Collaborative Approach of an Online Technical Course Design: Case Analysis by Activity Theory

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ABSTRACT

Challenge of digital pedagogy leads Moroccan universities to move towards a transition from a knowledge diffusion logic, in which they were rooted, to that of the knowledge navigation. The number of students immersed in the universal culture of the Internet is growing. They aspire to find in their training the convenience, the speed and the ease of access to information found on the Web. It also notes that multiple interactions made possible by the Internet, appear to shatter the hierarchies that previously were structuring academic life. This is why it is possible to assert that the technologies concerned will profoundly change the traditional forms of the training process. In this paper, we specify the difference between two concepts that need to be known before starting to use computer tools which are collaboration and cooperation. Once this clarification made, we move to the classification of collaborative activity supporting tools based on the time and space parameters. Then, we detail the scenario of our course "Technologie des Colonnes". Finally, we will analyze the results, of a collaborative learning approach, based on the theory of activity.

Keywords: Collaborative approach, E-learning device, Interaction Analysis, Activity Theory, Collaboration, Cooperation.

1. INTRODUCTION

The development of information and communications technologies offers us unparalleled opportunities for knowledge diffusion. In this context, a synergy of efforts is needed to allow the development of new training concepts that had to cohabit with all existing systems.

Currently, one of the challenges of training is the development of a critical mass of quality e-learning.

With the opening of the Moroccan university on technology, higher education needs to renovate and to renew the pedagogical arsenal. One component of this renewal is the introduction of ICT in teaching and research.

Learners evolve in a context of change of relationship to knowledge.

At the Moroccan university, they do not learn solely any more from the professor and the book.

Internet is now for many the primary source of access to knowledge. It gradually and permanently transforms the ways of thinking, teaching and communicating.

However, these changes, if they are susceptible to create interesting opportunities, also impose new ways of looking at some aspects of university pedagogy in Morocco. Because, juxtaposition between information and communication technologies and pedagogical approaches exceeded may not change anything in learning. E-pedagogy is the combination of the information and communication technologies (ICT) and all the whole of best teaching strategies resulting from the major theoretical currents. E-pedagogy is not to change the substance of what is to teach, to instruct and to educate. Only the way to make it changes.

In higher education, the objectives of the development of open and distance learning are particularly ambitious.

These courses represent an option favoring the acquisition of skills that Moroccans university students could greatly need in their future profession.
How to ensure, finally, that technology - historically unstable and often designed for purposes other than teaching - can really be an effective way?

In no case it is a safe solution. Trainers must demonstrate both dynamism and discernment. They must try to find a balance between maintaining some practices that were and still are the wealth of university pedagogy, and making available to students new opportunities facilitated by open and distance learning. Open and distance learning are the future of Moroccan university.

The transition to this type of training requires mastery of the use of appropriate IT tools. But before interest us these tools, we will specify the difference between two main concepts in e-learning: collaboration and cooperation.

We find a sharp distinction between collaboration and cooperation in the fields of research analyzing human workgroups. Collaboration much that cooperation involves the sharing of a common goal by several people but the distinction is made at the under-goals or immediate goals.

Individuals can pursue a common general goal even if the immediate goals of their tasks aren’t identical. Some authors then use the term cooperation or distributed cooperation. Rogalski, for example, uses the term distributed cooperation "for situations where under-tasks contributing to a common goal are distributed a priori to different actors” (Rogalski 1998) [1].

This term was used again by Gronier (Gronier, Valoggia 2009) [2]. In distributed cooperation "different actors have different under-goals, contributing to a common goal” (Rabardel, 1996) [3].

Individual activities are then developed to converge towards a common goal of different current goals. The term collaboration is used "for situations where the actors share the same goals throughout the completion of the task “ (Rogalski, 1998) [1]. The actors then maintain the same goal but also the same under-goals. Collaboration is sometimes seen as necessarily a synchronous activity:

« Collaboration is a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem as the mutual engagement of the participants in a coordinated effort to solve the problem together » (Roschelle, 1995) (Taneva, 2005) [4][5].

These definitions of collaboration and cooperation can exceed the context of human collective work to be extended to collective activities person / machine.

Thus, Leroux (Leroux, 1995) [6] defines cooperation as "solving a problem common to several agents with a distribution of tasks between the agents.” He considers the collaboration as “a solution to a problem by several agents, all tasks which make up the problem being conducted jointly by all the agents” (Leroux, 1995) [6]. In these two definitions the term agent refers to both an IT tool and a person.

We wish to synthesize the dominant differences between cooperation and collaboration. To do this, we must distinguish the activity of the action. The activity is led by a global goal and is composed of more elementary actions, led by immediate goals.

These actions are also themselves carried out by basic operations. The operations are therefore at the most basic level. "The action is performed by the operations that are determined by the characteristics of the object to transform and the conditions of implementation of these changes” (Savoyant, 1981) [7].

We also adopt the view of Roschelle and Teasley (Roschelle, 1995) [4] which state that collaboration is a synchronous collective action. The actors work therefore the same time and in the same work space (real or virtual). If immediate under-goals of actors are different in the case of individual activities, we will talk about co-action, that is to say individual actions with a possible sharing of resources.

In the case of a collective activity and different under-goals, we will talk about cooperation between the actors, that is to say individual actions coordinated.

In the next part, we will classify the collaboration tools according to time and space. These tools will be used in part three which concerns scriptwriting of our course.
2. CLASSIFICATION OF COLLABORATIVE ACTIVITY SUPPORT TOOLS

The variety of groupware comes from divergent definitions in the literature and the various origins of research on Computer Supported Cooperative Work (distributed system, distributed artificial intelligence, man-machine interface ...).

This classification will be restricted to classifications by locality, temporality and scalability. It shows a three-dimensional space where each collaborative tool system will take place (figure 1).

![Collaborative tools classification](image)

We use here the most commonly used categorization in the literature on the Computer Supported Cooperative Work (CSCW), called "space-time matrix" or "Johansen matrix" (Johansen, 1991) [8] in reference to the author who resorted first. Without being original, or more relevant, this classification has the advantage of simplicity (Elmqvist, 2011). [9] We reproduce below some parts of the projection on the temporal plane.

2.1 Same place, same time

The Group Support System (GSS) propose a set of methodological and practical features intended for improving the course and the effectiveness of the performance of a group.

The best known of these are the so called Electronic Meeting Systems (EMS), microcomputers such devices connected by a network, which equip a meeting room.

They provide "logistical" support for the duration of the meeting by supplying electronic functions of collection and classification of ideas and vote. They can automatically generate a report at the end of meeting (proposed ideas, major decisions taken, results of votes ...).

Typically, a team member plays the role of "facilitator", that is to say he is responsible for the animation of the meeting and decides the sequence of different phases (ideas generation, organization, evaluation). The aim of these applications is to facilitate the expression of the meeting members by the use of anonymity.

2.2 Same place, different times

This category can be misleading about what is meant by "same place". Indeed, it is often a question of a virtual place and not physically identifiable. For this reason, we speak of "same place" for all systems that use a spatial metaphor with persistence over time.

Thus, users of the network communicate asynchronously by leaving messages in a newsgroup where other users can read in the future. The newsgroup is the most common form of the tools in this category. The most "primitive" form could be the file directory shared over a network.
2.3 Different places, same time
By this we mean all types of applications that allow the "co-presence ", that is, the materialization of the presence of others while physically distant in order to communicate synchronously.

This materialization can be performed only by voice. This is called audio-conference system. We can consider the phone conference as the first system of this type.

These systems often also provide another type of co-face-to-face to communicate effectively with others, the "online discussion systems" (Chat). Video-conference allows more sound to convey the image.

Application sharing systems allow multiple users to work with the same software tool to achieve the same document simultaneously.

2.4 Different places, different times
The conjoint document edition - asynchronous – should not to be confused with document edition through the use of application sharing - synchronous - described above. The basic function of a conjoint edition system is managing the life cycle of a document whose final shape is the result of a cooperative process.

In the next part, we will script-write our course while using the approach of online course design (Benslimane, 2016) [10] and collaboration tools (Forum, chat ...). Results will be analyzed in the fourth part, based on the Activity theory.

3. THE SCENARIO OF OUR COURSE

3.1 Objective
The objective of this course is to enable students to understand and to master the operation of a column where a unit operation consisting of a mass and / or heat transfer is carried out. For this, students must have a perfect knowledge of all modes of contact and their implementation as well as all the elements that constitute a column.

Knowing the unit operation, the product to be treated and the feed to be treated, the student must be able to identify the type and characteristics of the column to use. (Ibriz, 2016)[11].

3.2 Division into modules
Each unit begins with a brief description of the objectives and tasks to be performed by the students. The content is made available to students in the form of a power point document and a certain number of resources in the form of PDF, word and URL. (Ibriz, 2016)[11]. The division into themes is detailed in table 1.

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<tr>
<th>Theme</th>
<th>Units</th>
<th>Theory and explanation</th>
<th>Interactive part</th>
<th>Evaluation</th>
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<td>Glossary</td>
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<td>- Vérification d’une colonne</td>
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<td>Les colonnes à plateaux</td>
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<td>Consulation</td>
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<td>Les colonnes dans les processus industriels</td>
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3.3 Pedagogical scenarios
The following diagram (figure 2) will specify weeks, content, mode ... of our scenario.

Figure 2  Scenario of course per weeks

4. COLLABORATION ANALYSIS BASED ON THEORY ACTIVITY MODEL

The study we present is based on analysis of the messages sent to the discussion forums, exchange messages in various chat rooms, access to different resources and rules of coordination used during the experience of the pilot class (course: “Technologie des Colonnes”).

Our analysis will be based on some key concepts in the Russian psychology, including the Activity Theory. The driving ideas of this work are inspired by Robert Lewis works (Lewis, 1998) [12]. According to this theory, collaborative learning is based on a set of interactions between the subject the object (of learning) and instruments available, interactions which also involved the learning community, rules and division of labour that emanate.

The Activity Theory highlights the characteristics features of efficacious working communities, and it is interesting to examine how they can be transposed to distribute learning communities. To analyze our experience, we have resorted to cutting triad presented by Lewis [12]. In this analysis we tried to consider a set of parameters that are linked to one of the triad dimensions and have an existence in the time and the space from the experiment.

It is probably futile to try to analyze all the relationships that influence learning activities, because of the multitude of interdependent parameters. But this complexity might be reduced by examining one by one nodes triads.

First we will present the experiment figure and then we'll analyze and interpret some results of this experiment.

4.1 The pilot class figure
A total of 40 second-year students (Technical University Degree, Process Engineering, option: Chemical Industries) and 1 tutor participated over a period of 11 weeks. Three forums and 145 messages posted. There have been 68 participations in the 4 chats for about 2,000 words per session. Connections to the course were 348 in number.

In previous work (Ibriz, 2016) [11], we analyzed three triads resulting from cutting done by Lewis, it was :
- Community-Object-Subject
- Community-Object-Tools
- Community-Subject-Tools
In this article we will continue this analysis for the following triad:

- Community-Subject-Rules
- Community-Subject-Division of Labour
- Community-Object-Division of Labour
- Community-Rules-Object

4.2 Analysis by the triad Community-Subject-Rules

This triad (figure 3) is concerning mainly the interaction protocols. How the subjects establish rules allowing them to interact. The simplest example in the context of work groups using communication technologies is the significance of the lack of response at a proposal (by mail or at a meeting) to take a certain decision.

In a face-to-face meeting, the lack of response is usually interpreted as tacit consent, while, by email, it remains some ambiguity unless this behavior is explicitly defined in the protocol.

The establishment of such protocols depends on the role of individuals and their expectations of others. These protocols are part of the division of labour.

To coordinate, if only implicitly, the participants first need to follow the activity of other participants and the use and the evolution of shared resources. But it is not enough to know what others are doing to act in a coordinated manner: we must also know and make known the role we can play in group activities.

![Figure 3 Triad Community-Subject-Rules](image)

It is therefore essential to distribute the appropriate roles to different participants in the various activities of the group.

These roles should not be static but rather they must be dynamic to change the rights and duties associated with these roles depending on the evolution of the group's activity.

![Figure 4 Analysis by the triad Community-Subject-Rules](image)
For the group to discuss the allocation of tasks and roles, making explicit the commitments taken, we left it to the learners to exchange messages in the forum, to make their group constitution proposals and to design a coordinator while explaining their need to select members from various sources (experimental sciences, math science ... ) and different profiles ( Brilliant, medium, low).

Learners of a group committed to supply the terminology forum of “Technologie des Colonnes” and coordinator in turn agrees to postpone the definitions in the glossary. This is of course to memorize the commitments made by the different participants. But it is also to support the activity of the group and of the commitment taken.

Indeed, when participants do not have time to get together, they must communicate through message, which complicates monitoring the negotiations by the group (figure 4).

4.3 Analysis by the triad Community-Subject-division of Labour

This triad (figure 5) concerns how the division of labour is decided and maintained to be effective. That's when examining this question the intentions of the problem appears and highlights the distinction between a cooperative or collaborative activity between what the community has to choose.

In cooperation, the objectives of each individual can be different but the contribution to the common goal is achieved through a certain division of labour among group members. In collaboration, a different distribution of work is needed to ensure complementarity of individual skills reinforces the sense of "ownership" of the common task.

We can’t discuss these needs without taking into account the structure and management of the group. In general, an activity can be carried out only after a series of actions performed by an individual or subgroup (which can in turn be broken down into more specific actions). Actions are most often carried out by the individual.

During the division of labour, it is important to ensure an adequate motivation for each member of the community.

4.4 Analysis by triad Community-Object-Division of labour

This triad (figure 6) highlights the common goal, by placing subjects (group members) to second place in the achievement. It contrasts sharply with the previous one in which the individual wishes and satisfactions were paramount. That said, only authoritarian regimes can (in theory) ignore the motivation of individuals. Again, the distinction between learning and work on common tasks can be important.
The figure 7 shows that the objectives with individual and collective distributions give a good result and a good learner motivation. When giving a meaning, a goal, when connecting the individual interests to those of the group, we can have the desired effect. When left a field of immense possibilities but without goal or direction to take, we will just have ghost tracker.

4.5 Analysis by triad Community-Rules-Object

The problem here (figure 8) is how the rules (or communication protocols) allows the community to achieve its objective. Individuals are still here in the background. It is the ratio of collective rules to the objectives that is paramount. However, it may be that individuals recognize the importance of certain rules in achieving the common objectives; it may also be that individuals accept these rules reluctantly but in the name of the common good.
In this phase of analysis, we made a presentation of the message sense of orientation during the different phases of explanation of a concept. The senses studied are of the learner to tutor and learner to another learner (figure 9).

We note that during the introduction phase of a concept, exchanges are from tutor to learners and vice versa with an unbalanced mode in learners side.

In explanation phases, exchanges are made more in the sense of the learner to tutor and little inversely with no exchange among learners.

In the production phase, learners have exchanged more messages.

In the final phase, the number of exchange is reduced only in case of single learners in the previous phases.

5. CONCLUSION

The study that we presented is based on the analysis of messages in discussion forums, exchange messages in different chats, access to different resources and rules of coordination used in the forum and chats during the experiment of the pilot class.

To analyze our experience, we have resorted to cutting triad (Lewis, 1998) [12].

In this analysis, we detailed the following triads:
- Community-Subject-Rules
- Community-Subject-Division of Labour
- Community-Object-Division of Labour
- Community-Rules-Object

This was done taking into account the parameters that have an influence on one of the dimensions of these triads and are related to time and space of our experience.

This analysis allowed us to deduce that the collaborative learning approaches are of great interest in the design and teaching of online technical courses. It is necessary to choose when and where to insert these collaborative activities in the e-learning device.
References


