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CLAS: a Collaborative learning awareness system

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Abstract

By interacting with the environment, a person generates a multitude of signals. In the case of collaborative learning, these signals allowed a learner to have some knowledge of the actions and the intentions of his colleagues. The knowledge of others, which is resulting from his interaction with the environment, is often mentioned in literature by the term 'awareness'. The latter can be translated in this context by 'be aware' or 'be aware of what' it happens. The awareness allows both learners to adjust and plan their behavior based on what they know each other. In this paper, we present CLAS, a collaborative learning system that takes into account the “awareness process”. For doing this, it provides its learners with a set of tools that facilitate the visualization of the traces of their teammates. These learners are grouped into small groups. These social groups can contain four learners at most. This work is a part of research project supported by Guelma University. The task dedicated to our team is to study the impacts of “group awareness” on the instructional level of learners. In other words, the aim is to study the effects of showing all the traces (i.e. actions) of learners by theirs peers. This visualization can be synchronous or asynchronous. In order to facilitate this task, several tools are provided to each learner. These tools are used for supporting the visualization of information about the actions of the other learners belonging to the same group. Some indicators can be calculated from these actions. Most of these indicators are taken from the Social Network Analysis (SNA). Among these indicators, we can cite task realization percentage, percentage of contribution of each group member in global task, cohesion degree, etc. At the end of the paper, we present some screen-shots of CLAS (Collaborative Learning Awareness System), which was implemented at computer science department of Guelma University.

Key words: Awareness, Collaborative learning, Indicator, Reaction analyzer, Traces.

1. Introduction and Motivation

In distance collaborative learning context, it is important for learners to be informed of the activities of their partners committed around the same task. To understand this phenomenon, research in technology education emphasizes the concept of "awareness". The notion of awareness in collaborative environments has been studied in much detail in last years. Dourish and Bellotti provide a general definition of awareness as “an understanding of the activities of others, which provides a context for your own activity” (Dourish et al., 1992). Gutwin et al. refined this definition for educational groupware, and break awareness up into four different subtypes: social awareness, task awareness, concept awareness, and workspace awareness (Gutwin et al., 2002). Workspace awareness can be exploited to increase the social interconnections between students, motivate the exploration of material, and provide feedback to the instructor/facilitator of the course.

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Awareness in collaborative learning environments is essential for any form of cooperation, including coordination, communication and collaboration (Caballé et al., 2004). It allows implicit coordination of collaborative learning, opportunities for informal and spontaneous communication, and gives users feedback part about what is to occur during the collaboration. Indeed, it is crucial that the group members realize (be aware) of the point at which the other members participating in the collaborative process as this will influence their decision-making (Dillenbourg, 1999).

Collaborative learning applications are characterized by a high degree of user-user interaction or user-system interaction and thus produce an enormous amount of information typically maintained in the form of event type information. To capture the interaction for the conscience properly, this event information can be classified in several categories such as work sessions, messages, workspaces, documents and other objects. Also, it can produce a large volume of information, particularly in a real online collaboration that includes learning activities and involves a considerable number of participants (Caballé et al., 2005). But, can the perception of other activities influence on the learner level? What is the relevant information to be visualised by other learners? Can the awareness play a crucial role in collaborative learning environment?

We try to respond on these research questions in this paper. For doing this, we had developed a system that takes into account the awareness process. The developed system is called CLAS (Collaborative Learning Awareness System). The latter is based on the perception of learners in a social group during their distance learning. So, the main objective of CLAS is to facilitate distance learning and interaction between learners. Furthermore, it offers the opportunity to learner to see the work of other learners who are online and their histories (traces) when they are offline.

CLAS provides tutors and learners with some ways for perceiving, understanding, and visualization of their traces (history). The perception of what happens during the learning activity plays a crucial role in enabling tutors to make decisions that they deem relevant and complete their tasks.

The rest of the paper is organized as follows. In the section two, we present the utility of the awareness in collaborative learning environments. Section three is reserved to the presentation of CLAS and its features. In section four, we present our responses on the research questions and the first results of an experiment of the system which was conducted at Guelma University. Finally, section five is reserved to a conclusion and future.

2. Awareness in collaborative learning environments

Previous researchers have defined awareness as knowledge created through interaction between an agent and its environment– in simple terms, “knowing what is going on” (Endsley, 1995). This conception of awareness involves states of knowledge as well as dynamic processes of perception and action. Four basic characteristics run through prior work on awareness (e.g. Adams et al., 1995; Norman, 1993; Endsley, 1995).

1. Awareness is knowledge about the state of an environment bounded in time and space.
2. Environments change over time, so awareness is knowledge that must be maintained and kept up to date.
3. People interact with and explore the environment, and the maintenance of awareness is accomplished through this interaction.
4. Awareness is a secondary goal in the task – that is, the overall goal is not simply to maintain awareness but to complete some task in the environment (Gutwin et al., 2001).

Several researchers studied the application of awareness principles in collaborative learning environment. In situations of face-to-face collaboration, learners still retain a direct perception of the presence of others and their actions. In distance collaborative environment, learners must take a look on the activity of other learners.

When users communicate and collaborate with each other, they need to take into account what other users are doing together and what others have done in the past. This involves receiving information in synchronous and asynchronous modes about the resources used and the users who interact with the system. In addition, the persistent storage of information of awareness as memory group (Conklin, 1992) is essential for students and tutors since, on one hand, it allows participants to not only access to the latest documents and data, which are usually stored for later retrieval, but also the context in which they were created. On the other hand, it allows tutors to track the process of collaborative learning for several purposes such as support (scaffolding) and assessment of learning outcomes. So, be aware of the activities of others is essential to support the activity of the group and enhance learning. Also, it

increases cooperation in terms of decision making, group organization, social commitment, support, monitoring and so on.

Most collaborative activities require coordination to avoid duplication, expectations (one expects that another person has completed a task for himself to start another task) and wanderings (we do not know who should perform a task ....). We therefore believe that awareness should help learners to coordinate their activities. When awareness is synchronous, learners should be aware of current activity in the group (the contribution of other members, their location and availability, users working on a shared document simultaneously, and so on) and need to know in real time what others are co-participants (e.g. during a drafting session, who makes publishing and what is shown). When awareness is asynchronous, users are aware of the activities carried out by receiving the information referred to whom, when, how and where shared resources are created, changed or read by others as a basic condition to solve the current task and to support asynchronous communication.

To provide different types of awareness, we must capture every type of data that could result in an enormous amount of information, which is produced and collected in data log files. Moreover, the need to analyze information available in real time requires a treatment beyond those of a single computer (Xhafa et al., 2004).

Many e-Learning systems adopting the awareness process were cited in the literature. We cite as example: CAS (Collaborative Awareness System), which is a cutting edge interactive environment that enables users to visualize and interact with real time situational data in new ways (CAS, 2011). Other researchers were interested in applying awareness in e-Learning environments like (Messeguer et al., 2008), (Shulman et al., 2011) and (Bodemer et al., 2006).

In the following section, we present a system that takes into account awareness process in collaborative learning. The system is the result of a research project, which is supported by Guelma University. The objective of this project is to give each student all the information on each of his teammates. This information can be transformed into indicators such as rate of completion of a task, rate of contribution of each member in the global task, etc. In this system, learners solve all the problems set by the teacher responsible for learning objects (modules or teaching materials).

3. Presentation of CLAS

The architecture of CLAS is shown in figure 1. This architecture contains: a database containing various information about the system, a web server for navigation and communication tools to ensure interaction between the actors of the system. In addition, it contains an awareness system that contains five modules (see figure 1). Also, this system is composed of three main interfaces that are: Learner interface, Teacher interface and Tutor interface.

3.1. Awareness system

The awareness system contains five modules. These modules are: Perception module, Visualization of interaction graphs, module, Indicators Calculator, Indicators analyzer and learners' reactions analyzer.

a. Perception module: It is devising into two modules: collector of past activities and collector of current activities. The collector of past activities allows each student to see the history of pedagogical activities of his group learners. Also, it allows tutors and teachers to visualize: History of actions, Historical artifacts, Event History, History of attendance and History of locations.

The collector of current activities allows human actors to see different elements of awareness among the learners of the same group:

- ***Presence:*** indicates on line learners.
- ***Identity:*** information on the identity of on line members.
- ***Identification of the author***: information on the identity of the learner who performs an action.
- ***Action:*** knowledge of an action performed by another learner.
- ***Intent:*** understanding the purpose of an action of another learner.
- ***Artifact:*** Identification of the object on which another learner is working.
- ***Location:*** knowledge of the whereabouts of another learner.

b - Indicators calculator: it takes into account the process of calculation of indicators from the traces of learners. These indicators are used by our system to know any information about either group or the learner. Also, they can used to draw some graphs such as: Centrality: Index indicating the existence of "zones" of density around some central nodes, Density, Number of messages sent and received a hearing, Cognitive profile of learner, and Social profile of learner or group.

c. Indicators analyzer: This module allows the tutor to decide the status of group (dynamic group, cohesive group ...) and the statements of learners (active learner, isolated learner ...).

d. Display graphs of interaction: This module allows representing the interaction between learners of the same group by a graph. This graph connects learners who send messages between them. The arcs of the graph contain information on the number of send messages.

e. Learner's Reactions analyzer: This module allows the tutor to analyze the response of each learner after consultation of the workspace of other members of his social groups. The tutor can send advices (individual or collective) to his learners. He can know whether the learner is active or isolated.

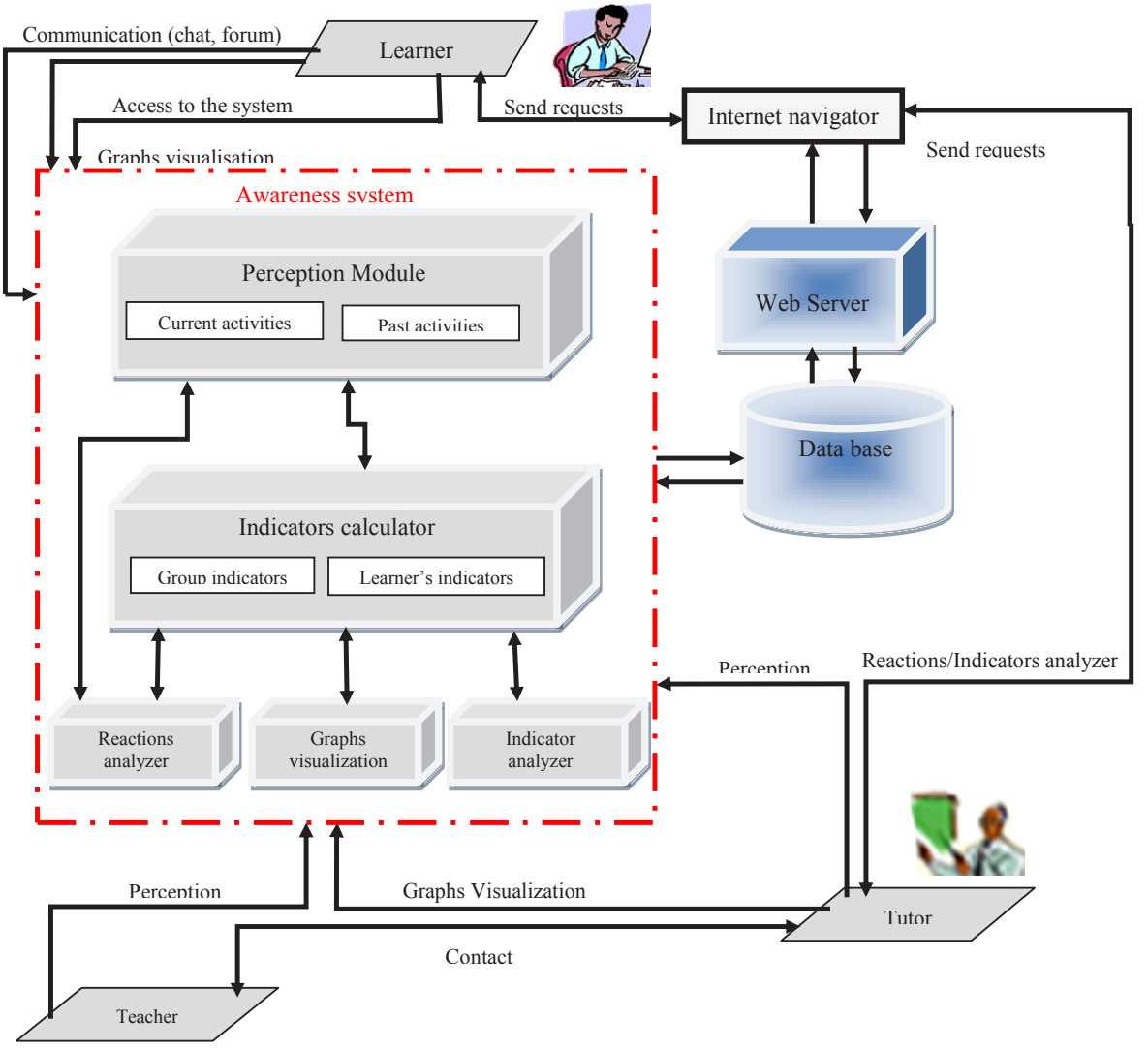

Figure 1: Functional architecture of the system.

3.2. System interfaces

a. Interface learner: it offers some tools to facilitate the pedagogical activities of learners. The main objective is to provide learner with some objects that facilitates his tasks such as: access to exercises and courses, contact various group members, see all the information about his teammates (who does what, who is on line, traces, etc.). In our system, a learner can: solve the exercises, communicate with his teammates, Self-assess, perceive the actions of other members of his group and collaborate with members of his group.

b. Tutor Interface: The tutor in our system is responsible of one or more groups of learners (Figure 2. Via his interface, he can follow all his students' groups during their learning. The tutor may: monitor groups and learners, organize virtual meetings, communicate with the learners, follow closely the discussion, correct erroneous knowledge, assess learners and groups, perceive the actions of learners in the group, see graph of interaction among learners of the same group, analyze indicators and analyze the responses of learners and their reactions.

b1. Indicators Analyzer: The results of calculated indicators (consistency, productivity, centrality, etc.) are used to help the tutor to analyze the consistency of group homogeneity, heterogeneity, how the work will take place between learners and which learner is most active (from the density around the learner), etc.

b2. Visualization of learners' reactions: This feature allows the tutor to understand the reactions of the same group of learners. For example, a learner can see the workspace of the other students, their activities, sent messages and received ones. The reaction of the learner can be positive (learner begins by discussing with another learner through sending messages or through discussion forums, he begins to solve problem given by teacher, seeking information, request for help ...) as it may be negative.

Figure 2: Group of Learners in CLAS (Tutor interface).

4. Experiment: first results and discussion

The first results of the experimentation of CLAS system at Guelma University show that learners and tutors appreciate its use. The perception module is the most admired element by both the actors (learners and tutors). The learners found some difficulties about the visualization of current activities, while some tutors indicate that some indicators are not useful such as the density of the group. Otherwise, they look that the social graph is more significant.

As responses on the research questions cited in the introduction, we can say that the perception of traces of other learners in the same group has positive effects on the cognitive profile of learners. Now, we are in the phase of analyzing the results of using the system by a sample of students and tutors. The first results argue that the cognitive level of students increases when using the features of awareness provided by CLAS system.

Concerning the relevant information to be visualized to learners, we can say that learning and assessment traces are the most relevant information to be presented to learners.

Finally, the main result of our researches is that awareness process plays a crucial role in collaborative learning environment and it has many advantages.

5. Conclusion and future work

In collaborative learning environment, other than cognitive aspect, monitoring of learners must take into account behavioral aspect of learner. In other words, interactions among learners must ultimately be analyzed to know content of exchanges and their natures. This analysis allows tutor to find deadlocks in the operation of each participant and/or each group of learners. All this allows adapting the interventions of tutors to learners and/or groups.

The objective of this work is to study a mechanism for monitoring the activities of learners in a collaborative learning environment, based on a shared space among learners. This space allows the same group of learners to follow one another whether online or offline. Tutor monitors the activities performed by learners (learning, assessment, collaboration) from a shared space, which includes the same group of learners. He can monitor the activities currently carried out by learners as he can view the history (trace) of each learner. Therefore, tips can be sent to learners who have difficulty in all available educational activities: training, evaluation and collaboration.

As future work, we propose the use of other communication tools (Forum, teleconference, etc.), the use of cameras in the shared space to increase awareness among students and seeking new ways to extract more accurate profiles of learners (cognitive and behavioral).

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