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Integration of Examination Strategies in E-Learning Platform for Assessment of Collaborative Activities

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ABSTRACT

In this article, the authors propose a set of examination strategies for distributing tasks of collaborative activities. The first purpose behind this proposal is to assess fairly the learners who are involved in group or team work at the e-learning platform. Indeed, in the literature, few methods are used to assess the learners' individual contributions to the collective or collaborative work. Therefore, the proposal of this article is based mainly around this issue. This will lead to an approach to assess individuals within the learning group (or team), which in turn, will allow to assess the group (or team) as a learning entity.

KEYWORDS

Assessment Process, Cap-Platform, Distribution Strategies, Division Of Labor, Team Working, Work Item

INTRODUCTION

Collective work, teamwork or networking learners' skills have become the key elements in all educational and professional organizations. Indeed, they increasingly use methods of work organization to better enable collaboration between learners working around the same activity. In such conditions, coordinating task assessment of learners working together may prove difficult, due to several factors such as, the difficulty of assessing the scenario to be played by learners, and the difficulty of finding a consensus for a fair work dispatch, etc. That is why, it is necessary to adapt the division of labor (between learners) befitting such activity or process.

Therefore, these new forms of work organization have widely spread through the usage of new Information and Communication Technologies (ICT). This later has favored the birth of Computer Supported Cooperative Work (CSCW) that studies the individual and collective mechanisms of group working, and then investigates how actors with various skills and different prerequisites can cooperate.

However, if one admits that these technologies offer a set of tools to communicate, coordinate and collaborate, the question is: "what would be the individual and collective performance criteria to be considered for an assessment of collaborative activities". Therefore, it is needed to evaluate and even measure the effectiveness and the added value of these activities in a professional setting. Furthermore, several important issues might arise: "how to reduce the subjectivity in the assessment and how to fairly assess learners involved in the group", and "how to ensure the assessment of learners' individual contributions in group, or the assessment of the group or the team itself?" However, among the six principles of group work assessment established in Galton (2010), "a fair system should be used that rewards both individual effort and group collaboration."

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This paper focuses on the problem of assessing teams or groups, taking into account the individual assessment of each member in the team (or the group). In fact, some authors like Saadoun and Levan (1996) distinguish between the concepts of group and team based on some parameters such as the adhesion (feeling of membership that is strong in teams) and the cohesion (harmony sought to lead without conflicts at work). Generally, in the team context, the examiner must have knowledge of the individual profile of each team members such as, his level, his competence, and background, etc. However, in the group, only the prerequisites are necessary to consider.

In fact, in a teaching context, assess a product resulting from examination of collaborative work does not necessarily reflect the quality of each member of the team, because the efforts of one could cover the shortcomings of others. For example, in a programming project, the skillful of the two programmers monopolizes the task to the point that the other cannot contribute.

Therefore, to achieve the set objective, this paper proposes a set of examination strategies that will be applied for the distribution of tasks between learners who are involved in a group or team working in order to achieve collaborative activities. For that, the authors are particularly interested to exploit the tools provided by CSCW field, particularly Workflow Technology (Van Der Aalst & Van Hee, 2002), that is considered the favorite coordination tool in this field. Then, they propose to take charge of all strategies envisaged through the implementation of a combined system: a Learning Management System (LMS) and a Workflow Management System (WfMS), for purposes of assessment of collaborative activities in e-learning. This paper includes: in section 2, a brief background related to this research. In section 3, an illustrative example that explains the problematic. In section 4, the concept "Activity" on which this research is based. Then, in section 5: a set of examination strategies have been proposed for the distribution of tasks of collaborative activities. In section 6: the e-learning platform in which the proposed strategies have been integrated and implemented. Finally, in section 7: an example to show the step implementation of one of proposed strategies in the platform which was performed for this purpose.

BACKGROUND

Collaborative learning is a teaching strategy by which learners can build their knowledge with their peers who work together in teams or groups. Nowadays, it is one of the most recommended in education. In this learning mode, learners can perform several types of activities such as: solving problems, carrying out projects or mini-projects, collective drafting of documents, etc. However, in this activity, the division of labor has a great interest for the organization and coordination of collaborative activities in which each group member performs a part of the overall activity.

Furthermore, project-based learning (Kilpatrick, 1918; Dougherty, 2018) is a teaching practice that includes collective working in a learning or even a professional environment. This practice places the project as a realization in group by the division of labor. In this case, the most important question is: "how to appropriately distribute tasks". In this context and in the professional middle, the project manager is responsible for attributing the missions or tasks to the various actors using project planning tools. Particularly, Gantt chart adapted by the American Henry Gantt is one the tools. This effective tool is a connected, oriented and valued graph which is used to show the distribution of tasks and graphically shows the project progress through the visualization of different tasks that constitute the project. In addition, this diagram is often a complement of Pert tool[1], that is another conventional method used in project management (developed in the United States in 1950). It provides a methodology and practical means for visualizing the dependence of tasks and proceeds to their scheduling. In addition, brainstorming[2] (Osborn, 1948) is another formalized and technical problem-solving tool, with the guidance of a facilitator. This formula can be useful for find a compromise to distribute tasks between the participants in collaborative activities.

On the other hand, the language for describing teaching contents (Koper, 2001) as the IMS-Learning Design (IMS Global Learning Consortium, 2003) greatly facilitates the construction of

teaching contents (Hermans, Janssen & Koper, 2016). However, they do not offer all the flexibility needed to treat problems as those for tracking and assessing, particularly, the assessment of collaborative activities. In addition, this type of language does not cover the needs in terms of possibilities of task distribution between learners. They are intended to describe the possible variations or scenarios in a training program within contents and not teaching activity. In the case of IMS-LD the description of content has been made through a markup language. This one contains some elements to control the execution of scenarios such as, the sequence, the selection, etc. Also, to support collaborative learning, IMS-LD enables the attribution of several persons and/or roles to the same learning activity, because any distribution strategy was defined in this language.

In addition, the current e-learning platforms try to provide tools to facilitate the exchange and sharing of knowledge between learners through the integration of sharing spaces such as, discussion forums, wikis, sharing spaces of documents, etc. These are designed to support collaborative learning and group working. However, they offer no means to structure, monitor and control the activities performed by learners in these spaces. From this point of view, authors think it is appropriate to exploit the technologies provided by the CSCW field, particularly the Workflow that represents a solution to better structure and coordinate collaborative activities. In the case of Sadiq (Sadiq & Orlowska, 2002), it is recommended to use workflow in education, in order, to manage teaching staff and editorial contents. In addition, VanTroys and Peter (2002) propose a workflow-based environment for running and tracking individual learning works. Also, Cesarini, Monga and Tedesco (2004) present a workflow engine supporting the learning processes. Finally, Yong, Yan and Huang (2006) propose to use workflow technology to implement data integration for e-learning. Aprilinda, Sukoco and Cucus (2016) use the WfMS in the development of e-learning platforms to ensure a better efficiency and coordination of distance learning. Regarding assessment in e-learning, Hajjej, Bendaly Hlaoui and Ben Ayed (2013; 2014) propose a generic specification and a design approach based on the workflow technology for creating e-learning processes and particularly of e-assessment adapted for each learner. Consequently, according to the various studies presented above, we conclude that there is again a great lack in methods and adequate tools for monitoring, managing and assessing learning activities, particularly, those of collaborative type. To respond, the present study proposes a set of distribution strategies of collaborative work to fill one of shortcomings of current systems, to ensure a better coordination and development of assessment processes and make assessing the learners who are working around these processes more objective.

In fact, a collaborative process of teaching or assessment represents a set of activities that are organized around a certain project type (mini-projects, projects for collective drafting of documents, practical works, etc.). These collaborative activities may be yielded with one or more distribution strategies to carry out the collaborative learning project. Therefore, to make a dispatch of learning activities in a collaborative context, (Mahdaoui, 2008) proposed two ways. The first approach proposes an equitable sharing of activities between the team members. The second approach proposes to give more freedom to learners in choose and dispatch labor between them. The activities are not shared in advance so as to give more freedom to learners in the choice and distribution of labor. In the following, the problematic is explained through an illustrative example.

ILLUSTRATIVE EXAMPLE AND PROBLEMATIC

Illustrative Example

Suppose a set of learners who are organized into a group or team and which have a set of activities to do in order to accomplish the collaborative process of drafting a document, these activities can be for example: conduct research on the subject, describe the document sections, draft the document sections, organize the different parts and structure the final document.

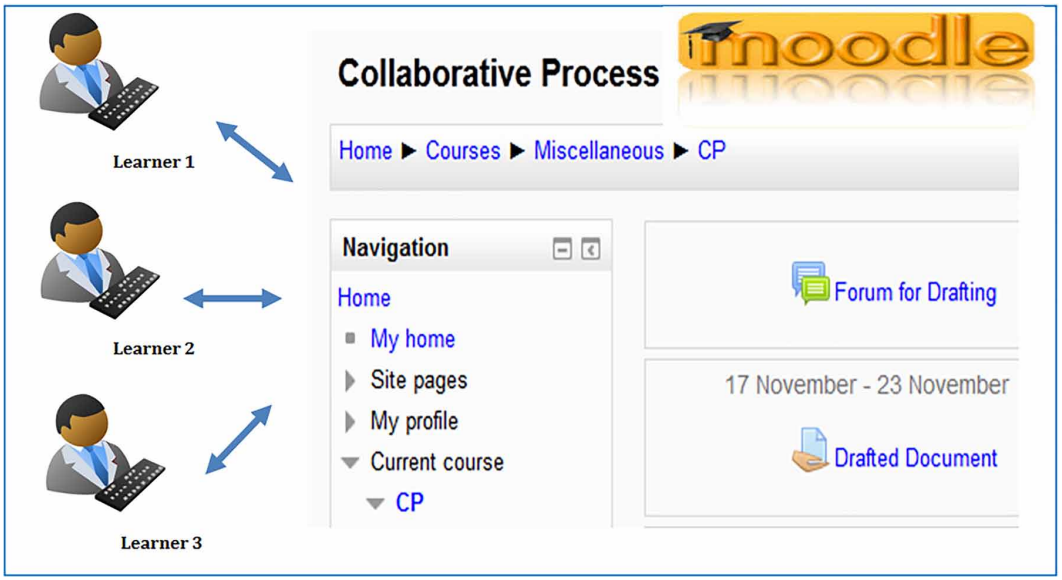
If we use an LMS as the platform “Moodle” (Moodle) to describe this collaborative process and to assess these learners, we will insert the activities that produce the document, which are in

this case the two activities "Forum and Assignment" (Figure 1). Therefore, learners must work together around these two activities to produce the final document and load it in the platform. In this situation, we cannot know how this document has been actually achieved neither assess the contribution of individual effort in this collaborative process. In fact, the assessor may assess only the final document assumed to be collectively produced by learners and assess exchanges between learners in the discussion forum. Indeed, an activity like forum can give some exchanges without necessarily detailing individual contributions.

However, to assess collaborative activities, it is necessary to assess the final individual and collective production of learners and the collaborative process or the approach followed by learners to achieve this production. In the second case, the assessment is based on measurement indicators specified by assessor, in order to estimate learners' individual and collective efforts through exchanges analysis, produced by participants in shared spaces like discussion forums, wikis, etc. Indeed, these tools are integrated into the existing e-learning platforms to facilitate exchange within the learners' community. These two complementary approaches of assessment can cover all aspects to carry out a more comprehensive and objective assessment.

Furthermore, in previously mentioned and used platform i.e., Moodle, one can make a direct individual assignment of activities, but one cannot know the execution traces of tasks to track the progress of overall activity. In other terms, with the use of this training device, one can do some structuring, but it remains informal. In addition, such platforms do not offer methods or strategies to distribute tasks between learners who are working together around collaborative processes. On the other hand, the LMS are based on what is called the language of description of pedagogic contents that offers a great ease for the construction of teaching contents. But they do not offer all the flexibility wanted to treat problems like those of monitoring and assessment, particularly the assessment of collaborative activities. In the next sub-section, a comparison between the LMS and WfMS was made to identify the problematic addressed in this paper.

Figure 1. Collaborative process "drafting a document" in Moodle platform



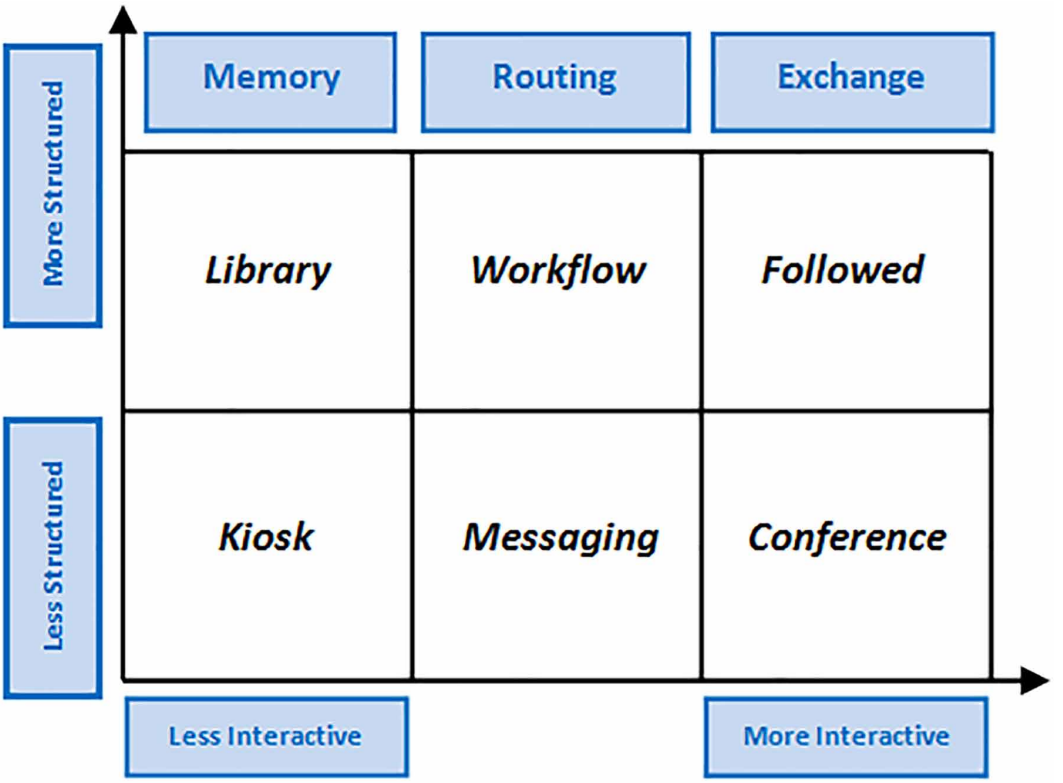
Discussion

The LMS are a category of groupware tools that specifically provides communication and collaboration features to various participants. Figure 2 presents a fairly common classification of applications and tools related to the groupware field.

From Figure 2, the LMS are considered as exchange groupware applications with less structured routing, and therefore, the coordination and structuration aspects of teaching activities in such systems are very limited (Lonchamp, 2003; Levan, 2000). The WfMS is another groupware category which represents systems intended mainly for the coordination and structuring of business activities. In the following, few points have been mentioned that detail the difference between the two categories of systems; to show the limitations of an LMS compared with the coordination aspect considered interesting for structuring learning or assessment activities, particularly of collaborative type. Recall some basic definitions commonly known in groupware tools, particularly workflow:

- **The instantiation of a process:** it is the execution of a workflow on a specific situation.
- **A work item:** describes the representation of the work to be performed by an actor as part of an instance of a collaborative process that will then be executed by workflow engine.
- **A Workflow Engine (MWF):** is a tool that can interpret the definition of a process, manage the participants' coordination and call external applications.
- **Expression of activities:** this aspect represents the manner to envisage the activities in both types of systems. In fact, in an LMS, a training program is defined by a set of themes. Each of them is composed in turn by a set of non-decomposable activities. In addition, the definition

Figure 2. Groupware applications (Morand, 2001)



of these activities is limited by repositories concepts proposed by the LMS itself such as the activity: Wiki, Quiz, Survey, etc., in Moodle. In contrast, in a WfMS, a process is composed of a recursive manner by a set of sub-processes, activities and tasks. These will consist of a set of executable operations or primitives by workflow engine. This decomposition is detailed in the workflow modeling functional aspect (Aouine & Mahdaoui, 2013; Saikali, 2001; WfMC, 1996). On the other hand, contrary to WfMS, the LMS does not have their own graphical tools to simplify the creation of scenarios and ensure a good schematic visualization. Nevertheless, it is still possible to interface a LMS with an author tool to describe graphically the contents (Paquette, Léonard, Lundgren-Cayrol, Mihaila & Gareau, 2006; OMG, 2004; Dalziel, 2003), and ensure their interpretation using languages such as SCORM, IMS-LD, etc. However, it is important to note that an author tool is focused on the content and not the learner's activity and even less for a learners' group/team. And as stated previously in this work, there is no clearly defined flow control operators for the distribution of work items in pedagogic languages and consequently in the LMS.

- **Expression of flow control:** this aspect represents the execution logic of activities related to the overall scenario. Indeed, the LMS impose a sequential description of activities, in addition to some other form of flow operators, that can be used implicitly (they are not clearly defined), such as the parallelism that can be defined with setting of start and end dates of activities. However, this expression of flow is described in terms of accessing activities, but not in terms of work performed by learners. By this we mean, the possibilities of separate assignment of activities to different learners at the same time, due to the absence of instance concept materialized by a work item in the WfMS. Indeed, the WfMS provide a set of flow control operators (sequence, alignment, joint, selection, etc.) that are clearly defined and whose semantics are precise. These operators allow splitting or merging different parts of work, which is interpreted by a set of tasks that will then be performed by actors, who in turn are assigned work items.
- **Assignment of activities to actors:** this aspect is important because it allows specifying actor who will play a predefined role. In the LMS, one can only make an assignment of activities to predefined roles in the platform (tutor, learner, etc.), without being able to clearly associate the actor instance because of the lack of work item. The same principle is used in WfMS, except that at the instantiation of a process, one can have a static or dynamic assignment of work items, and so can identify the actor who will play the role associated with the specific task. Indeed, the static assignment is to assign tasks to roles in the design phase of the process; also called "Build-time", while a dynamic assignment will be made during the execution of process i.e. during the "Run-time" phase.
- **Instantiation of activities:** this aspect describes the execution phase of processes models or training scenarios (programs). In fact, the LMS is limited to the management of activities instances to be performed by learners; but, no way of tracking or monitoring the execution of these instances, is proposed in these systems. In contrast, in the WfMS, the instantiation function is to follow the progress of process and the different tasks associated with this process. More about management of users, groups and roles, in which, the workflow engine must specify every moment at what group a user is assigned and the role entrusted to him.

The Problematic

In light of the previous discussion, the lack of structuring in LMS in terms of the possibility of distributing work items and therefore the coordination of collaborative activities, appears clearly. Indeed, in a collaborative work setting, one can distinguish several problematic situations resulting from the impossibility to better distribute the work by a teacher and the inability usually observed in learners to distribute work among themselves in certain activity types. So, if one takes the case of two learners working together to jointly achieve their objective, one can fall into a situation where

these learners are able to properly coordinate their activities. One can say then that they are able to define their own distribution strategy of work. In a reverse situation, learners may not be able to reach consensus among them to conduct their cooperation (achieving the common objective). In other words, they are struggling to adopt an appropriate strategy for equitable dispatch of work. This problem may be due to several reasons such as: the lack of harmony between members of the group or the team, one or more learners who dominate the other(s) negatively, etc. In this case, it would be better to impose a distribution strategy by the leader to ensure the smooth progress of the learning process, specifically the assessment, and thus ensure a good estimate of each learner's contribution in relation to the other.

Finally, for better performance of some collaborative activities by involved members (particularly the structured activities), it is often more appropriate to assign the tasks of these activities to learners in a certain way to ensure better efficiency and smooth progress of assessment process, from the moment one is interested in this process type. Furthermore, in reality, the members who work together try to always set a fair distribution of tasks for the achievement of their collaborative activities. Therefore, this paper proposes a set of distribution strategies of tasks for the purpose of collective examination. Before detailing all of these strategies in the fifth section, it is important to address the "activity" concept around which it focuses this study.

TOWARDS A MODEL CONSIDERING THE EXAMINATION STRATEGIES

The Concept "Activity" in the Activity Theory

The activity theory is a reference for all approaches based on the "activity" concept including that of CSCW and its variant CSCL (Computer Supported Collaborative Learning), which highlights the main elements and means in collaboration with the actors to achieve the common objectives of a distributed community as that of e-learning.

This theory emanates from Soviet psychology and was first introduced by the famous Russian psychologist Vygotsky (1978), and then developed by his student Leontiev (Leontiev & Englewood Cliffs, 1978). This theory provides a general conceptual framework for understanding and analyzing human activities (Lonchamp, 2003), in which each activity is performed by a "Subject" and directed by an "Object" (actor). The existing mediation between subject and object is represented by the support "Tool". Moreover, the subject or the actor is not isolated, and he is part of a "Community". The community represents the set of subjects that share the same object of activity. The community-object relationship is defined by the "division of labor" while the community-subject relationship is defined by a set of "rules" (see Figure 3).

On the other hand, the tools provided by CSCL field as the LMS do not offer the coordination feature, and task distribution for learners working together, and cover only two triads shown in Figure 3.

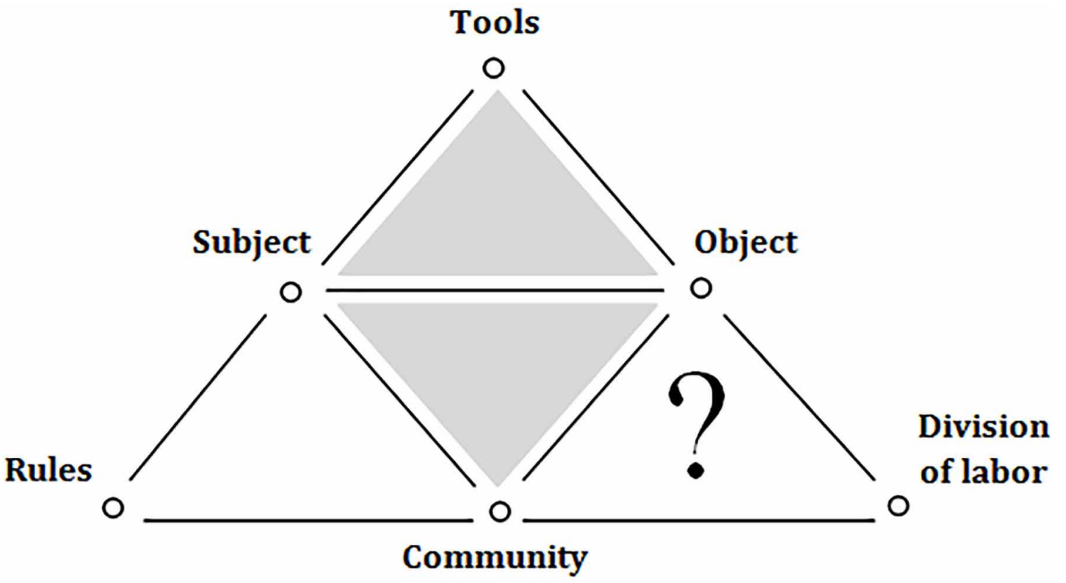
In accordance with the foundations provided by the activity theory, in an e-learning community, the learners perform their activities of learning or assessment to achieve one or more pedagogic objectives predetermined by examiners, using tools which in this case represent the execution environment of the assessment processes. The "staff examiners" community brings people (author, tutor, and assessor) who intervene through this environment to create, monitor and assess the examination processes and help learners to complete these processes.

In the following, one reminds the meta-model of Educational Modeling Language IMS-LD. The starting point was first to study what offers this meta-model, then extending it so that it meets the requirements of the coordination and distribution of tasks of collaborative activities.

The Concept "Activity" in the Educational Modeling Language IMS-LD

IMS-LD represents the most widely accepted specification by the educational community (Cuevas, Muñoz-Merino, Fernandez-Panadero & Kloos, 2010). It offers an educational language that puts the

Figure 3. The Activity Theory (Engeström, 1987)



activity in center of the pedagogic process and allows specifying the learning unit's progress and the description of pedagogic scenarios (Figure 4).

Indeed, the choice of IMS-LD meta-model is motivated by the fact that this latter is intended for pedagogic engineering field, and it allows to support concepts from the CSCW field with a vast possibility to make comparisons and analogies while remaining in the pedagogic field (Aouine & Mahdaoui, 2013). Also, the activity theory is the shared base between collaborative working and collaborative learning. Indeed, work/learn are twin activities and therefore can be considered as two sides of the same piece.

In Aouine & Mahdaoui (2013), the authors have proposed an extension of IMS-LD meta-model based on the workflow technology for assessment purposes, in particular, the assessment of collaborative activities i.e. the group/team work. This extension covers four aspects: organizational, functional, behavioral and informational. Figure 5 represents a part of this extension that shows the static aspect related to distribution strategies since this is the objective of this study.

The assessment activity is the most important concept in the context of the assessment processes modeling. While, one can describe an assessment process in terms of sub-processes or eventually of activities[3]. A sub-process corresponds to an individual assessment plan (IAP) or collective assessment plan (CAP). An IAP is described by a set of individual activities while a CAP is described by a set of activities with at least one collective. We show these different levels of granularity and different types and links between them through Figure 5. Also, a collective assessment activity can be either structured or non-structured. A collective assessment activity non-structured or non-coordinated supported by computer is an activity not modeled by a workflow because the order of interventions is not pre-determined in advance. This activity type is supported by systems that offer primarily shared workspaces with communication and collaboration features as in the LMS. In contrast, a structured collective assessment activity can be supported by systems that generally monitor the progress of processes and information exchange (Lonchamp, 2003). In general, a structured activity is decomposed into a series of tasks. This decomposition may give rise to a sequence of tasks executed one after another, just as it is possible to organize the tasks according to a distribution strategy by exploiting the flow control operators.

Figure 4. IMS-LD meta-model (IMS Global Learning Consortium, 2003)

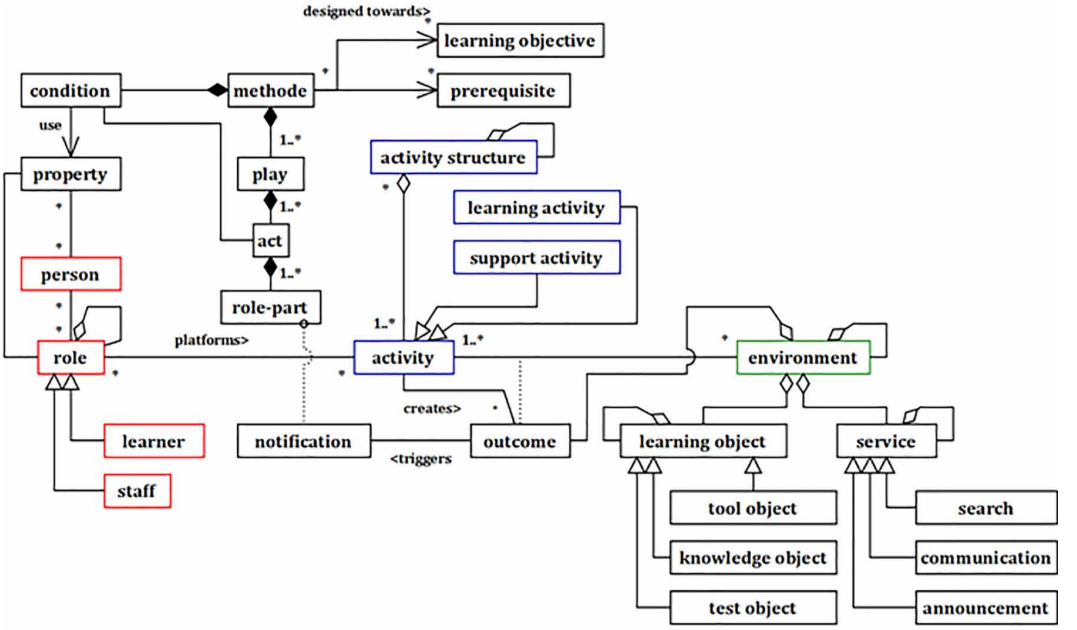
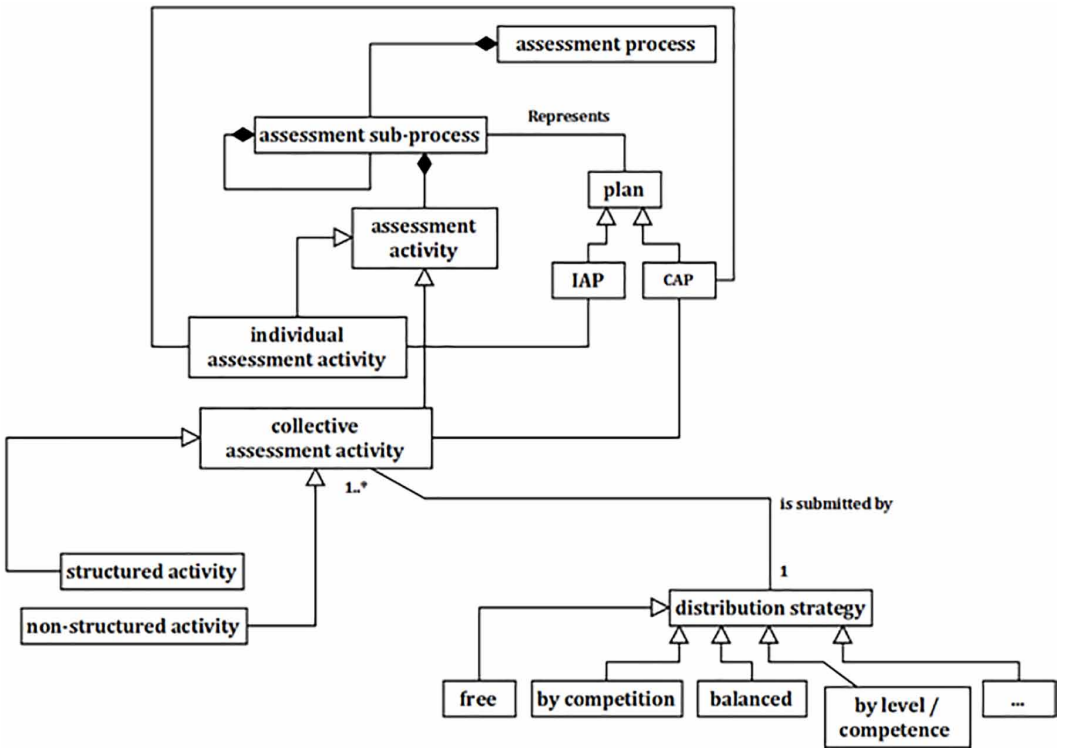


Figure 5. Extension of IMS-LD meta-model (part of functional aspect) (Aouine & Mahdaoui, 2013)



In summary and after the presentation of two previous subsections, the existing methods and tools do not take into account the collaborative aspect in assessment and particularly the one related to the division of labor between learners. Following this, the next section details a set of distribution strategies called "examination strategies", that allows covering this important aspect related to the assessment of collaborative activities.

Detailed Description of Some Proposed Examination Strategies

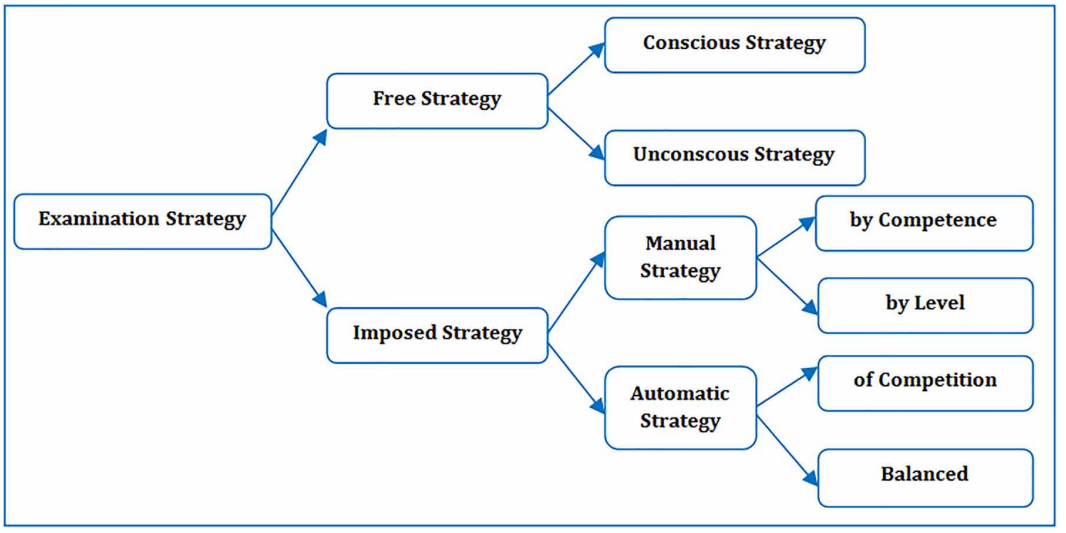
The analysis of different learning and assessment situations of collaborative activities of learners, allow identifying a set of variations in terms of possibility of division of labor between learners. These different situations are presented in the following figure. For reason of paper space, this work details only some proposed strategies.

Summary of Different Situations of Application of Some Examination Strategies

When speaking of distribution strategies of tasks of collaborative activities, the first question that arises is: "In what situation should we apply such and such strategy?" In general, in a given situation, the examiner can detect the non-feasibility of applying a free distribution strategy, either because of non-compatibility between nature of assessment activity and this type of strategy, or because the learners may have a difficulty in determining a favorable dispatching of work. In this case, the examiner must replace this strategy by another strategy that it will have to be imposed.

1. **The free strategies:** The free strategies are inspired by "brainstorming" technique that is known in project management. In this type of strategies, the learners will have the possibility to organize and divide tasks between themselves to perform the activities designated by the staff examiner. The free strategies are performed according to a consensus between examined. It aims to implement and promote cooperation, coordination and communication within the group or team. It offers some advantages so that to give to the examined the responsibility to find a consensus for a fair dispatch of labor. It will depend on the degree of understanding and agreement between them, besides increasing the competitive spirit between learners. However, let's note that conflicts are an exception, which will involve the tutor to trying to solve the problem first, if not, to eventually

Figure 6. Forms of examination strategies



apply an imposed strategy. In this type of strategies, one distinguishes two forms: conscious and unconscious.

2. **The imposed strategies:** In this type of strategies, the tutor plans tasks execution and the learners just have to follow the instructions assigned to them. These strategies can operate in two possible ways (manual or automatic) shown in the following two subsections:
    a. The manual strategies: In terms of their level or competence, the tutor assigns manually the various tasks to learners according to a manual strategy by level or by competence.
    b. The automatic strategies: When the tutor selects one of strategies (balanced or competition), the assignment of tasks to learners will be ensured in an automatic manner by the software system that manages the monitoring of examination plans.
        i. Balanced strategy: In this strategy, the assignment of assessment tasks to learners is done automatically by the software system and in a balanced way. So, the objective of the assessor behind the application of this strategy is to ensure a balance in the division of tasks that will be assigned to learners.
        ii. Strategy by competition: In this strategy, the responsible launches a list of assessment tasks according to the dynamic roles[4] that learners will play. Then, the learner who connects the first may take a task and so one. The main purpose of this strategy is to increase the competitive spirit between learners of the same team or group, from where it is called competition strategy.
        iii. According to the criteria explained above, we identify a set of typical scenarios representing situations where the proposed strategies could be implemented. The following table summarizes one category of strategies (imposed- automatic) by explaining the objectives behind the application of each associated scenario (Table 1).

It is recalled that in the third section, we had discussed and compared between two types of groupware applications that are the LMS and WfMS. In fact, this comparison was aimed to demonstrate the lack of coordination in LMS and show the ability of WfMS in this aspect (coordination) and distribution of tasks of collaborative activities.

In order to implement the different proposed strategies, we propose to use the workflow technologies that we will combine with classic LMS. In this technology, a distribution strategy represents the manner to divide and assign work items to different users. Remember that a work item describes the representation of work to be performed by an actor in the context of an instance of a collaborative process, which will then be executed by the workflow engine. In the following, we have implemented a subset of examination strategies among the proposed series by integrating them into a platform dedicated to the execution of collaborative assessment processes.

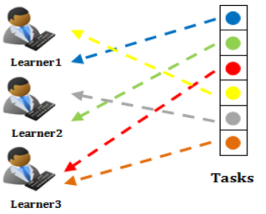
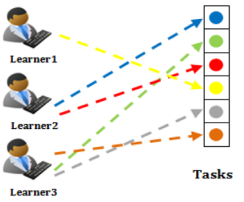
THE CAP-PLATFORM

The CAP-platform is an e-learning platform (Aouine & Mahdaoui, 2014) for assessing collaborative activities. Its main purpose is to assess individuals in the team/group. The functioning of this platform depends on the use of a WfMS for the management of structured activities and an LMS for the management of unstructured activities, using "web service" technology. The following figure illustrates the general operation of this platform as well as the exchanges between users and used systems.

In addition, in the following figure, we present a code portion related to the implementation of the balanced strategy in CAP-platform, in which we invoked the two web services "New Case" and "Reassign Case" (ProcessMaker WSDL Web Services) offered by the WfMS "ProcessMaker" to assign tasks to learners.

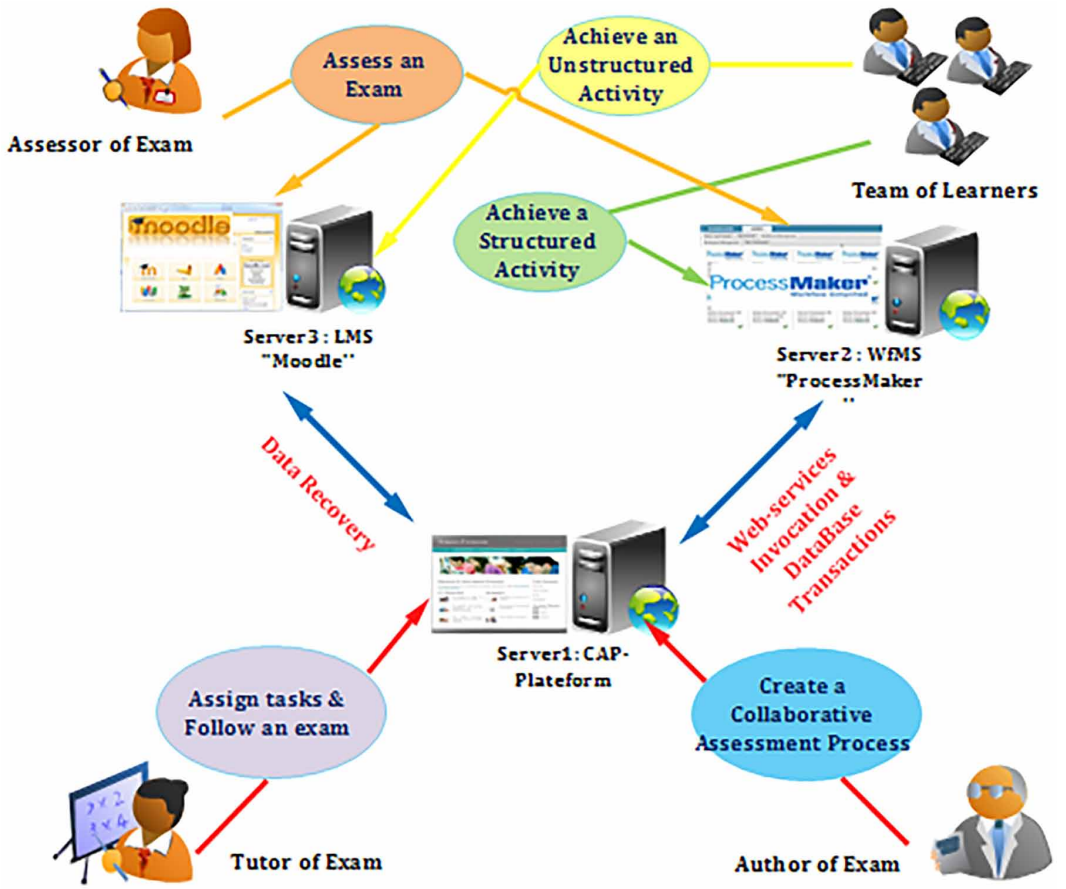
In fact, "ProcessMaker" provides a set of policies for assigning tasks to users and a set of flow control operators to ensure the flow and routing of tasks in a business process. Note, however, that some policies provided by this WfMS fit very well with some of the proposed strategies in this research.

Table 1. Description of imposed-automatic examination strategies

Imposed-Automatic Strategy	Situation of application	Implementation mechanism
Balanced Strategy	In this strategy, the examiner wants to ensure a balance in the distribution of tasks, i.e. the tasks number to assign by the learner in the group without taking in consideration other factors such as the level, the learner's prerequisites, etc. The staff who prepares the exam will ensure that tasks are of the same level of difficulty and require almost the same time to their execution.	The set of work items will be assigned automatically to learners respecting the balance of work of each one. An automatic assignment program will handle the distribution of tasks (Ratio = total number of tasks to assign/ number of learners).  *Blanced Strategy*
Strategy by competition	In this strategy, the examiner wants to increase the competitive spirit between the members of team or group. So, he will launch a set of tasks and let the learners work in competition to achieve the maximum of tasks of a given examination process. In this strategy, no members will be assigned to divide the work internally. Each will proceed according to his advancement degree. This strategy may be useful for judging differences in levels between learners for a newly formed group.	The interface provides to learners a set of work items, in which each learner can assign an available work item to himself and perform the corresponding task and so on until all tasks are consumed. It will be assumed that conflict situations will have little chance of occurring (two learners with the same level of advancement and trying to access the same task at the same time).  *Strategy by competition*

However, assignment policies of work items and flow control operators of WfMS are usually used in a framework, i.e., professional. In this case, the organizational aspect is important for defining and assigning business roles. In this study, we suggest using this technology for collaborative learning field, particularly the assessment. A particular interest is given to the assessment in an e-learning context. Some of the proposed strategies are simple enough to run and support with a WfMS. For example, automatic strategies will obey predefined rules that the engine will execute. While for other strategies, human intervention is necessary for a good progress such as, the strategy by competence which requires other data and parameters that only the teacher/examiner can know and estimate. In the following, we will present a case study in which we apply one of the proposed examination strategies.

Figure 7. General operation of CAP-platform (Aouine, Mahdaoui, & Moccozet, 2019)



CASE STUDY

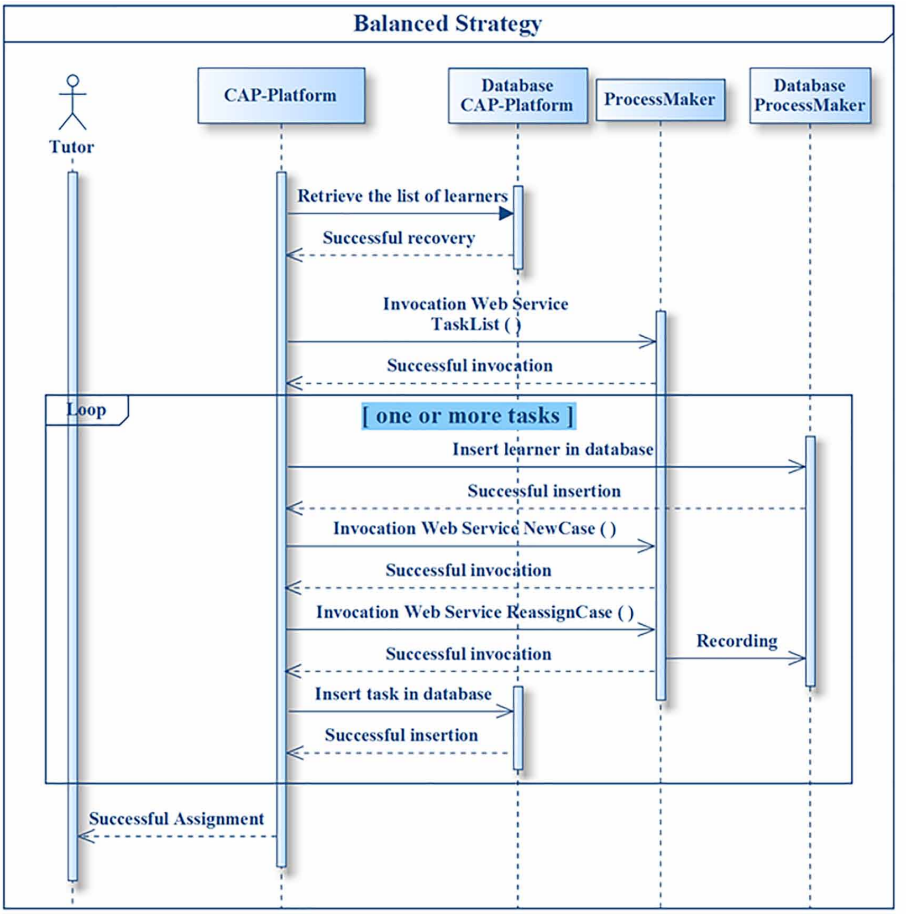
Presentation of the Case Study

In this section and to demonstrate the effectiveness of the proposed solution, we present an example that shows the application of balanced examination strategy implemented in CAP-platform. In fact, this strategy ensures equity in the assignment of tasks to learners, and therefore, improves learners' motivation to perform the tasks assigned to them.

The chosen assessment scenario describes a collective assessment situation. It will be for learners to carry out a work of collective drafting of scientific documents (research articles) within the module setting "Initiation to Research" taught in "Academic Master." Students will be organized in teams of 03 to 04 individuals who will collaborate to write their research article. For this situation, we will distinguish in the Collaborative Assessment Plan (CAP) related to this situation, three main activities (Figure 9):

1. Discussion and elaboration of document drafting plan.
2. Drafting the various parts of document.
3. Structuring the document and integrating individual contributions.

Figure 8. Sequence diagram and computer code "assign the task to a learner by balanced strategy"




```
      // code for assign the task to a learner "Balanced Strategy"
mysql_connect('localhost:3307','root','');
mysql_select_db('wf_workflow');

$sql1="select usr_uid from users where usr_username='".$utilisateurs[$j]['login']."'";
$r1=mysql_query($sql1) or die("erreur sql <br/> $sql1 <br/>".mysql_error());
$res1=mysql_fetch_assoc($r1);
$vr=mysql_query("select * from task_user where tas_uid='".$don['tas_uid']."' and usr_uid='".$res1['usr_uid']."'");
if(mysql_num_rows($vr)==0)
{
    $sql="insert into task_user values('".$don['tas_uid']."','".$res1['usr_uid']."','1','1')";
    mysql_query($sql) or die("erreur sql <br/>$sql<br/>".mysql_error());

}
$s="update task set tas_user='".$res1['usr_uid']."' where tas_uid='".$don['tas_uid']."'";
$q=mysql_query($s) or die("erreur sql <br/>$s<br/>".mysql_error());
$verif=mysql_query("select tas_start from task where tas_uid='".$don['tas_uid']."'");
$rverif=mysql_fetch_assoc($verif);
```

The first step "discussion and elaboration of the document plan" represents an unstructured activity supported by an LMS. This environment will allow us to provide a forum/chat space and assign accounts to learners to establish the document plan to be written. The tutor has the right to access this forum/chat and can therefore participate in the discussion to add clues and observations. Then, in the second step "drafting the various parts of the document", which represents a structured activity supported by the WfMS "ProcessMaker", each learner must draft one or more parts of the document and the tasks will be assigned to learners automatically according to the balanced strategy that is adopted by the tutor. Therefore, the first task will be assigned to the first learner and the second to the second learner and so on, if all learners taking tasks and there are still others, then there will be a turnstile and the first learner takes another task and so on. Finally, the third step "structuring and integration" also represents an unstructured activity that will take place in a forum/chat space to integrate the various parts and structure the final document.

Instantiation of Roles, Resources and Activities

The actors involved in the assessment process: (1) twenty learners examined are organized in four teams of three learners and two teams of four learners who will play the role of writer; (2) the examiner staff: the creation of the assessment plan and content (author of examination role), the moderation and follow-up of the assessment process (tutor role) as well as the final assessment of work (assessor role) will be the responsibility of the teacher of the course.

Services used and resources manipulated: (1) a descriptive content that specifies the different phases of the work and interprets the work required of the learners; (2) a template of article format to be drafted; (3) a common discussion forum for learners and tutor; (4) the final product produced by learners (the documents that contain the individual contributions of learners and the final version of the scientific article), then used by the assessor.

Activities and tasks handled in the assessment process are shown in Figures 10, 11 and 12.

CONCLUSION AND PERSPECTIVES

In this article, we proposed a set of examination strategies for the distribution of tasks of collaborative activities in e-learning. Then, we integrated these strategies into an e-learning platform dedicated to creating, monitoring and assessing collaborative processes. The first purpose behind this proposal is to make a fairer assessment of learners who work collectively at the group or the team. In fact, it is difficult to determine and implement all strategies exhaustively.

As prospects, we plan to automate manual-type strategies. However, to automate some proposed strategies, such as competency-based strategy and strategy by level, we need to know and have indicators and measures on the profile of the team/group members. In addition, we would like to go further in testing of each proposed strategy in order to analyze deeply the findings obtained under a massive usage. Besides, we plan to use a survey to collect users' opinions for knowing effectiveness of our proposal in terms of fairness in assessment of collaborative activities in an online community.

Figure 9. The overall process "collective drafting of documents"

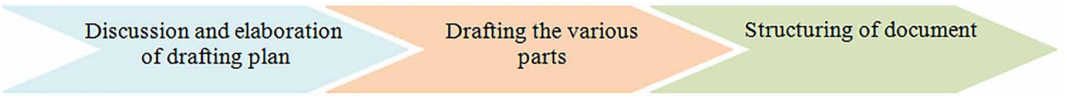


Figure 10. The activities of collaborative process "draft a document" in the CAP-platform

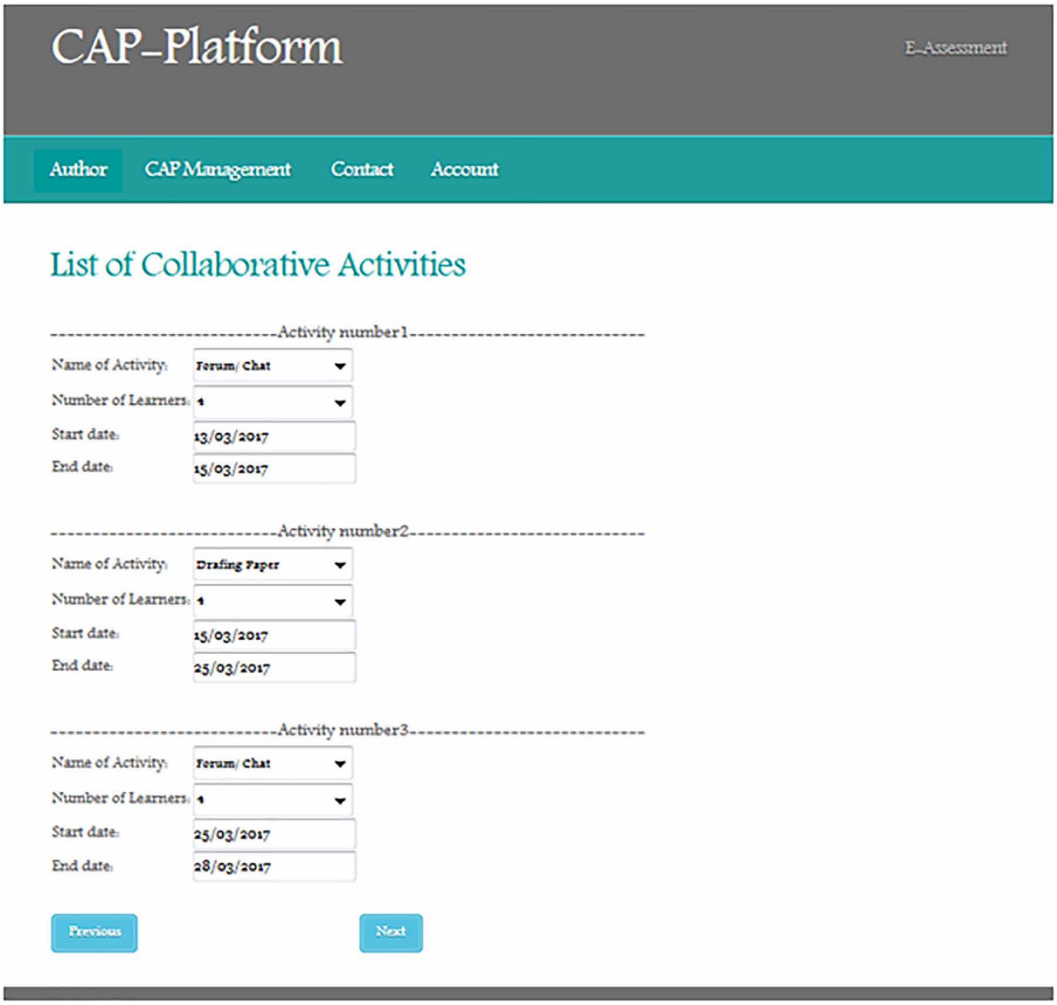


Figure 11. Execution of the activity "drafting parts of the document" in "ProcessMaker" by learners

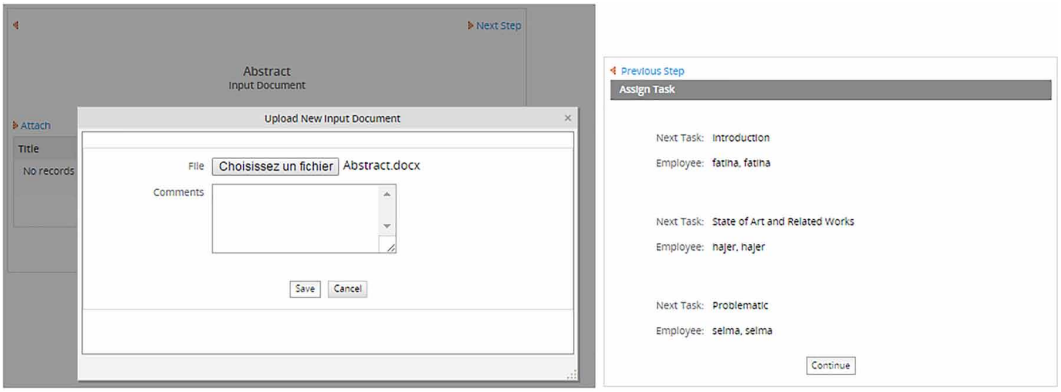
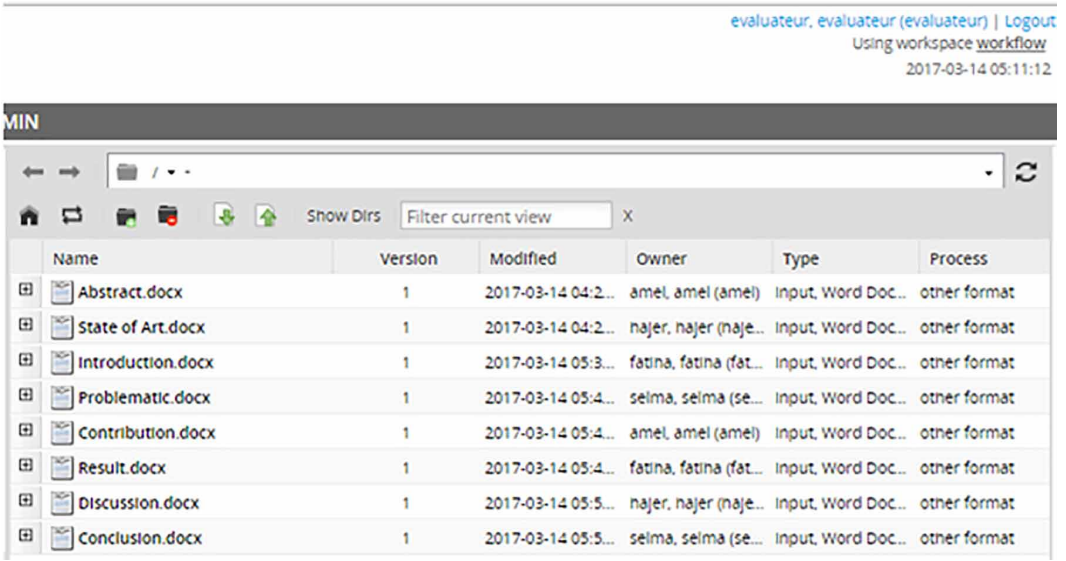


Figure 12. Recovery of learners' individual contributions by assessor



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ENDNOTES

1 Pert: Program Evaluation and Review Technique
2 Brainstorming: (to storm) a problem with the (brain)
3 It depends on the complexity of the assessment plan to elaborate.
4 The dynamic role represents the role played by learner during an examination process.

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