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A SYSTEM TO SUPPORT TUTORS IN ADAPTING DISTANCE LEARNING SITUATIONS TO STUDENTS

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Abstract: Currently, tutor's roles in distance learning are not clearly defined and few tools support him/her in his/her functions. Some tools help tutors to monitor learners and interact with them, but no tools assist them in the setting-up of learning sessions. Activities are created by instructional designers who envisage standard scenarios without knowing the learners. Thus, the aim of our research project is to create a system to help tutors to adapt learning situations to learners' needs and characteristics. The first phase of our work consists in determine tutor's roles in collaborative distance learning, in order to identify his/her needs. Then, we implement an assistance system based on an ontology containing learners' characteristics and parameters of learning situations. An inference engine creates links between these characteristics by reasoning on the ontology. Finally, some rules deduce relations between ontology elements in order to give the tutor advice.

1 INTRODUCTION

Over the last thirty years, distance learning moved from postal to an on-line teaching in which information and communication technologies (ICT) play a prominent part. In particular, it involved a new definition of teacher roles, even if up to now these are rather badly defined and vary from one educational institution to the other.

Our research is in the area of the computer-based environments for human learning, using partnership between man and machine, particularly through ICT. Internet generalization makes this dimension currently central.

On the one hand, we identify tutor's roles, especially in collaborative learning situations; on the other hand, we design a system aiming at helping the tutor to take up all roles which are assigned to him. More particularly, this tool assists tutor in the setting-up of learning sessions adapted to learners' needs and characteristics.

In this paper, we first determine distance learning functions of tutors, compared with traditional teacher roles. The next section explains why we supply an assistance tool to the tutor. The following sections show system design with an example of implementation in the form of rules which advice

the tutor. The final section presents an overview of our work in progress.

2 TEACHER'S ROLES: FROM PRESENCE TO DISTANCE

Our work is based on a literature survey on teacher's roles in traditional education and distance learning. We first want to determine the effects of distance on teachers' roles and the differences on the actors' interactions and relations due to distance, specifically in collaborative learning. The aim of this study is to determine the roles of the different actors of the course, especially the role of "tutor".

Houssaye (1988) represents relations between learner, teacher and knowledge, under the shape of the "educational triangle". This triangle brings out three educational styles (Faerber, 2002). The teacher-knowledge relation corresponds to the traditional education with transmission of knowledge, the teacher-learner relation defines the emotional and psychological relation between these two actors and learner-knowledge relation represents the appropriation phase of knowledge by the learner.

In traditional education, teacher often has a role of "transmitter of knowledge" and learners absorb a

quantity of information, among which little will be transformed into knowledge. School has still an approach to education which tends to inculcate a set of knowledge and capacities which will not be reusable in another context than the one in which they were learnt (Perrenoud, 2000).

Perrenoud (2000) suggests setting learners in true situations, steps of project, open problems, and incites teachers to offer learners activities in which they will be the actors of their learning. It joins to it the constructivist theories (Doise *et al.*, 1984) which consider learning as a personal experience towards knowledge, influenced by the social context in which it takes place.

According to the socio-constructivist approach, interactions between learners play a dynamic role in individual learning. In this way, collaborative learning activities are more and more used in distance education. This kind of activity, as project-based learning (George *et al.*, 2001), business game, case solving, has already proved to be useful

When we transpose the “educational triangle” to collaborative and distance learning, other poles and relations appear. In a specific collaborative learning, another element appears: learning group (Faerber, 2002). By introducing this new element, we take into account interactions and relations between learner, teacher and learning group, each learner being a member of a group. These relations and interactions are more complex in the context of our study due to distance. So it is very important to consider the learning group in order to identify teachers’ roles and to help the different actors to interact in a positive way.

In distance learning, the function of teacher is then divided into two distinct roles: the instructional designer of courses supports and contents, and the tutor who helps learners to build knowledge and competencies and assess them. A one single person can play both roles, but each role does not intervene in the same moment of the course.

Figure 2 represents new relations between that appear between the learning elements. The relations between items have to be defined: both between the pedagogical team (instructional designer and tutor) and other elements (group, learner and knowledge), and between instructional designer and tutor. Are these both in relation with knowledge? Are they both in relation with learners? A lot of questions appear and our research tends to answer them.

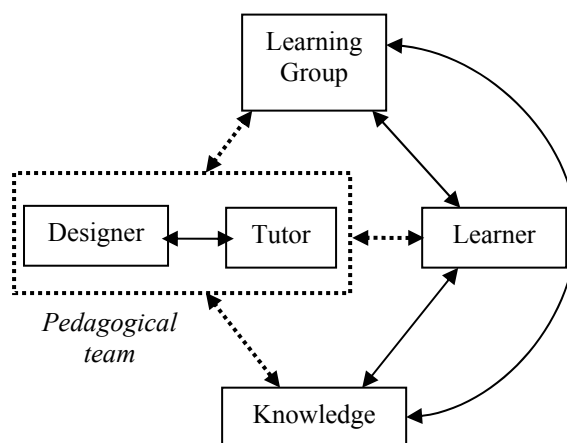


Figure 2: Relations between actors of learning and knowledge

We want to determine relations between learner, learning group and pedagogical team and with the knowledge to be acquired by the learner. With this in mind, we consider the tutor as the centre of the learning and try to identify his/her role in specific collaborative distance learning.

3 TUTOR’S ROLES

In literature, distance tutors are named differently, according to the functions that one assigns to them: moderator, facilitator, online tutor, online moderator, e-moderator, coach, distance education tutor, e-tutor... Reviewing the literature on the tutor’s role in distance learning, we were surprised by all the roles that are assigned to only one person and the differences according to distance courses.

Tutors’ roles are generally classified into four parts: pedagogical, organisational, relational and technical. Denis *et al.* (2004), inside the Learn-Nett project, assign seven different roles to the tutor. For them, the tutor is a content, metacognition and process facilitator, an advisor/counsellor, an assessor, a technologist and a resource provider. According to Lentell (2003, p. 74), “They [tutors] have to be effective listeners and communicators, to be a coach, facilitator, mentor, supporter and resource. They have to listen, to shape, to give feedback, to motivate, to direct, to appreciate – broadly to be developmental and problem solving.” According to Dillenbourg (1999), the tutor is a “facilitator” because he/she has to assure a minimal educational intervention to guide the learning group in a productive way or to follow which members are except the interaction.

We based our view of tutors' roles on those who are assigned to them by the platform ACOLAD (Faerber, 2003) and on the view of Daele *et al.* (2002). Tutors, in the ACOLAD environment, decide which learning situations to propose to learners, in order to adapt them to their needs. For a given situation, tutors can bring documents and personal references. We agree with this view of tutors' roles because we think that it is very important for them to have the possibility to adapt the activities to learners' needs and characteristics.

It is necessary to differentiate the activities and the interactions so that each learner is in his/her proximal zone of development (Vygotsky, 1986), so that he/she is constantly or at least very often confronted with the most fertile didactics situations for him/her. Tutors, thanks to their psychological and emotional role, are the ones who are best placed to choose the activities which are appropriated to learners and the resources which they need.

Daele *et al.* (2002) are interested in collaborative distance learning based on a pedagogical model centred on the learner and on interactions. In this context, they distinguish two levels of intervention: with the learning group and with the learner. Tutors help the group to define a common project, to find adapted resources, to organize and regulate exchanges, to respect the instructions and deadlines, and to structure itself. They help the learner to express his/her personal project, to articulate it to the project of the group, to think about his/her own approach of learning and collaboration at distance. We also think it is essential to distinguish these two levels of intervention in order not to lose the learner into the learning group.

Dillenbourg (1999) gives four means to try to develop interactions. These means are the following: to carefully set up the situation of learning (group size, selection of group members, suited tasks...), to specify the "contract of collaboration" with a scenario based on roles (to give different viewpoint to subjects, asking subjects to play a specific role in an argumentation,...), to specify interaction rules for the computer-mediated interactions in collaboration, to monitor and regulate the interactions. This advice corresponds with many roles tutors have to perform in collaborative learning.

In order to be able to play all their roles, tutors must have experience and competencies to base on, so as to be credible towards learners. The tutor may have experience as a teacher or in a local point of expertise in the field of the contents. It is necessary that the tutor has a minimum of competencies in these two fields (pedagogy and in the subject area),

so as to have capacities to build himself/herself as an expert. He/she is a witness of his/her personal experience; he/she must be able to bring out the sense of the contents to learners, for example by giving them anecdotes and personal references.

Regarding the works previously described, we synthesize tutors' roles. For the learning group, the tutor is:

- **A group assessor:** he/she assess the learning group's productions and activities.
- **A resource provider:** for a given learning situation, he/she can provide documents or advise adapted resources in order to guide learners in a good way.
- **A moderator:** he/she has to set up the dynamic of the group and to develop interactions within all possible means (Dillenbourg, 1999).
- **A pedagogical architect** (George, 2004): he/she has degrees of freedom to adapt the learning situations created by the instructional designer to learners' needs and characteristics, provided that the designer foresaw that one needs to furnish the training (Faerber, 2003).

Tutors also have different roles to help the learner. For a learner in particular, the tutor is:

- **A learner assessor:** he/she evaluates the knowledge and competencies that the learner has acquired during the course.
- **A psychological and emotional support:** he/she is a human mediator to motivate the learner, to encourage, stimulate and boost him (Lentell, 2003).
- **A regulator:** he/she has to regulate the learning, to adapt learning situation difficulties for each learner, and to give him/her feedback on the assessment.
- **A guide and facilitator** so that the learner acquires the competencies necessary to autonomy in a specific context of distance and collaborative learning (George, 2004). He/she helps the learner to take part to the learning group interactions and activities.

4 AN ASSISTANCE TOOL FOR THE TUTOR

As Dufresne *et al.* (2003) emphasize, the instrumentation of tutors' activity in distance learning environments is still little developed. Research was rather centred on the characterization

and the standardization of learning activities in order to assist authors in the designing of scenarios, and also centred on tutors to support them to monitor learner's activities and interact to solve difficulties (Després, 2003).

As we assert in the previous section, tutors have several roles which do not only consist in monitoring and interacting with learners. We want tutors to be resource providers and pedagogical architects, to set-up the dynamic of the group, to regulate the learning and to adapt situations to learning groups and to each learner in particular. We think that it is impossible for tutors to assume all these roles without a tool to assist them. As suggested by Bennett *et al.* (2002) tutors are being asked "to run before they can walk".

Generally, the instructional designer prepares scenarios without knowing learners. We prefer the concept of "learning situation" to "scenario". A scenario anticipates a learning process and interactions during learning sessions (Faerber, 2004). It generally defines a progress through contents, resources, and it anticipates behaviour, tasks sequencing. But is it possible to provide a scenario for all possible cases? We prefer the term "learning situation" which is more general and shows all the possibilities offered to the tutor to adapt learning sessions during the course, according to learners' needs and progress, not defined a priori.

The system we developed assists tutors in the instantiation of generic learning situations provided by instructional designers. Learning situations consist of a set of activities carried-out by a learners group engaged in a same objective. Project, case study, problems resolution... are examples of learning situations. The designer defines parameters for each situation, in order to give degrees of freedom to the tutor to adapt them to learners. The system assists and advises tutors in the setting-up of learning sessions, by creating links between learners' characteristics and the parameters of activities.

Figure 3 highlights the role of the assistance system for tutors to help them to set-up learning sessions. In this configuration, the instructional designer has to envisage a variety of activities and possible situations of learning with parameters (number of students, group size...). Then the tutor can prepare specific learning situations from existing generic situations.

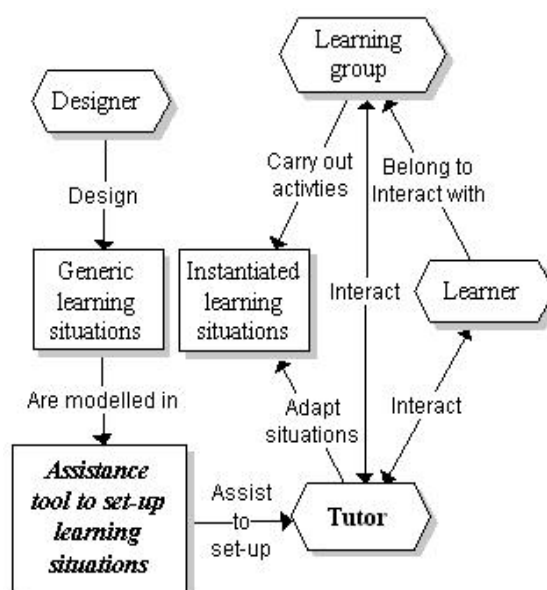


Figure 3: The functioning and the place of our assistance tool to help tutors

5 DESIGN OF THE ASSISTANCE TOOL

5.1 Development choices

The assistance system must be able to adapt to learning situations which vary according to the type of online courses and the tutoring model applied. That's why we chose to separate knowledge and reasoning. The system is based on an ontology which represents the different concepts (like actors or activities), their properties and the relations existing between them. Ontology has the advantage to make explicit what is regarded as implicit in the field (Kasai *et al.*, 2004), to use a vocabulary comprehensible by all actors, to re-use and make this vocabulary evolve.

Concerning the implementation, we chose the software *Protege2000*¹, a tool for modelling and knowledge acquisition developed by the University of Stanford, in the United States. The plug-in *JessTab*², integrated into *Protege2000*, makes it possible to introduce the knowledge stored by *Protege2000* into a data base, in order to be inferred by some rules written in the inference engine *Jess*³, an expert system independent of *Protege2000*.

¹ <http://protege.stanford.edu/>

² <http://www.ida.liu.se/~her/JessTab/>

³ <http://herzberg.ca.sandia.gov/jess/>

5.2 Ontological model

The developed ontology identifies and describes several concepts: the actors of the learning (learner, tutor, designer...), learning situations (project, case-study...), resources, knowledge, behaviour and an historic of the learning.

For example, we created two different concepts: Actor and Actors' characteristics. These two concepts correspond to classes which each contains subclasses (figure 4). The class Actor has for subclasses Learner, Tutor, Instructional Designer and Computer Designer. To each subclass of the class Actors'-characteristics correspond general characteristics (like identity) and the subclass Learner has specific characteristics. For the moment, we have especially developed learner characteristics but tutor characteristics can be added later. Both concepts are connected by properties of the class Actor which are instances of the class Actors'-characteristics.

For the learner, we identified five general characteristics: learner's knowledge and behaviour, his/her experience, identity profile (curriculum-vitae, cultural origins, interests and habits), needs and objectives, and cognitive capacities (figure 4).

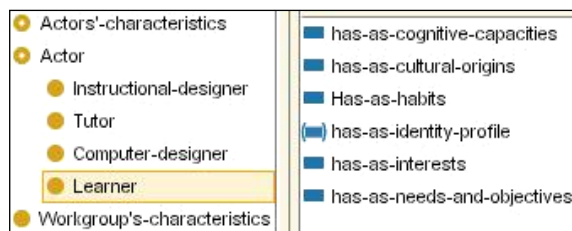


Figure 4: Properties associating to learners characteristics in Protege2000

To give a structure and describe learning situations, we referred to the granularity levels of the standard IMS-LD (IMS Learning Design)⁴. This model, based on the EML standard (Koper, 2001), describes a formal way to represent the structure of a Unit of Learning and the concept of a pedagogical method specifying roles and activities that learners and support persons can play using learning objects.

In the ontology, activities are decomposed in the following way: Course -> Learning situation -> Activity -> Resources and communication tool -> Media (figure 5). The course corresponds to a unit of learning described in IMS-LD and, as we said in the previous section, the concept of "learning situation" is preferred to "scenario".

We consider that learners carry out a set of activities within a same learning situation. In a case study-based learning, an activity can be the problem formalization, searching for causes or solutions. Some resources (documents...) and means of communication (chat, forum, e-mail...) are offered to actors before and during learning sessions. They represent the learning environment. A resource is composed of media (picture, video, sound...).

We have brought out two important concepts: knowledge and behaviour (Paquette, 2002), because these two concepts are linked to other concepts of the ontology: activity, learning situation and learner. On the one hand, activities and learning situations have properties which define pre-required knowledge and behaviours, and knowledge and behaviours to be acquired. On the other hand, learners have initial behaviours and knowledge, and some to acquire during the course.

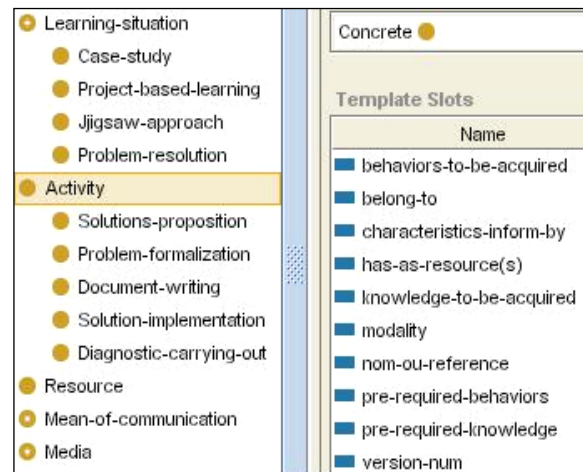


Figure 5: Activities description in Protege2000

It is important for the tutor to have the possibility to note and to have access to data concerning learners. We give tutor the possibility to keep for each learner and learning group a chronological record of learning. With this chronological record tutors can indicate learners' achievements, interactions and carried-out activities. Tutors can also note their perceptions about learners, on their level of initiative, motivation, stress, autonomy or interactions, at some point of the course.

6 IMPLEMENTATION OF RULES TO ADVISE THE TUTOR

The implementation of the system consists in writing different types of inference rules. These types are the following ones:

- Rules which create links between learners' characteristics.
- Rules which deduct advice to give to the tutor concerning the type of pedagogy to be applied for each learner, according to some of his/her characteristics.
- Rules which create links between activities' parameters and learners' characteristics by advising the tutor an activity to attribute to a learner according to some variables.

Rules can help tutors to play all the roles we assigned in a previous section. For example, tutors are moderators who have to develop interactions. To play this role, Dillenbourg (1999) gives recommendations: set up the situation, specify interaction rules and roles inside the learning group. These recommendations can be implemented in the system in the form of rules, which infer advice to tutors, according to the characteristics of a given activity defined in the ontology, in the form of an instance of the class Activity.

For example, let us consider a learner who has just validated an activity. We have developed a rule which advises the tutor an activity to attribute to the learner and the modality associated (individual or collective), according to the need for autonomy declared by this learner. The rule so created looks for activities which need the pre-required activities validated by the learner. Then, in the case of an activity which can be indifferently done in an individual or collective way, we look at the need in autonomy declared by the learner and we advise an activity with the associated modality. We present a part of the code which enables this rule to be followed:

```
(if (and (eq ?pre_required_activities
?validated_activities_object)
(eq (slot-get ?activity
modality) individual-or-collaborative))
then (foreach ?need (slot-get ?learner
has-as-needs-and-objectives)
(if (eq (slot-get ?need
autonomy) TRUE)
then (printout t "Propose to
learner "?name" to do the activity
"?activity_name "individually."crlf))
```

The rules have no ambition to be totally educationally valid at this time of the project; they only show the feasibility of the system. To validate the rules, we will work with specialists of education sciences.

We also want to give the possibility to tutors to modify and create the instructional rules themselves, so as to ensure a good appropriation of the tool by

tutors. We do not want either to replace the tutor by a system, or to automate its work. We want to assist him/her in his/her functions with a system which gives advice. This research is based on the partnership between man and machine.

7 WORK IN PROGRESS

In the next weeks, we will validate our view of tutors' roles and needs by interviewing some of them. We are in relation with several tutors of various backgrounds who are interested in working in collaboration on this subject. We will present to tutors a model of our assistance tool, so as to make its functionalities progress.

We developed a system to assist the tutor before learning sessions in the setting-up of learning situations. Tutors also monitor and manage learning sessions. Beyond the learners monitoring necessary in a pedagogical way, we are more particularly interested in recovering information about learners' activities and interactions which will guide tutors in the setting-up of sessions to come. This iterative functioning is the heart of our future research work (figure 7).

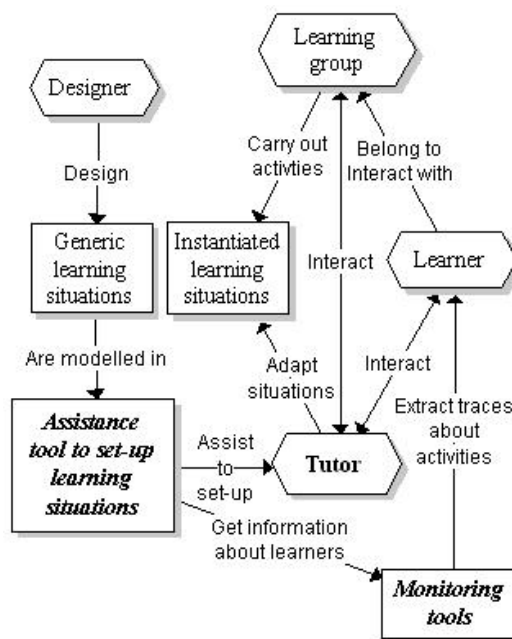


Figure 7: Iterative functioning of the system

The aim is to develop specific monitoring tools in order to trace learner activities to determine or get more precise learners' characteristics. The monitoring tools will have to be configurable by the tutor.

8 CONCLUSION AND FUTURE DIRECTION

A result of this research concerns tutors' roles in collaborative distance learning. We assigned four roles in regard to the learning group and four roles in regard to each learner individually. This work led to the implementation of a system to help tutors to adapt learning sessions to learners, taking into account their characteristics and needs during the course.

The system is based on an ontology which integrates all the learning concepts (actors, learning situations, activities, resources) by specifying their properties and relations. Finally, the development of the system containing rules, which apply on the classes instances of the ontology, showed the feasibility of our assistance system to set-up learning situations. Moreover, the diversity of rules shows the flexibility of the system and the many prospects offered.

Future research will be directed towards two axes: the validation of our view of tutors' roles and needs and the complete implementation of the system. We are in relation with several tutors of various specialities who are interested in working in collaboration on this subject. It will be as many possible grounds for our future experiments.

Concerning the tutor's assistance system to configure learning activities, we want to conceive various interfaces for learning actors, in order to guide them to insert data in the ontology. In addition, it will be interesting to give the tutor the possibility to modify and create learning rules himself, thus ensuring a feed-back on uses and a good appropriation of the tool. We also have in prospect to associate an interactions analysis agent to automatically feed the system with data concerning interactions between learners.

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