented towards the tutor that we referred to by the terms *appointed intervener*; and
- the LEARNER category (Figure 6) is oriented towards the learner that we have identified as being a *natural intervener*, because such a learner spontaneously emerges as an aid resource in a particular learning context.

Figure 7 synthesizes the typology of eventual SAME users. The first level of this typology regroups users previously placed in three categories: experts, trainers and learners. In the second level, a classification has been made, according to the nature of the above-described intervention. This classification was made to illustrate a nomenclature of interveners: the group of experts, the appointed interveners that includes all trainers and the natural interveners that refer to learners. The outcome of this typology is a more complete definition of the concept of leader.

### Possible Applications of SAME

SAME users form a group of helpers corresponding to the generic term of leader. In practice, problems or specific cases related to learning take the form of requests formulated by one or another instances of leadership. When the inventory of these requests was made, the requests were regrouped in a case base. What follows, describes the methodology according to which the requests were regrouped.

### Expertise Acquisition Methodology

For the purpose of our inquiry, we have conducted an empirical study based on Gauthier's work (1993) during which community of learners, tutors and institutional interveners (Figure 5) have been interviewed. This community was divided into two groups: the real community and the online or virtual community. While the real community is only constituted of institutional interveners, the virtual community is made of both instructors and learner categories (Figures 6 and 7). The means of communication that are considered are the same as the ones used by each group in their professional capacity. Group meetings to initiate an operation or interviews (collective or individual) were used to specify some elements of the inquiry. While the real community required interviews that took place by meeting each members of the group in person, the virtual community was interviewed using the teleconferencing system named COSY. These group meetings have been followed by a questionnaire that have been filled out and returned (directly or electronically) by 99 participants.

A case record (Figure 8) is used as a basic tool for gathering expertise; it includes eight headings for each recorded case. The main headings are: assistance requests and related answers, caller's profile, request frequency, tools and sources of information used. While tools include everything that is material – course guides and lists – *information sources* refer to other human resources required for problem solving.

The *information sources* heading allows for the identification of the interactions between SAME users, and permits deep knowledge of the different information and expertise sources. Each heading is a descriptor that guided our first regrouping. This expertise gathering has led to the identification of one set of requests related to a form of activities, and referring to several aspects of assistance. Furthermore, it permitted the enlisting and regrouping of requests. The first regrouping helped us to validate several aspects of *leadership*. Thus, an inventory of 99 case records was made, one case record per interviewed participant. For the purpose of information gathering and according to the classes of requested resources, the case records are distributed as follows: 38 for the EXPERT category, 31 for the TRAINER category and 30 for the LEARNER category. Each record is identified by a classification mark constituted of two letters and one number. The two letters (Table 1) indicate the function of the resource followed by a number specifying the order of processing the case record.

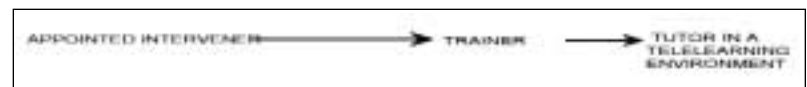


Figure 5. The INSTRUCTOR categories



Figure 6. The LEARNER category

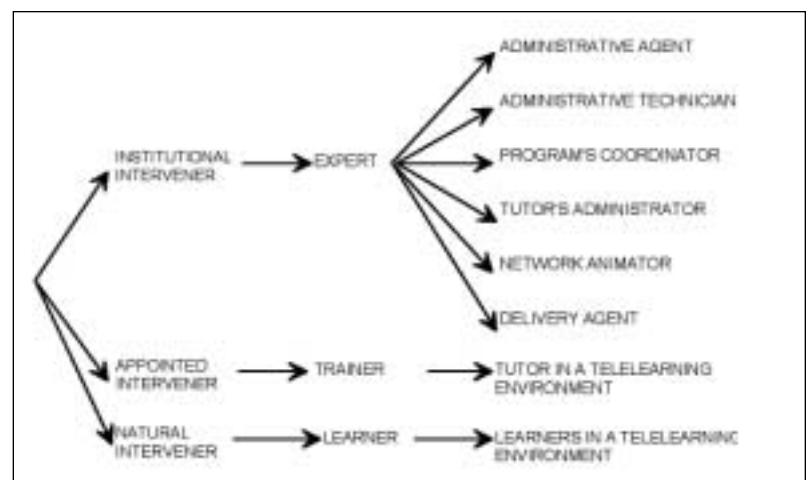


Figure 7. Typology of SAME users

The first time, this processing led to the emergence of four categories of requests: information requests, clarification requests, processing requests and advice requests. The latter category includes all requests needed to guide a caller who is under-

taking a specific activity such as the management of learning time. The second time, this processing led to the association of each request with one of the following verbs: inform, clarify, process and advise. Each verb corresponds to one of the request categories identified after the preceding operation. These verbs indicate both the nature and purpose of the activity that can be required.

To ensure a greater precision in our classification approach, a refinement of the regrouping method was carried out to eliminate inter- and intra-classes redundancies. In this sense, each class is exhaustive and exclusive of the others. This operation has led to a regrouping into one class several requests that are of the same nature.

### Classes of Applications

Classifying requests serves to establish definitions of the assistance tasks addressed to SAME. For this purpose, we have considered the nature of the request and the objective of the related assistance. However, we are aware that a pedagogical supervision, even in a situation of tele-learning, remains a human action accomplished through the use of different resources, regardless of whether or not the latter are supported. Such resources are those classified in SAME typology.

*Information requests* (Figure 9) inform the caller. Both learners and institutional resources place them. Often, *information requests* are questions about the following: the institution and its rules, course delivery, etc.

Information on a teaching institution is considered general when it is about administrative structure, organization of teaching, statistics on academic success and so forth. Information on institutional rules is about studies and graduation, particularly certain forms of graduation. Information on programming refers to the official description of courses and programs, changes in course programming, teaching and research units where programs and courses are designed.

Last, information on course delivery is punctual and targeted. It concerns delivery resources and services, as well as operations related to the logistical aspects of a course, exam schedules, mode of shipping assignments, etc. A *clarification request* (Figure 10) is a call for information that exists and is known by the caller, but that the latter has difficulty understanding.

The first category regroups requests for course content and organization. Such requests are also for specification of course objectives and pedagogical approach. They also include demands for explanation of assignments, evaluation, learning mode and activities. In the second category, requests are about three well specified aspects: services provided by the communication system,

**Table 1.** Classification marks attributed to case records

Mark	Resource Function
AA	Administrative Agent
AT	Administrative Technician
DA	Delivery Agent
PC	Program's Coordinator
TA	Tutor's Administrator
TU	Tutor
LE	Learners

<p><b>1. IDENTIFICATION</b> (capacity)</p> <hr/> <hr/>
<p><b>2. ASSISTANCE REQUEST</b> (problem)</p> <hr/> <hr/>
<p><b>3. TYPE OF CALLER</b> (for example, program coordinator, supervision specialist, networked community animator, DE technician, agent, tutor, learner)</p> <hr/> <hr/>
<p><b>4. FREQUENCY</b> (5 to 1 from + to -)</p> <hr/> <hr/>
<p><b>5. RESPONSE TO THE REQUEST</b></p> <hr/> <hr/>
<p><b>6. IN WHICH CAPACITY</b> (in capacity of a complaint technician, delivery agent, learner etc.)</p> <hr/> <hr/>
<p><b>7. TOOLS USED</b></p> <hr/> <hr/>
<p><b>8. INFORMATION SOURCES</b></p> <hr/> <hr/>
<p><b>9. COMMENTS</b></p> <hr/> <hr/>

**Figure 8.** Case record

course software and functions of the digitized courses that are developed and implemented through the use of author-software system or application generators. These requests lead to a better understanding of user guides, software and functions, such as printing of files and documents. Learners exclusively address requests for clarification to tutors or other learners.

Figure 11 illustrates the processing request that requires triggers, a specialized follow-up process. We have identified the administrative follow-up and complaint follow-up. The former carries out program admission, registration and managerial procedures such as learner mark revision or exclusion. The follow-up of a complaint is related to both computerized function operations and tutors' pedagogical skills. Sometimes, a complaint follow-up is about tutors' availability and their openness to the learners' concerns.

Processing requests are addressed to the administrative personnel such as technicians and program coordinators. These requests are directly addressed to tutors and tutors' administrators who carry out the complaint follow-up.

The *advice request* is defined in Figure 12. It consists of a demand of an idea about the preferable action in a given problematic context. In learning processes, this category regroups a set of demands translating the needs of support expressed by learners who update and complete their learning requirements. In addition, an advice request is closely related to learners' progress, and it is often about pedagogical, regulatory and administrative aspects of learning. Requests for advice can be addressed to tutors' administrators, tutors or to a learner.

The analysis of case records allowed for the inventory of requests and permitted the identification of the tools used by aids as well as information resources. Information resources guide aid resources to address their requests. These tools provide for a part of required knowledge, and supply the information needed by SAME. This information is presented into two forms: the institutional and promotional type on the one hand, and the pedagogical information type on the other. In the former category, there are year-books, lists of courses, program promotion and study regulations. The latter category contains program files, course materials and pedagogical and software guides. The case records also invoke the use of a set of tools that illuminate the domain covered by information sources. These tools include lists, sheets, tables and forms.

The information sources are those used by SAME users when acting in their capacities as expertise providers. Indeed, they are both experts and peers who help their equal in the

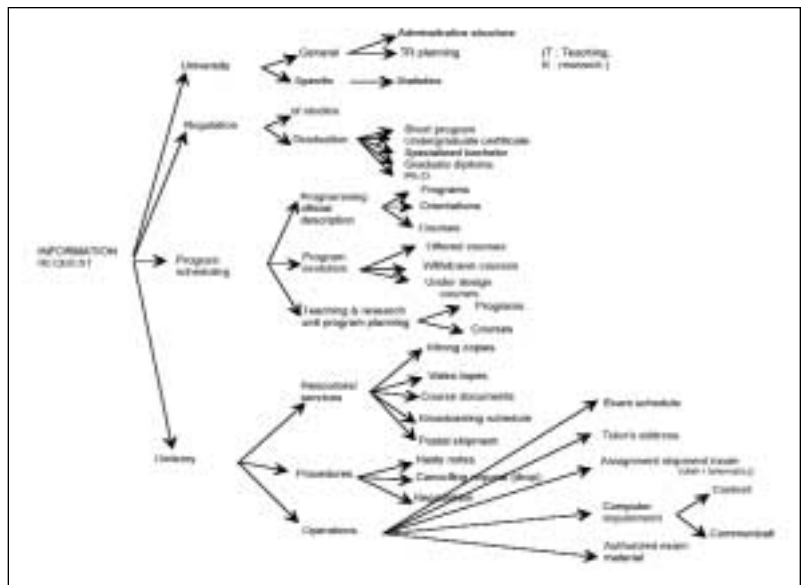


Figure 9. Information request category

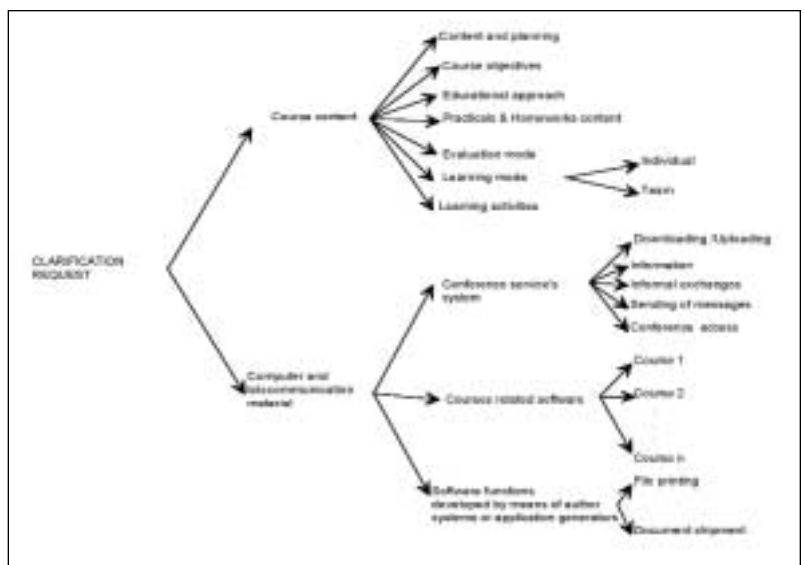


Figure 10. Clarification request category

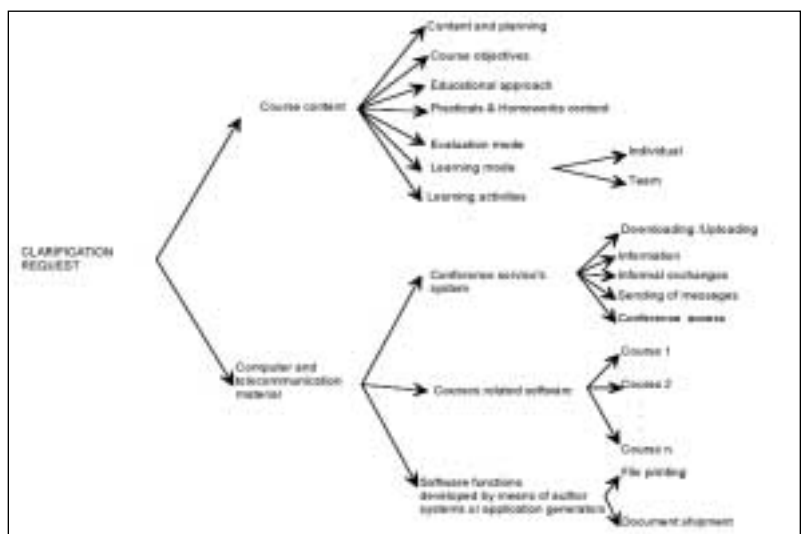


Figure 11. Processing request category



processing of a request. This is simply because they supply information or know-how required for solving assistance problems.

### COOPERATIVE STRATEGY FOR SOLVING CONFLICTS

In our context of telelearning, interveners who are organized in groups cooperate in information gathering and exchange. A specific protocol of leadership appointment is then required for elaborating a cooperative strategy for solving conflicts.

### LEADER APPOINTMENT PROTOCOL

In the context of self-managed groups, leaders are an agent of cooperation. They are required to be well intentioned towards the other participants. Their role must facilitate cooperation in problem solving or improve the learning conditions. Generally, participants' commitment to each other permits the description of dependent relationships during the achievement of a social task – for example, "If you participate, then I would." This is an individual commitment anticipating the adherence of several participants. Cooperation is both about the activity of the entire group and the sharing of resources.

The leader appointment protocol grants an active role to the leader, according to two ideal scenarios. In the first scenario, the appointment process is initiated by an appeal from one or several participants. Then, one or several participants respond to the appeal by committing themselves to the consideration of the request. The number of appeals successively addressed to the same participant determines the choice of the latter as leader: this is a form of reactive leadership. In the second scenario, a participant attracts the attention of the whole to a problem: this is a form of pro-active leadership.

Since our leadership appointment protocol is based on the notion of commitment, we analyzed

the exchange of messages between participants. This analysis shows that commitments have social and emotional aspects and are the result of communication processes. Henceforth, it is possible to imagine several commitment protocols. For example, the commitment of one agent to another can be determined by means of a demand/response protocol – for example, "Can you help me?" "Sure!" – or by an offer/response type of protocol – for example, "Can I help you?" "Yes, thank you" (Bouron, 1993).

Regarding the demand/response type of protocol, there is a solicitation from the group (question) intended to an individual and commitment of an individual who feels solicited (response) by a group. We have taken into account a group of six participants, five of whom are students and one is a tutor. In this scenario, the student #2 feels solicited and commits himself to the group. There is also a recognition of the group toward this commitment.

**Student 1:** Addresses a request to the tutor:

« Concerning the question: "State five knowledge that help to characterize the space of the state", I would like to know the difference between both the abstract level and symbolic levels ».

**Student 2:** Proposes an answer to student 1.

**Tutor:** Confirms the answer of student 1 to student 2.

**Student 1:** Addresses, again, a request to the tutor:

« I would like to have an example to the question of practical work 1: « Outline a trace of the search for a solution » concerning both the abstract and symbolic levels ».

**Student 2:** Proposes again an answer to Student.

**Student 3:** Recognizes the Leadership by student 2:

« Hello dear Paul,  
It seems to me that all these affirmations make sense »

**Student 2:** Provide information to his fellow students.

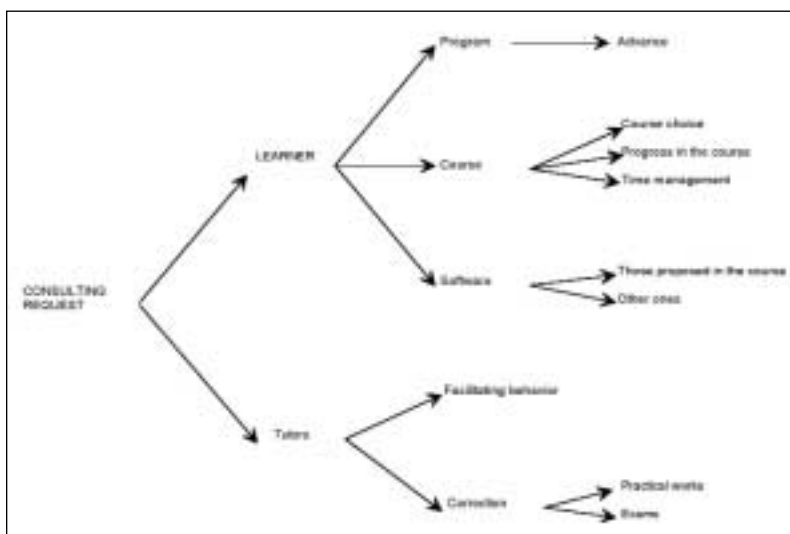
« I have found on the Net some interesting sites that have information on practical implementations of problem solving methods [...] ».

**Student 4 (of group 6):** Thanks Student 2 for the answer provided:

«I am Isabelle of group 6. I have received your answer to my question. [...] So, I would like to thank you for having taken me out of trouble!!! ».

**Student 2:** Responds to Student 5, and encourages him in his approach to learning.

« A few words to assure you. There will be at least one person who will have read you. In return, if that can reassure you, the material presented at the expertise level is a little bit practical [...]. Thus, I would need to exchange with others on the course material, either to reassure myself or to allow myself to be adjusted. I think, I have assimilated large parts but...often I have a doubt ».



**Figure 12.** Advice request category

Regarding the offer/response type of protocol, there is a solicitation of the group by an individual. The commitment of this individual to the group is expressed in the form of a response. Like in the previous case, we have elaborated a scenario that can be at the basis of the offer/response type of commitment protocol, and applicable to the proactive leader.

Let us consider a group of 30 students participating in the socialization conference *CAFÉ* in the context of a computer program applied to organizations (IAO). In this scenario, the group is composed of three categories of participants: a leader (Student, L), a group of six students (E) acting as partners (P) ( $P=\{E_1, E_2, \dots, E_6\}$ ) of L, and 20 other students (E) ( $E=\{E_7, E_8, \dots, E_{26}\}$ ) who collaborate in the exchanges and validation of means proposed by L supported by P. Figure 13 represents the organization of the group as we have seen it in the workshop *BESOINS* (needs) of the conference *CAFÉ*.

In this scenario, L solicitates the student of his study program about a need related to the pursuit of their training, while offering to undertake an action aiming to satisfy this need.

- L:** Attract the group's attention to a fact:  
For example: Need to transform the certificat program in informatics into a bachelor program.
- E:** Show their interest in this demand from L, by participating in an exchange on the question posed.
- L:** Proposes an action plan to validate a point of view.  
For example: Open a private teleconference for:
  - discussing the question;
  - deciding on an action to be taken;
  - co-authoring a letter to be addressed to the university authority;
  - a meeting with the pedagogical instances of the program.
- E:** agree to participate in the exchange on the action plan and to validate it.
- P:** Directly and publicly associated to L as partners in the organization and execution of the action plan. P and L constitute a team.
- L:** Lead the group with the help of P;
  - Proposes the means;
  - Initiate the vote;
  - Take actions.

The two previous scenarios illustrate types of interactions that have really taken place in the network within the group of students. These demonstrations of assistance belong to the process of dynamic mutual help as it exists in the functioning of a self-managed cooperative telelearning group that can be observed in the interactive telelearning environment. These

observations were performed during the implantation on the field of two telelearning systems: the prototypes of the courses INF 6550 - Methods and Tools for Problem-Solving; and TEC 6200 - New Technologies and Cognitive Development of the Télé-université (Quebec).

The process of designating leaders is characterized by three essential phases: solicitation, engagement and disengagement. For each of these phases corresponds a protocol: the demand/response type of solicitation protocol, engagement protocol, and disengagement protocol. These three protocols are regrouped into a unique protocol that manages the entire process of appointment of *leaders*.

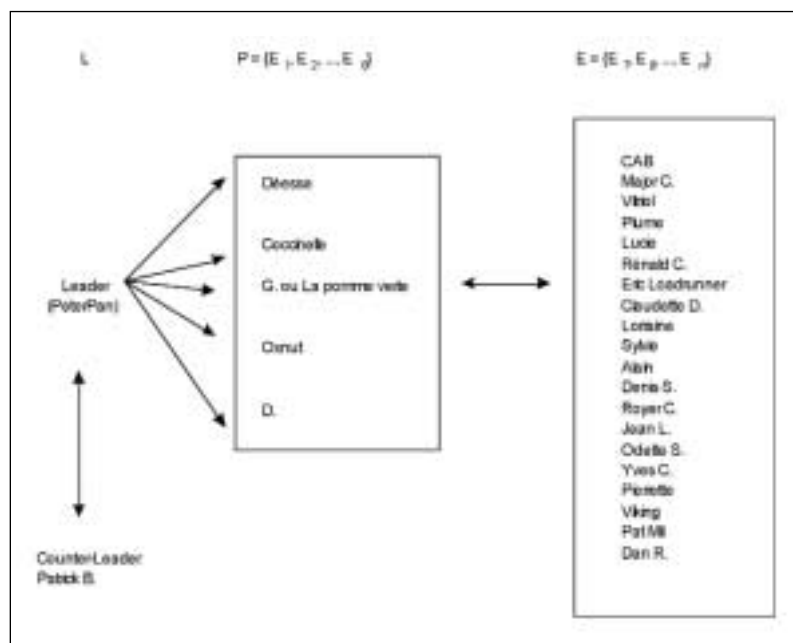
### Solicitation

Solicitation is expressed in the form of a request addressed to the group by one or several participants. It is clarified by the exchanges among the participants in the form of a series of messages written and transmitted electronically which creates a first form of expression of the dynamics of mutual help within a group.

### Engagement

Engagement is a reaction to a solicitation. It manifests itself as an answer to a question or a proposition for an action to be taken. The engagement is strengthened by support from other participants on the choice of action proposed by the leader.

The group recognizes the leader. This recognition manifests itself by a confirmation of the leader's competence by his peers or through the form of collective support to the action plan proposed by the leader. The recognition by the peers



**Figure 13.** Organization of the group in BESOINS

is expressed by the response of participant  $X_2$  to participant  $Y_4$ : *Proposes to participant  $Y_4$  to speak to participant  $X_1$ .*

### ***Disengagement***

In the two forms of recognition described earlier, one can see a mutual commitment between the *leader* and the group. The leader is committed to the group either by playing the role of a facilitator in solving the problems that are directly related to learning or by proposing a means of action to allow the group to express its opinion. When one of the parties breaks this commitment, there is a rupture of communication between them. In this case, one would note a lack of reaction to the leader's initiative. If the leader leads a teleconference specific to the object of mutual commitment, a progressive decrease in the members' participation occurs. The disengagement of the group towards the leader occurs, once the action agreed upon by the group is achieved by the leader and the results of this action are transmitted to the group.

This entire protocol manages the exchanges between participants to proceed with the appointment of leaders. These exchanges are mainly done in the form of electronic messages through a computer-aided teleconference system. Regarding the solicitation, the messages are of two kinds: requests expressed as demands for assistance addressed to the group, or statements of facts – to the attention of the group – about particular aspects of learning. The commitment is expressed as requests emitted by an individual in reaction to one or several requests coming from members of a group, or from a proposition of an action plan. Recognition is expressed through personalized and public messages addressed to the reactive leader, who responds to the requests addressed to the group, or through messages of support to the action plan proposed by the proactive leader. Finally, in the majority of cases, the disengagement is translated by an absence of messages from the group to the *leader*. A leader can also end its in the same fashion.

### **PROCESSING CONFLICTS**

The strategy proposed for solving conflicts is adapted to both the context where the group evolves and the nature of conflicting parties. This strategy deals with situations where experts, trainers and learners interact and form a relational system. Each information (output) produced by a participant is transmitted (input) to the other participants who use it in accomplishing a task. While leaders emerge in such context of group interactions, they can enter into conflicts against each other or against followers. Such conflicts can result in a slowdown of the

entire cooperation dynamic.

Conflict situations can take two forms that are both related to the sharing of influence within a single group. The first form originates in the non-recognition of the emerging leader by the appointed tutor. The second form can be caused by the simultaneous rise of two or several leaders within one group. The first form of conflict displays an antagonism between an emerging leader and an appointed tutor. This type of conflict is often about the sharing of the role of assistance to learners. The second form of conflict pitches two participants endowed with the same status, entering into a competition for leadership. In each form of conflict, the group controls the comportment of the actors and acts as a conflict mediator. It also acts to preserve its own existence, if one of the competitors prefers disrupting the group rather than losing the leadership context. Both forms of conflict are illustrated in the case study described in the following section.

We have identified four cases of leadership: the first is where there is no emerging leader; the second is where one is emerging; the third is where two are rising; and the fourth is where several individuals are competing for one leadership position. In the first case, a conflict can take place between participants. However, this is not related to an exercise of leadership. Rather, it can be any other conflict between individuals in the group (In this article, we are not interested in this kind of conflict). The second case of conflict is between an emerging leader and a person who assumes an institutional role. The third is a case that is more prone to confrontation, because it is a struggle for power between two individuals. The outcome of such a struggle is the dismissal of one of the emerging leaders. Finally, the resolution of the fourth case requires a share of influence between different natural participants. The leader who emerges from this conflict would support the institutional leader that is already in function. Our conflict-resolution strategy forces the antagonistic elements to negotiate. The group acts as an intermediary between its antagonistic forces. It sets the terms of the dialogue and specifies both the objectives and beliefs of the parties in conflict. The negotiation emphasizes common interests.

Our leadership appointment protocol combines negotiation and integration as the best strategy to solve a problem. Indeed, it is difficult to imagine two leaders who emerge from the same group but pursue radically opposing objectives. In effect, the leaders' objectives cannot be radically different because, ultimately, their actions are meant to contribute to the group's

learning achievement. Mediation between the conflicting parties and exercised by the group affiliation is the best strategy for solving conflicts between emerging leaders within a group. Such mediation is also an occasion where the group sets its objectives. In this context, one of the main outcomes of mediation is cooperation because it leads ultimately to the adherence to common objectives, sharing of resources and tasks, as well as to the distribution of roles. Negotiation is an invitation to all participants to share their competence for the benefit of the whole.

When two participants or more are involved in a leadership contest, the conflict-resolution strategy stresses the balance of influence. Emphasizing a balance of influence within a group is ultimately seeking for the creation of a shared leadership. Such sharing can be brought into play by assessing the different forms of leadership required by the group's cohesion. Indeed, a telelearning group requires a functional leadership whose concern is common production or the implementation of an action plan. Even though only one individual is recognized as a leader, that person requires the assistance of other participants who, themselves, are leaders in their own right. When these participants provide their assistance to the leader, the latter requires their specific competence, knowledge in certain domains or simply their ability to persuade others in pursuing the same objectives. The recognition of each potential leader's quality is the best way to avoid a conflict, encouraging partnership and ensuring cooperation.

#### **A CASE STUDY: PETER PAN/PATRICK B**

This case is drawn from the reading of messages exchanged within diverse categories of conferences in the telelearning environment. It is an example of conflict management based on the search for a balanced influence through a shared leadership involving a partnership, not a coalition, between two opposing leaders. This partnership is characterized, on one hand, by an assistance provided for the main leader by other adjunct leaders and, on the other hand, by the rejection of an antagonistic leader by the group supporting the main leader.

Peter Pan and Patrick B are learners in a computer science program at Télé-université. Like all the learners in this program, Peter and Patrick are members of the telelearning community. Among other learners, their colleagues are Déesse, Coccinelle and Diane, who belong to the socialization conference *CAFÉ*.

Peter Pan and his colleagues form a group that promotes solutions for its members' distance training in computer science. This group

functions on a mutual help basis. The group's action is both right claim and affirmation of autonomy. The conference in which the group participates is divided into workshops called *BESOINS* (needs) and *BÂTISSONS* (build). The group also develops information strategies to infiltrate other learning groups that participate in the same environment.

Within this new social context, the group became sufficiently autonomous and coherent, capable of managing its own leader. Here, leadership is characterized by the existence of a natural group formed around a leader. The collective adherence to the group's objectives takes the form of a support offered to the appointed leader. Peter Pan is recognized as a leader because he takes charge of the group's claims. Déesse, Coccinelle and Diane are Peter Pan's associate. Together they form the subgroup *BÂTISSONS*, which proposes concrete actions to the entire group

Déesse, Coccinelle, Diane and some others symbolize a form of social/emotional leadership because they support the functional leader by persuading the other group members on both the validity of the operations envisioned and the value of the *leader*, Peter Pan. The leadership exercised by Déesse and her two colleagues supports the action of the functional leadership. Diane supports Peter by animating conferences that are open to computer science learners. Thus, they can influence both Peter and the pedagogical instances.

Under Peter's *leadership*, all the group's activities are meant for forming (commitment) a structured telelearning group that seeks for the improvement of the program offered by the university. Peter Pan initiates the *BESOINS* conference that prepares the required tools for the assessment of the learners' needs. This activity grants the commitment of certain group members with whom Peter creates the *BÂTISSONS* committee. The mandate of the latter is the elaboration of an action plan for the organization of a meeting with the pedagogical authorities of the program. Peter Pan leads the exchanges between the group's members and facilitates the decision-making within *BÂTISSONS*.

Patrick B emerges within the group as a troublemaker. He openly opposed Peter's position by making negative comments about the pedagogical instances of the university. Patrick B's comments were about technical matters, such as learners' free access to the Internet. He wanted the learners to believe that *BÂTISSONS* was going the wrong way. In doing so, Patrick B doubted the legitimacy of the movement initiated by Peter Pan and his group. Thus, Patrick B

became the negative leader. However, he was not a threat to the group's cohesion because Peter Pan enjoyed the support of the entire group. Finally, the group rejected Patrick B and asserted Peter Pan as the leader on the pressure from the Peter Pan's associates (see Figure 13). The associates proclaimed Peter Pan's leadership, and urged the rest of the group to reject Patrick B. This action made Patrick B more discreet. The group had never been directly consulted on this matter. Peter Pan's associates only send messages to the CAFÉ teleconference against Patrick B's behavior. Peter Pan can use the collective decision-making tools of SAME to learn about the feeling of the entire group. Then, Peter Pan had improved his leadership and maybe obtained the better results than he had anticipated.

This conflict situation opposed two participants who have the same status. Both were learners who contested the leadership position within the group. This was a confrontation between two emerging leaders in a context where the group controls the behavior of the two competing participants. On one hand, there was Peter Pan, who worked for the improvement of the program; on the other hand, there was Patrick B, who criticizes the university. Peter Pan was the positive *leader*, and Patrick B was the counter-*leader*. They were conflict generators not only in their reciprocal relation, but also in their relationship with the group.

Figure 14 schematizes the antagonism between Peter Pan and Patrick B and shows a relationship of power between three elements: the expert, the trainer and the learner. The ele-

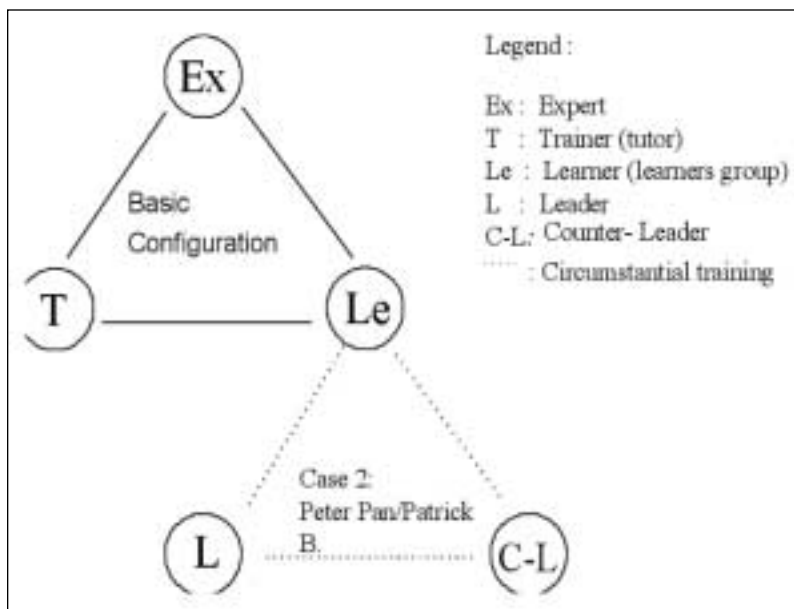
ment **Le** represents the group who plays a central role in this configuration. **Le** is the group of learners who form the third element that mediated the conflict between Peter (**L**) and Patrick (**C-L**). By mediating the struggle for power between **L** and **C-L**, **Le** also struggled for its own survival as a group.

## CONCLUSION

In this article, we have presented a telelearning support environment that ensures pedagogical assistance from a distance. The generic notion of the *leader* is a fundamental element in cooperative telelearning, as we have characterized it. We have defined the *leader* as a resource (internal or external to a group) playing the role of a facilitator in the integration of the learners to a learning group. The *leader* does so by encouraging each member to participate in the group's achievement. Such a leadership is supported by information, by training in various aspects of leadership, and by appropriate tools. This environment, currently under test, is used by 600 computer science learners.

First, we have characterized the *leader* as a facilitator. Second, we described a multi-agent system, SAME, that assists the leader. SAME is currently under development, according to a client-server mode. Some of its functions that allows for welcoming and searching for information are currently under test. Other functions more directly related to the exercise of leadership – F-Animate, F-Conflict, F-Group and F-Leader – are in design phase. They make use of SAME's use and user typologies elaborated in the section titled *Characterizing Users in a Telelearning Environment*. This typology clarifies the requests and interactions among these users according the nature of the role assigned to them within the environment. Thus, we were able to systematically describe the exchange of information between different group members, as well as the rules and protocols for the appointment of leaders. In doing so, we took into account the objectives pursued by the groups to which the emerging leaders belong. Finally, we have proposed a cooperative strategy based on group mediation and negotiation for solving conflicts. This mediation exercised by the group appears to be the best strategy for solving conflicts between emerging leaders within a group.

The originality of this entire research lies on the fact that it is not oriented towards the help provided to the learner, but rather towards the help put at the disposal of any resource that facilitates collaborate telelearning, in a context of computer-aided pedagogical supervision. The most unique aspect of the system under development is its



**Figure 14.** Antagonism between Peter Pan and Patrick B

approach to resolving emergent conflicts over leadership in a shared discourse space. 🌐

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