Modelling collaborative pratival work processes in an e-learning context of Engineering Electric Education

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***Abstract*—This work deals with the modeling of the processes of the collaborative practical work of electronics in a context of e-learning and the remote laboratory which is new technology allows the students to manipulate the practical works of electronics and the researchers can realize its scientific experiment by control, command and manipulation of all equipment and instruments of a laboratory via the web without this move to the laboratory for to solve the problems of massification of students in universities and the restriction of time and places and the lack of some instrument in the laboratory. even this new project will allow the sharing of the instruments and equipments between the universities on the international scale for to have Coordination, integration and cooperation between universities. In this work we are interested to modeling the processes of collaborative electronics practical work, whose actors are : the tutor, the member, the coordinator and the secretary and collaborative tools. Two models have been developed: a tutor-student model showing the activities of the learner and tutor, and moderating-member-secretary model that focuses more specifically on the roles of the moderator (coordinator) and the secretary (rapportor). This modeling has made it possible to better understand the processes considered and to detect the various problems that may arise during an online particle work collaborative process.**

Keywords: E-Learning, modelling UML ,Remote laboratories, Embedded system Engineering electric Education, collaborative work.

I. INTRODUCTION

One of the important factors in the formation of physic science specialy in the field electronique is the Practical work . This is allows students to acquire the necessary technical skills. Through the realization of experiments for verify and supplement the knowledge provided in the theoretical courses.This desire is confronted with a set of problems : Massification in front of the large numbers of students. Insufficiency of materials and equipments.Insufficiency of practical work premises.The security of the material and the students . The classic method for to solve this problems we find Group work; The benefits of working in a group are many : sharing tasks, sharing knowledge, and idea but some time we need student to be autonome and relies on himself . The simulators same as isis and multisim ,This virtual solution are used to explain the theoretical framework by simulations. but for the exact sciences, we need student to see and notice the effect of environement and the take real musurments .

Hence the need to find a solution.The manipulation of practical work online and remotely is an alternative solution to help solve these problems.Our solution is Create a embedded system allows students to control and manipulate all laboratory equipment and measuring instruments just via the web[1]. in our previous work we have interested about the performance of this system . For that it is necessary this system of Learning uses and respects the pedagogical standards followed in the teachings[10] .On the other hand, this system must make it easier for the laboratory manager to prepare and manage access to experiments and manipulations The performance of the system regarding the presision and speed of interaction with the laboratory[2]. And in this work we will be interested in a very important vollet in the teaching it is the collaborative work and more precisely The collaboration in the praticale works of electronics online is an active means by which the learner works for construction his knowledge. It

is an educational strategy that promotes exchange, interaction between members and sharing a common goal. This type of learning requires the presence of several actors whose main ones are the learner who can be a simple member of the working group or play the role of a moderator and a secretary and the tutor whose function is the accompaniment of the group during its formation. and an embedded system that will offer tools for online collaboration via the web .

A modeling of collaborative work processes in the practical work of electronics in an elearning context is carried in this article[3]. More precisely, we have schematized the different activities of the actors and we have arrived at three models:a tutor-student model showing the activities of the learner as well as those of the tutor, a moderating-member-secretary model that focuses more specifically on the roles of the moderator (coordinator) and the secretary (rapporteur) and a moderator-membermodel that excludes the secretary role. Finally, the problems encountered in accomplishing these processes are presented. This article is structured as follows: in the second section, a general idea is given about distance education and tutoring. The third section presents the collaborative work: its characteristics and its different actors. The fourth section presents the models that were developed during this work. The fifth section highlights the main problems encountered during online collaborative work. Finally, a conclusion completes this article.

II. E-LEARNING AND PRACTICAL WORK OF ELECTRONIC ONLINE (E @ LAB).

E@lab :is an open source web conferencing system for on-line learning is an embedded system for formation in which the theoretical and practical teaching is provided partially or totally by a

trainer remote from the learner in space and / or time so that the communication in its entirety or essentially between teacher and student is done indirectly through an artificial medium, it is an institutional means of providing pedagogical and technical support to students who are thus relocated from the university, in order to help them to optimize their learning. Distance education consists of coaching psychological learners by tutors.It is the mediatization of human relations via a foad / elearning device between the tutors and the learners. So e@lab provides real-time application of sharing audio, video, chat, and screen and the most important is sharing the same electrical scheme of a practical work and the same workspace between students for control and command commun [4][9].

The world outside E@Lab :

It is important to identify how E@Lab works with other components in order to develop and maintain the software. The external entities that are connected to E@Lab are displayed in Figure 1

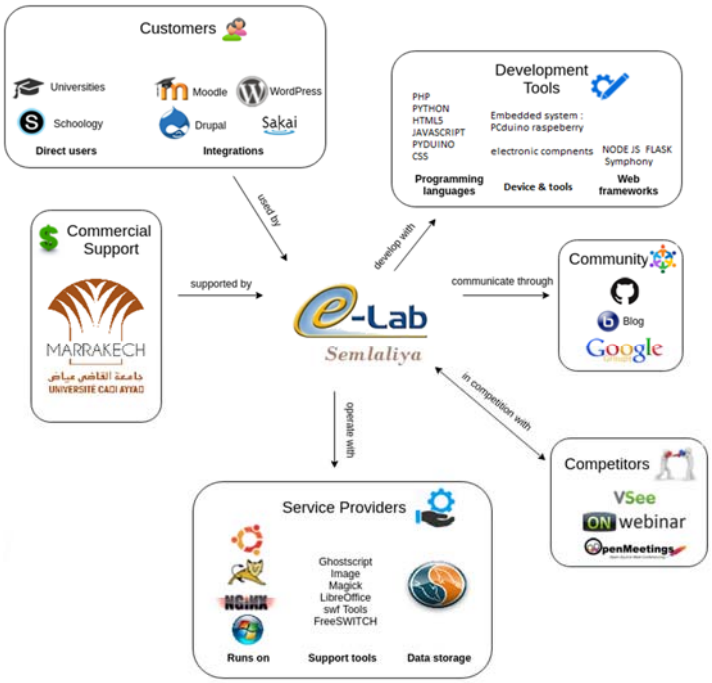


Figure 1 outside E@Lab

Architecture And Technology Of System

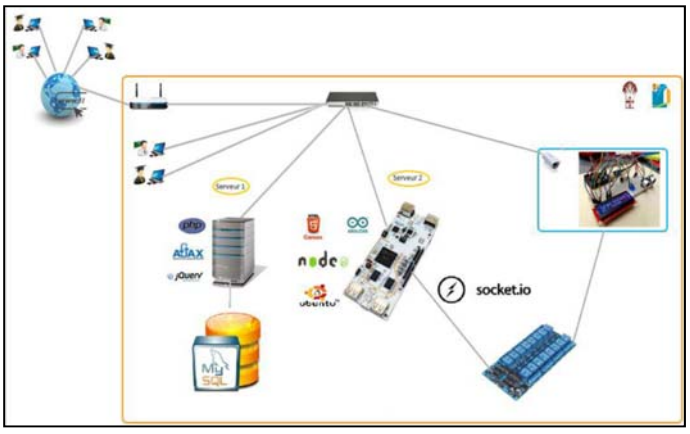


Figure 2 :Architecture and technologies system

Implemented laboratory architecture is centered on a main server and uses many other types of equipment to be correctly connected . The server2 is connected to several measuring devices and instruments. In the diagram of Figure 1, there are two perimeters. The first is the web (Internet) and the second is the perimeter of the university (specifically the local school network LAN). In the perimeter of LAN, we have two web servers, one containing the learning platform that represents the central faculty information system, where all information is found. The second server is a pcduino or raspebery that contains the application that will allow students to handle the practical work. The process would work as follows: a teacher or teachers connect either using the Web or the local network; each teacher defines one or more TP, puts the theoretical part and the scenario after having made the TP reservation for all students. On the other side, students connect using either the Web or the local network (Most of the time, students will use the web, because the use of web was among our goals from the begin-ning). If the student has a appointment for Travel work, he consults and reads the scenario, then he checks the reservation. If the reservation time arrives, he manipulates and remote the travel work; during this stage each reservation is destined towards the server 2 (pcduino card). If the reservation time elapses, the TP ends and the material resources are released for a future reservation[5][6].

2-1 Control and command Interface.

Student will achieve the electrical schema of the circuit and can control and order the real Assembly of laboratory via the web. The great technologies used in this application are html 5 especially its suitcase canvas, Node.js, websocket (socket.io) and a embedded system (pcduino,raspebery). To have reactivity between the client and the system we used the canvas suitcase of html5 that comes to replace the flash.

This technology will allow to virtualizes the electronic component and the real practical work for realized the circuits by using the pictures and animation that will be the ways by which the student will manipulate and control the real circuit and TW. Developed an application with html5 (<canvas>) for to have a animation and flexibility to choose the device and link them, its requires using a lot of JavaScript and for That is why we used the Node.js technology that will allow to set up a web server on our electronic card pcduino (it's Also the card by which we will control the real circuit). Advantages of using Node.js is that it allows running the java script in the server side in-stead of the client side and is based on the engine of google chrome V8 that makes faster the execution of JavaScript. This technology already used but what is new: is in the sock-et.io library that allows the exchange of information between the client and the server: this library in the latest projects is used, but it does not operate the interest in this Library; they are only used for sending the request from the client towards the server, knowing that we can do just with Ajax because it actually allows the client and server to exchange information with-out reloading the page. But in Ajax it is always the customer who request and the server re-peats. The server cannot decide by itself to send information to the client. with Socket.io this has become possible, and we were going to exploit it since our server is itself our pcduino card by which we aregoing to protect the real circuit and device. If the voltage of the threshold level is exceeded, then the server must inform the client to pay attention to the protected component and device.

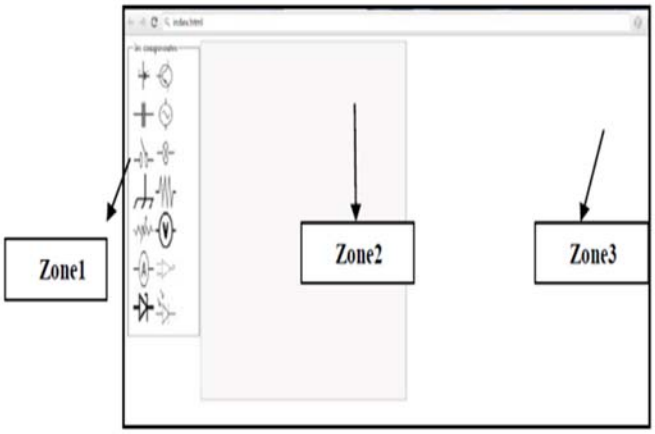


Figure 3: control interface

Zone 1: This zone contains all the electronic components that the student has to choose and works at.

Zone2 in this area where the student must carry his electric scheme.

Zone 3 : This area will display the control interface when the student will choose the measuring tool or power because we will exploit the existence of some measure of material and source of energy configurable and controlled via the web from a web interface such as tools of Vision Agilent.

Laboratory must be equipped with a embedded system (pcduino or raspebery) and a board on which all the electronic components mounted depending on the given needs. These components are connected between them by relays[7][8].

In the Embedded system we will use the Node.js technology that will allow us to create an http server and the application of the control. This card uses a Linux operating system, and from the Linux file system we can control and order the pins of pcduino to manipulate the real assembly

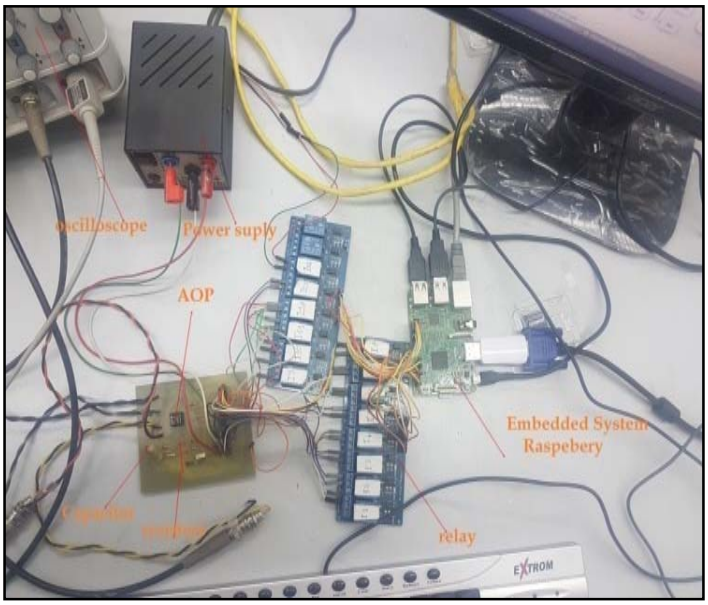


Figure 4 : Real Component in Laboratory

Figure 5 : pratical Work AOP in real laboratory

III. Collaboration in the practical work of electronics online

Collaborative learning is defined as any learning activity carried out by a group of learners with a common purpose, each being a source of information, motivation, interaction, mutual help and benefiting each of the contributions of others. the synergy of the group and the help of a trainer facilitating individual and collective learning**[13]**.

3.1. The actors of an online collaborative work

3.1.1. The tutor

It is the one who has a coaching function for all teams during their training. It plays a driving role, it can intervene at different levels, with various functions: in the conception and in the elaboration of the contents, in the correction, where it is a matter of making the link between the content and the learner and to build an evaluation from the productions of the latter, etc. The tutor is a mediator between the learner and the tool, it gives the basic tools (method, rules of work) necessary for any task. It is an intermediary between the learner and the content of the course, it must be attentive to the working arrangements of the learner and lead gradually to independent intellectual activity. It helps the learner to act and decide, he pushes him to find the keys to the situation and he guides him.

3.1.2. The learner

In the context of online collaborative work, the learner is no longer the traditional learner whose role is to memorize the knowledge transmitted by his teacher for a restitution on the day of the exam, but he governs his teaching process. learning by transforming information into knowledge and creating interactions with other members of the group. During the communication, the learner can be either a transmitter who must: to be listened to and to be understood: to express himself as succinctly as possible in order to avoid encroaching on the expression time of the other members of the team, express yourself clearly and accurately and use accessible language. He must also be a receiver who must, to listen well and understand what the transmitter

Communicates: adopt a comprehensive attitude, let the other person express themselves to the end, ensure the good understanding of the ideas emitted by the issuer by asking questions or reformulating the

ideas he has expressed and be sensitive to the issuer by trying to understand its reality and perception of things.

3.1.3. The moderator

The moderator is a person responsible, among other things, for coordinating tasks and assigning responsibilities. This actor has the power to influence the members of his team by his personal characteristics: his qualities, his talents, his previous experiences, the type of personality that he possesses, the beliefs to which he adheres and the attitude that he maintains to other members or to the work of the group.He participates in the task and tries to maintain a good climate within the group, he strives to influencepositively negative people, he frequently brings examples related to the purpose of work, he puts a lot of effort to try to reconcile two people who adopt different points of view of each other.

3.1.4. The Secretary

As for the secretary, he must objectively note the words and ideas discussed during the meetings and which will be used for the drafting of documents. Some teams feel that the secretary must produce a report that is to say a summary or a detailed summary of each meeting. Other teams feel that this procedure is too long and not very useful in view of the objectives pursued. In this respect, it is up to each team to establish a modality that suits them according to their needs.

Like the other members of the group (moderator, learner), the secretary must actively participate in the group's discussion and work.

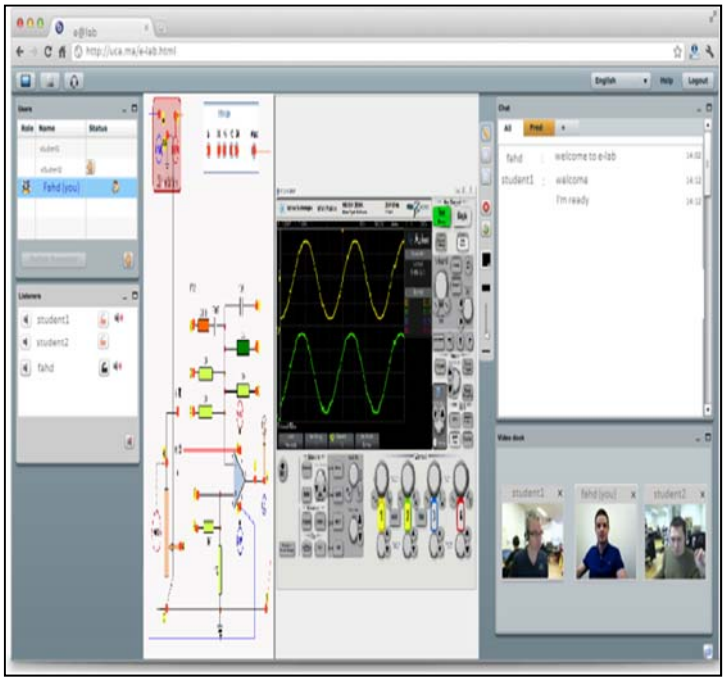


Figure 6 Example collaboratif pratical work of AOP

2.2. Elements of a collaborative work :

the three elements of collaborative work are: coordination, communication and the sharing.

3.2.1. The coordination

Coordination is about the effective organization of activities, people and resources to achieve a goal.

To better channel and coordinate the energies and activities of the group, three variables are to be controlled by the teacher or by the learners: the task, the composition of the group and the animation.

• The task: Achieving a collaborative task means working together and helping each other to achieve the goal that the group has set for itself by negotiating and taking into account everyone's expectations.

The composition of the group: It is a question of answering the following questions: what will be the size of the group? Should we create homogeneous or heterogeneous groups? Which method should to use to divide learners into groups?

• Animation: In a collaboration in virtual mode, the animation of the collaboration activity is done mainly through the forums: privileged places for discussion, work, socialization and coordination. It is usually the guardian who is primarily responsible for the decisions to be made in animation matter.

3.2.2. Communication

It brings the learner to express ideas in order to share them with the group, to make connections between the ideas expressed to allow the emergence of new ideas and to structure the ideas to give them meaning and build knowledge.

Coordination, together with communication, is one of the two cornerstones of collaboration.

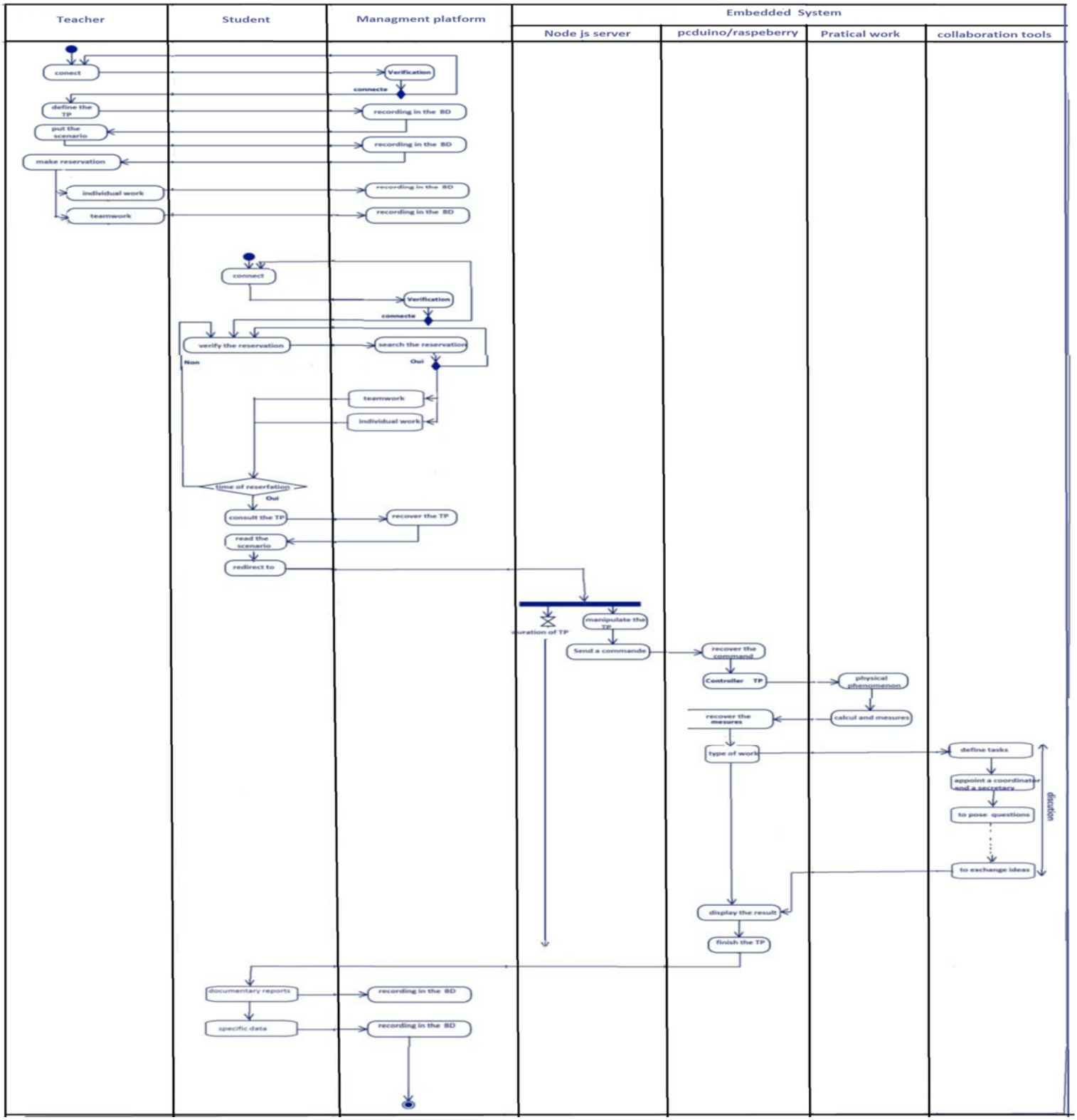
3.2.3. The sharing

Collaborative learning invites students to share, to build positive interdependencies and to engage in common productions.

Pedagogical sharing can take many forms: sharing of ideas, activities (learning, teaching, evaluation of learning), teaching materials or pedagogical knowledge

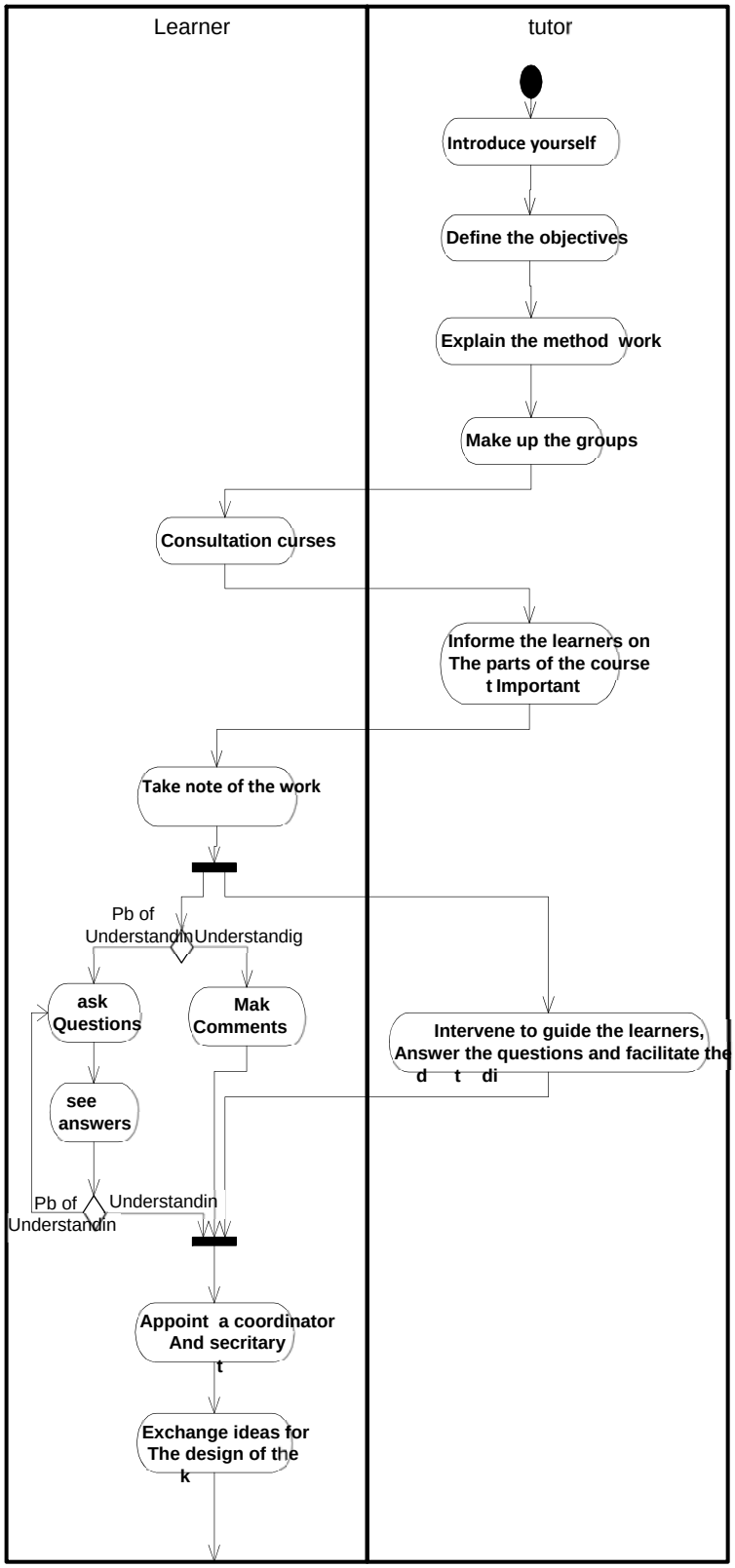
IV. Modeling with UML

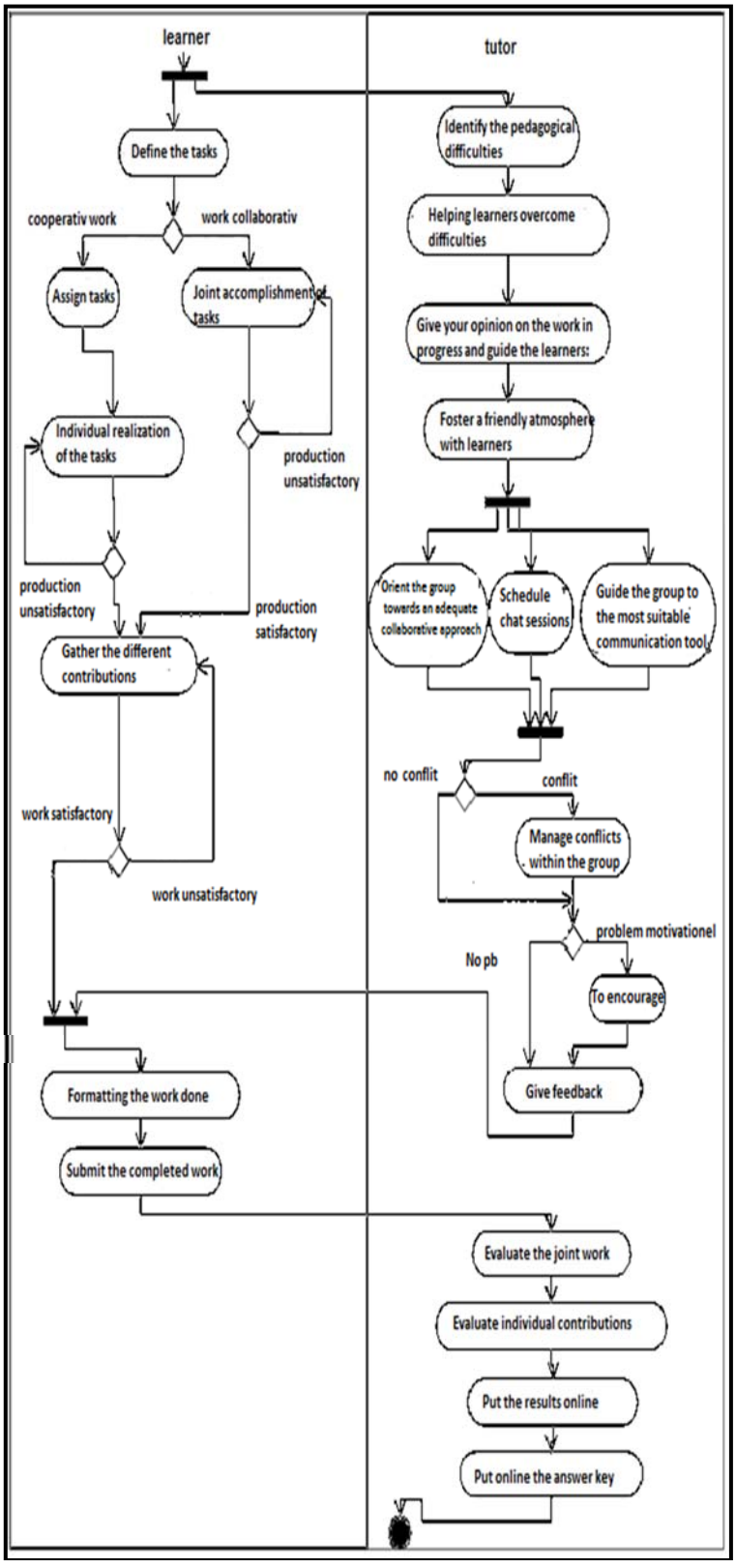
Modeling is of great importance in understanding and analyzing a process [11]. Thus, we proceed to the modeling of the activities of the actors: tutor, learner, moderator and secretary. More specifically, three models could be developed: tutor model, moderator model secretary member and moderator member model. It is 3 models respect the general modeling to write in fig 3. the difference will be in the actors and the relation between them:



3.1. Learner tutor model:

As shown in Figure 1, this model corresponds to a UML (Unified Modeling Language) activity diagram showing two actors: the learner and the tutor.The main activities that this model uses are:

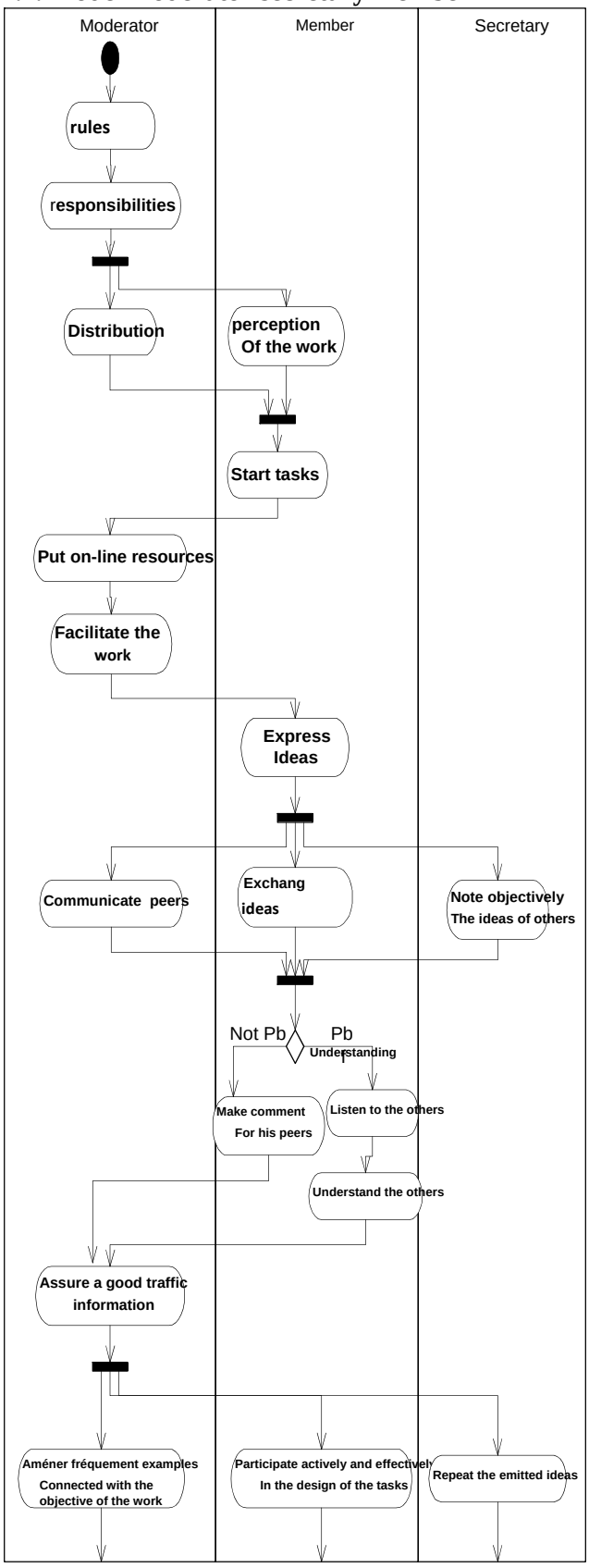


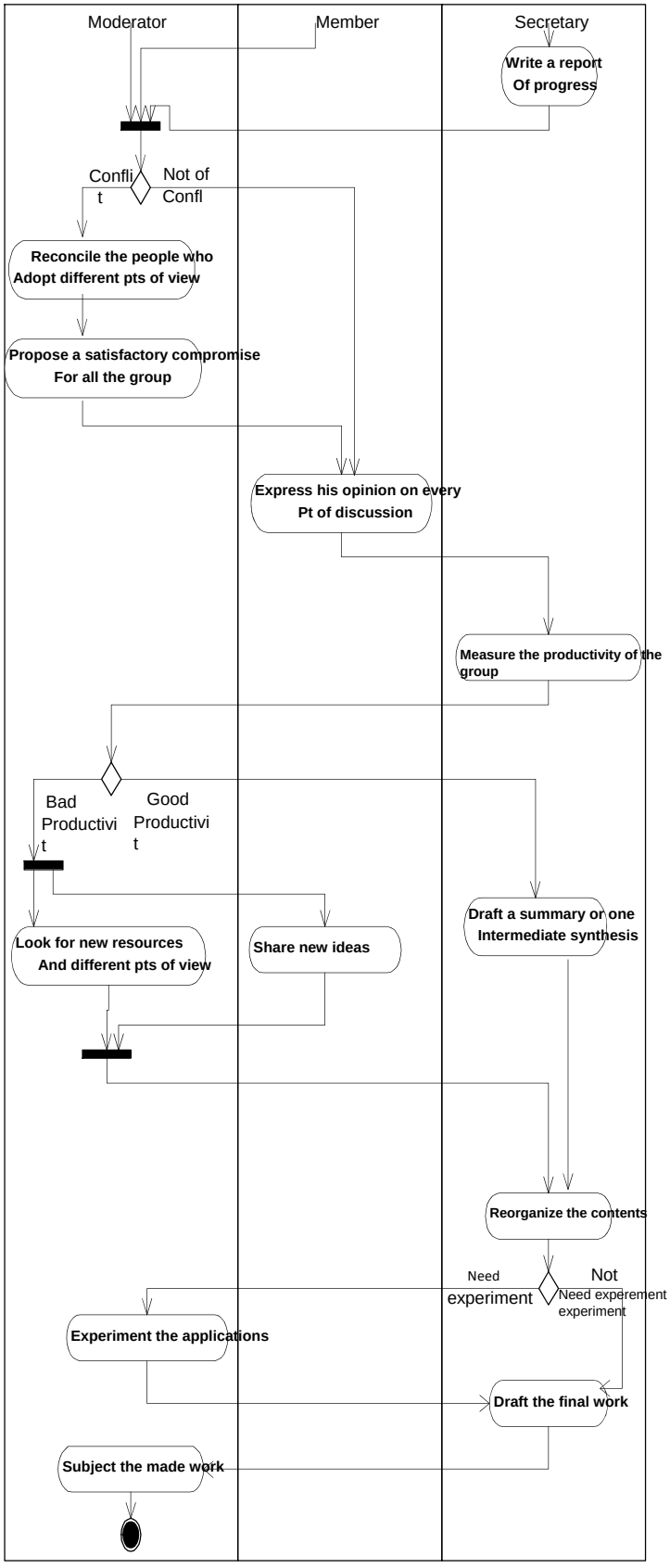


Activite	Description
Introduce yourself to the learners:	From the first meeting, the guardian must introduce himself, mention not only his name and surname, but also disclose all the information he deems useful and necessary for the accomplishment of the work with its learners. This information may relate to his skills relating to the work to be carried out, his abilities
Define the objectives of the course:	The tutor defines the objectives of the course that the learners must reach at the end of the work.
Explain the working method	It is a question of answering certain questions relating for example on the time of delivery of the works, the collaborative step to follow, the dates of starting and end of the activity
Composing groups:	The tutor composes the groups based on certain criteria such as the heterogeneity that characterizes learners with differences in age, culture, education, occupation or homogeneity. As he can let each group be composed by choosing its members.
Course Consultation	The learners consult the content of the online course and discover the theme they will work on.
Inform learners about the most important parts of the course	In order to ensure that learners are on the right track, the tutor informs them about the most important parts of the course that help them achieve the goals of the work they are doing.
Take note of the work to be done:	Once informed about the objectives to be achieved, the most important parts of the course and the method of the work to be done, the learner becomes aware of the work to be done, is it a project of creation of a website, programming
To ask questions :	The learner with comprehension problems asks questions to the rest of the group members and even to the tutor who can intervene to facilitate understanding and remove ambiguities.
See answers	These answers can come either from learners who do not have problems of comprehension and who must help their colleagues to overcome these problems, either of the tutor.
To comment :	It is the part of those members of the group who can better understand the work to be done, its goals and objectives. They help others overcome certain problems.
Intervene to guide learners, answer questions and facilitate understanding	This activity is parallel to previous activities. As learners exchange comprehension questions and answers, the tutor intervenes by clarifying the concepts and clarifying the instructions in problem situations. Whenever we are faced with problems of comprehension, the same work is repeated, it is a loop. Learners ask questions, receive answers and the tutor intervenes to guide them and facilitate understanding.
Appoint a coordinator and a secretary	In a collaborative approach, learners exchange ideas and agree to appoint a coordinator and a secretary to facilitate the completion of the requested work.
To exchange ideas for the realization of the work	Le travail collaboratif se base sur la communication, le partage et les interactions entre les différents membres du groupe. Chacun participe à la progression du travail de groupe. Chaque membre doit être attentif à l'expérience des autres afin de pouvoir dégager ce qui pourra aider ou nuire à la bonne marche des activités du groupe. Ces échanges peuvent porter sur le cours ou concerner des échanges personnels. Par ailleurs, ces échanges peuvent être synchrones ou asynchrones.
Identify the pedagogical difficulties:	Lors d'un travail collaboratif en ligne, certaines difficultés pédagogiques peuvent survenir tels que les problèmes terminologiques, de compréhension des questions ou d'assimilation des concepts présentés dans le cours lui même.
Helping learners overcome difficulties	During the monitoring and support function, the tutor helps learners overcome difficulties by motivating and encouraging them.
Give your opinion on the work in progress and guide the learners:	The tutor is the backbone of online collaborative work. It helps learners deal with different types of problems, gives feedback on the work in progress and guides learners by promoting collaborative and sharing.

Foster a friendly atmosphere with learners:	During exchanges, a friendly network occurs between learner / learner and learner / tutor, which has the effect of revealing the human aspect of the tutor, breaking the traditional dividing line between teacher / learner and facilitating exchanges.
Orient the group towards an adequate collaborative approach:	The goal of the tutor is for the learners to follow a process where all the members of the group participate actively in defining the goals to be attained. Each member is responsible for encouraging the participation of other members of the group.
Schedule chat sessions	Chat is a synchronous communication tool that is a real-time meeting between the learners and the tutor.
Guide the group to the most suitable communication tool:	The diversity of communication tools for remote collaborative work can leave the learner falling on the wrong choice of the tool to help the realization of the requested work. The tutor intervenes to direct him to the tool that meets his needs in terms of speed and interactivity.
Manage conflicts within the group:	This activity takes place in the event of conflicts occurring. These conflicts can be the result of differences of ideas of the learners or of a participation of a member of the group which is considered insufficient compared to the others, the tutor then intervenes to manage these conflicts and to ensure the order within the group for example by proposing a satisfactory compromise for all members of the group. For some, conflict is a source of interactivity.
To encourage :	In the case of motivational problems, the tutor encourages learners to overcome them.
Define the tasks:	Learners define the tasks to be accomplished.
Joint accomplishment of tasks:	In the case of collaborative work, there is no real division of labor between participants. They all work together at every stage of the development of the work. It is difficult to identify the work provided by each. If the joint accomplishment of the tasks is unsatisfactory, the learners repeat the same work. One enters in a loop and in the case where the realization is satisfactory one passes to the following activity.
Assign tasks :	We talk about this activity when it comes to cooperative work. There will then be a clear division of work between the learners, ie each learner will be assigned a clear and concrete task.
Individual realization of the tasks:	Each member has the responsibility to take part in the task entrusted to him by the coordinator. If the realization is unsatisfactory: it is a loop and the same work is repeated if we go to the next activity.
Give feedback:	Approaching the completion of the work requested and controlling the various work done, the tutor accesses the forums of the different groups and is the only person who is a member of all the groups at a time. The tutor gives feedbacks, gives an overview of the progress of the work, makes comments and proposes corrections. The learner receives these feedbacks to improve his work.
Gather the different contributions	The different contributions of the members of each group will be gathered to build the final work. If the job is unsatisfactory, the group is responsible for improving it, otherwise it moves on to the next activity.
Formatting the work done:	These are changes to the text or code of the project. If it is a text, make sure it is well written and formatted (clear, free of spelling errors and syntax errors), if it is a text project of programming or creation of a web site, it is necessary to experiment it and to make sure of its good functioning.
Submit the completed work:	Once ready, the final work will be submitted for evaluation by the tutor.
Evaluate the joint work:	The evaluation of group work is one of the tutor's functions. Thus, in the first instance, the tutor evaluates the group's common work.
Evaluate individual contributions	This is to evaluate the performance of each member of the group. The tutor measures the contribution of each to the progress of the work based on certain evaluation criteria such as the volume of intervention, the type of intervention and the reactions of others, ie what the interventions entail.
Put the results online:	Once the work of the learners evaluated, they can know their results posted online.
Put online the answer key:	The tutor often puts a standard answer key online for those interested in the project.

4.2. Model moderator secretary member





Activite	Description
Establish rules:	From the first meetings, the moderator establishes rules to facilitate the work since it is a collaborative approach that must be followed. Among these rules: to inform the members of his group of the obligation of active participation in carrying out the work requested, to avoid as much as possible the problem of absenteeism at synchronous meetings,
Assign responsibilities	To ensure the participation of all members and for the work to be the fruit of the convergent efforts of the whole group, the moderator assigns a responsibility to each learner and encourages him to successfully carry out his tasks.
Divide the tasks, express his perception of the work to be done:	These two tasks are carried out in parallel by two different actors. After the assignment of responsibilities, the work will be distributed. For example, for the roles of moderator and secretary, they can be taken each time by different learners. There will be a role exchange. At the same time, and once informed about the proposed theme, learners express in a coherent, meaningful and understandable way for others the ideas that come to their minds on this topic.
Start tasks:	The objective of the course being defined, the members can start the realization of the tasks which are entrusted to them within the group.
Upload resources:	It is necessary for the moderator to put resources online, to provide information that he deems useful and necessary for the accomplishment of the work.
Facilitate the work of the group:	The objective of the moderator is the success of his group which depends on the effort made by each member. The moderator's interest is to motivate the whole group by encouraging them, facilitating their work and creating a climate conducive to exchanges and fellowship.
Express your ideas and opinions:	Each learner is a source of information for other members from whom everyone must express their ideas and opinions about the work they are asking for. The learner can take advantage of different visions.
Communicate with peers, exchange ideas and different visions, objectively note the ideas of others:	These three activities are parallel but they are carried out by three different actors. The moderator communicates with his peers always trying to positively influence his group and encourage a person who shows little interest in group activities. The other members exchange different ideas and visions which creates interactions favoring the emergence of new ideas and must structure them to give them meaning and to build knowledge. The secretary objectively notes the ideas put forth in order to extract information and subsequently knowledge.
Listen to others :	In order to promote the success of their collaboration and in particular in the case of presence of comprehension problems, the members of the group must listen to each other.
To comment :	Those who understand the objectives of the course and the work required and manage to overcome the learning difficulties help their peers to become more involved in the process and advice.
Understand others:	It is essential that each member be heard and understood.
Ensure a good flow of information:	The moderator is responsible for ensuring a good flow of information within the group so that the learner is always informed about the progress of the work.
Frequently bring examples related to the purpose of the work, participate actively and effectively in carrying out tasks, reformulate the ideas expressed:	These three activities are parallel. The moderator whose goal is the success of his group frequently brings examples related to the purpose of the work. Each member becomes responsible for achieving the common goal and remains a resource for others by helping to support the group through its effective motivation and his efforts. The secretary must reformulate the ideas expressed during the exchanges and structure them to give them meaning and to build knowledge.
Write a progress report:	After the reformulation of ideas, the secretary writes a progress report containing various structured and organized information.
Reconcile people who adopt different points of view:	In the case of conflict, the moderator puts a lot of effort into trying to reconcile people who adopt different points of view.

To propose a satisfactory compromise for the whole group	Conflicts can be the result of diverging ideas or an imbalance in efforts, as they can be a source of abandonment for some in the case of disagreements. To ensure order, the moderator offers a satisfactory compromise for the whole group, in which he takes into consideration all the ideas expressed.
Express your opinion on each point of discussion:	Among the tools for measuring the productivity of the group, the degree of interactivity, ie the exchanges and their nature or the interventions and their relevance is why the learner must maximize his interventions. Everyone has the responsibility to participate in the task, to express their opinion on each point of discussion and to carry out research and reflection.
Measure the productivity of the group:	The secretary is responsible for measuring the productivity of the group since it is the one who reformulates the ideas and drafts progress reports. His role allows him to know the productivity of the group.
Find new resources, share new ideas:	These two tasks are parallel and carried out by the moderator and the members. In the case of poor productivity, the moderator looks for new resources and encourages members to interact and collaborate more to improve the group's productivity. At the same time, members share new resources and ideas and each suggests a solution to all the problems the group faces.
Write a summary or an intermediate synthesis:	Once the productivity is improved, the secretary writes a summary where he gathers the different knowledge built, it is an intermediate synthesis.
Rearrange the content:	Once the intermediate synthesis is written, the secretary reorganizes the content that will be presented in the final work.
Experimenting applications:	In the case of the necessity of experimentation, the moderator, in collaboration with all members of the group (members and secretary), is in charge of experimenting the applications.
Write the final work:	From the beginning, the secretary is responsible for reformulating ideas, writing progress reports, writing interim syntheses and reorganizing the work. All these steps allow him to facilitate the writing and preparation of the final work.
Submit the final work:	After writing, if it is a text, the secretary checks the mistakes spelling, style, font and formatting. If it is a programming or the creation of a website, it checks its functioning to finally submit the work of the group.

V. Difficulties met in the fulfillment of these processes

The models presented in the previous section bring in as actors the guardian and the learner who can be a simple member of the group, the moderator or the secretary.

These various actors can meet certain problems during the fulfillment of the processes such as:

- Accelerated rhythm of the work so that the learner must every day be informed about what takes place in the forum and to intervene there.
- Necessity of an enormous work in an online training, asking for a big availability and not only for a half-time work.
- Technical problems for certain learners, such as the bad control of the computing tools and the sciences of the information and the communication in a general way.
- Bad choice of the coordinator in certain cases .
- Conflicts at the level of the on-line collaborative work which can have because of the differences of ideas and points of view or the imbalance of the supplied efforts. They are a source of abandonment.
- The isolation of the learner: in certain cases, the learner is alone and has practically no direct contact with the other learners.
- Lack of training of certain guardians or lack of coordination between them.
- Problems of connection: it is the most important problem; he concerns the impossibility of connection, the interruptions, the low flow, etc. Such problems can cause several discouragements.
- Equipments no always available: the learners sometimes meet the problem of no availability of a computer at their disposal in their workplace or at their home .

- Deadlines granted for the discount of the works: for certain learners the duration assigned to the design of the works can seem too short.
- Complexity and volume importing certain courses which ask for many efforts in a very limited time.
- Problem of groups: certain learners complain about the lack of dynamism within their group.
- Presence of passive members within the groups.
- Absence of synchronous tools in certain trainings.
- Sometimes raised costs of training.

VI. Conclusions and perspectives

In conclusion, the modelling of the processes of collaborative work in the context of e-learning, through diagrams of activities of UML, allowed to specify the roles played by the guardian, the learner, the moderator and the secretary and to discover the various problems met during the fulfillment of these processes such as educational problems and others of order technical.It seems interesting to spread the type of study whom we made, by deepening the reflections made in the field of the distance teaching and that of the on-line collaborative work, to model other educational or administrative processes. This work could be even completed and enriched by the search for solutions to the various problems met during a collaborative approach in a context of e-learning.

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