Towards a collaborative learning process based on the hybrid cloud computing and Web 2.0 tools

Boubker Sbihi [#1], Kamal Eddine El Kadiri [*2], Noura Aknin [*3]

[#] Laboratoiry LIROSA, Ecole des Sciences de l'Information
Avenue Allal El Fassi. Cité Al Irfane
BP 6204 Rabat-instituts, Morocco
[1] bsbihi@esi.ac.ma
[*] Laboratoiry LIROSA,
ENSA of Tétouan, Mhannech II, B.P : 2222 Tétouan, Morocco
[2] Elkadiri@uae.ma
[3] Aknin@uae.ma

Abstract—**The aim of our article is to propose an online collaborative learning process composed of three iterative steps which mix the advantages of hybrid cloud computing, Web 2.0 tools and the online questionnaire to improve the quality of the educational content of the course in the classroom. Indeed, it consists of transporting the course contents generated in the classroom managed by a private cloud computing towards its learning community managed by a public cloud computing in order to improve them by the learning community using the collaborative web 2.0 tools and the online questionnaire. The contents will be returned later to the private cloud computing of the classroom as tested and revised educational supports, which will allow their re-evaluation and reactivation according to the best proposals and opinions expressed by the learning community. In this context, we ask each user, in the public Cloud computing to complete one or more questionnaires according to the targeted need as counterparty for his access to the submitted documents. This approach will allow benefiting from the collaborative as well as communal intelligence offered by the Web 2.0 and will integrate the class within its community allowing its learners and teachers to create personal and professional social relations, and thus maximizing the sharing, collaboration and wide dissemination of the contents in the internet network.**

Keyword- Collaborative process, Hybrid Cloud Computing, Web 2.0, Questionnaire

I. INTRODUCTION

With the advent of the twenty first millennium, the technological evolution has changed the world through the proposal of a new generation of packs of services which include new and often mobile hardware, various high quality software to be used online or offline, and finally a variety of high speed networks wired and non-wired on a worldwide scale. The result is a permanent connection of any user within his community. This evolution had a prototypical success thanks to the lower prices of hardware as well as of the telecommunication means and also to the emergence of packages and special offers as a result of the companies' competition in the context of globalization. Moreover, this evolution has been accompanied by a migration from copyrighted to free and open source software with a wide range of free and open licenses [4]. This technological evolution has affected not only the information container but also extended to cover the contents with the advent of web 2.0 since 2004 [14].

Indeed, Web 2.0 has proposed real progress of the web since the user is no more considered as a simple spectator and consumer of the information but rather as a potential producer of contents of all types, including those with multimedia [14] and, therefore, a vital actor who produces content on the web [11].

As a matter of fact, in addition to the seven concepts defining the web 2.0, it proposes various other collaborative tools such as the blogs, the wikis, the social networks or the podcasts and videocasts. These put users at the center of the network, and thus benefitting from their participation and collaboration to produce rich, diversified contents and of all types including those in multimedia. This situation, where everyone can produce and participate in the creation of contents, generated a large amount of information often of poor quality by an increasing number of users. In order to manage this big data, while profiting from all the performance of the storage servers and the networks, Cloud computing – a new computing model – proposes a complete online platform composed of a large number of services used while needed [9]. Supervised by the supplier, cloud computing allows restoring, virtualizing, sharing and offering additional services without the need to install or update them [5]. The cloud computing improves user efficiency and makes significant economies while managing the resources according to what is available. This model has a rapid and wide dissemination and

adoption by small, medium and large companies taking into account the fact that competitiveness has become more severe in all branches of industry in the context of globalization.

In addition, the questionnaire and the interviews are deemed as powerful tools used in the quantitative and qualitative methods [3]. They are the basis of the surveys that allow, through sampling methods, to achieve the objectives expressed through the respondents' answers. With the emergence of information technology, the questionnaire has migrated to the online electronic format. compared to the traditional questionnaire, the electronic questionnaire really offers a very large number of advantages such as the reduction of cost and deadline of data collection, the proposal of the instantaneous results, the ability to reach respondents anywhere and anytime, the decrease of the number of errors thanks to auto-administration, the automation of data analysis, a better interactivity by integrating multimedia and finally taking advantage of its simplicity, objectivity and liberty to achieve the targeted goals.

In the next section, we will present the concepts of Web 2.0 and the questionnaires in the e-learning. Then, we expose the usefulness of the cloud computing in e-learning. We propose, thereafter, the progress of the collaborative learning process based on hybrid cloud computing. In the remainder of this section, we will deal with web 2.0 tools and the online questionnaire to improve the quality of course content in the classroom. Finally we will conclude with a general conclusion where some perspectives are presented..

II. WEB 2.0 AND THE QUESTIONNAIRE IN E-LEARNING

The participatory web opens a large window on the informal collaborative knowledge by offering a large number of collaborative, simple, popular, versatile and open tools based on user participation. Indeed, Web 2.0 tools permit the creation, correction and publication of collaborative content of all types, especially multimedia content. Moreover, these tools are often free and do not require any installation, which makes them available without any technical or technological constraints for all types of users. They present an archetypical environment for sharing, collaborating and exchange contents with the community enjoying the capitalization of knowledge and collective intelligence on the network. This provides opportunities for informal collaborative teaching and learning considering their easy and simple use at anytime, anywhere and often for free in addition to their wide popularity among the younger generations. This situation generated a new way of teaching and learning called E-learning 2.0 [8] which is an e-learning centered on the learner and based on the concept of collaboration using web 2.0 tools to create the contents of the training [15]. The learner has become the creator of his content and will be able to exchange his ideas and his opinions with his practice community instead of doing it just with the learners of his class [16].

In this context, each Web 2.0 tool alone or in combination with other tools can provide collaborative learning models. We can cite, for example, learning by using blogs [12] [6], wikis [7], social networks [20] or podcasts and videocasts [10]. Through cooperative learning environments centered on the learner and based on web 2.0 tools, the traditional learning methods of the transmission approach move towards learning methods based on the constructive collaborative approach resulting from the participation of learners. This migration redefined the role of the teacher who changes from a knowledge holder to a simple supervisor who assists learners in their learning activities. This change is the result of the web evolution content which becomes a growing global digital library, rich, varied and multilingual with often free access replacing the contents of teacher course by other teachers' and specialists' courses. Indeed, with these changes, the role of the teacher is limited to orientate and guide learners while providing a supervision that is pure and often personalized, limiting their range of research according to the hourly volume allocated. In this context, the teacher specifies an exhaustive list of good digital bibliographical addresses in order to achieve the objectives and the skills needed during the course [17] [18]. This approach is sometimes resisted by some students who lack the desire, maturity and autonomy to follow the courses. Moreover, the online questionnaire is always considered as a powerful tool of observation and measurement which permits quantifying and interpreting the information collected from any population.

In the educational context, it is proposed like an effective and widely used didactic tool which is utilized to collect the necessary data to achieve several objectives such as the study of training needs, the assessments of learners' knowledge or those objectives related to the quality of the teaching method like the measurement of the achievement of objectives and knowing the extent of learners' satisfaction.

The online questionnaire can accompany an e-learning project from beginning to end in a generally transparent manner. It is often used like MCQ to perform the tests and examinations in order to measure the acquired skills by the leaners before, during and after each section of the course. The combination of Web 2.0 and the online questionnaire emerged as a new way of learning called e-learning 2.5 [17] which adds to the collaborative process based on web 2.0 tools a step of evaluation through the collaborative online questionnaire [17].

III. CLOUD COMPUTING IN THE E-LEARNING

In the current era of new technologies of information and communication and in the context of globalization and competition, the organizations, whatever their nature and their size are confronted with obstacles in storage, management and restoration of their information. The Cloud computing offers a real simple, fast, and very powerful solution. It consists of outsourcing data and the applications of a physical or moral individual in a personal or professional context towards a distant server on the internet in a transparent and secure manner and where access is made via a web browser [19].

The Cloud computing is about combining the hardware and software applications on a distance server as a service [1]. Although Cloud computing is an old concept which dates back to the sixties with IBM mainframes, it is used again worldwide while benefitting from the technological developments regarding the hardware, software and networks.

Cloud computing can increase the work efficiency of an organization by providing access to computer resources pooled and shared while controlling the costs of the proposed services. These services could be deployed in short time and offer the opportunity of using the latest hardware and software updates in an almost transparent way and without any additional charge. The files stored in centralized way on cloud computing are always accessible anytime, anywhere and by anyone, which replaces the storage equipment that can be lost or damaged physically or logically. The Cloud computing eliminates the archiving and backup cost while following the news media storage and their read / write devices by optimizing the time and efforts to maximize profitability of an organization. The following table lists the advantages and the limits of the cloud computing

TABLE I
Advantages and limits of the cloud computing

Advantages	Limits
Centralization of resources	Lack of security
Efficiency and competitiveness	Obligatory connection
Evolutionarity and updates	Need good connection speed
Computing power and mobility	Bottleneck access
Cost control	Lack of confidentiality

As the last table shows, the lack of security and confidentiality in addition to the need of a good and permanent connection are among the limits of cloud computing. Added to these limitations, there are other types of limitations such as those related to legal problems regarding the property on the localization of data or the negative impacts on the environment [13]. Regarding the models of cloud computing, it offers three different models [19] in addition to other derived ones. The three core models and their characteristics are illustrated in the following table:

TABLE III
Principal models of the Cloud computing

Cloud computing Model	Cloud computing Actors	Hardware	Storage	Network	Applications	Database	Server software
IaaS Infrastructure as a service	Customer	-	-	-	X	X	X
	Supplier	X	X	X	-	-	-
PaaS Platform as a service	Customer	-	-	-	X	-	-
	Supplier	X	X	X		X	X
Saas Software as a service	Customer	-	-	-	-	-	-
	Supplier	X	X	X	X	X	X

Moreover, there are three other types of cloud computing; these are the public cloud, private cloud and hybrid cloud. The latter includes at least one public cloud and one private cloud. The public cloud is available for a large public where the resources hosted by external providers can be shared between several entities. Contrary to the public cloud, the private cloud is deployed in the data center of the organization.

This type of cloud computing is adopted by several organizations and companies because it offers a controlled and secure environment since the information circulating only in the midst of the cloud computing as the Intranet environment. The third and last type of cloud computing is the hybrid cloud computing where the advantages of public and private cloud computing can be offered. It allows to internalize the sensitive data in the private cloud computing and outsource other types of data in the public cloud computing.

In the world of education, the cloud computing is a concept which was used to maximize performance while controlling the costs of training. It provides a rich and secure learning environment allowing optimization of

performance while seeking a better ratio quality/price. In this context, a learner or teacher can connect anywhere and from any mobile device to the internet to find documents and contents relative to their training.

It improves collaboration within the classroom by giving the possibility to a group of learners geographically scattered to work simultaneously in a collaborative and synchronized manner on documents and shared applications. The cloud computing proposes a collaborative process which preserves all the files in a central location and enjoying the benefits of a centralized architecture at the web.

Among the advantages of this mode of learning is the maximization of the effectiveness of the training and the minimization of the delay of research obtained. In addition, the centralization of data used to generate statistics on the real-time of the training in an almost transparent way allows conducting several qualitative and quantitative studies added to the ability to make real-time assessments.

IV. PROGRESS OF THE COLLABORATIVE LEARNING PROCESS

The teaching and learning methods knew a radical change since the evolution of the web by moving from the transmission approaches to the constructive ones. Indeed, with the emergence of multimedia, often free on the web, the courses' contents were transferred to audio and video containers maximizing the possibility of being widely shared and disseminated among the learning community. In this context, we propose a learning process which offers the advantages of the three most powerful tools in the context of an e-learning project; these are cloud computing, Web 2.0 tools and finally the online questionnaire. The general architecture of the proposed learning process is illustrated in the following figure:
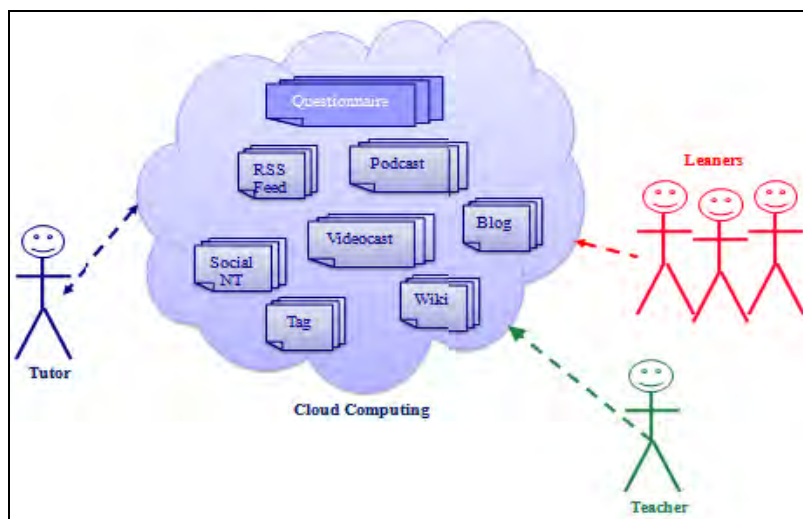

Fig. 1. General architecture of the collaborative process

In a learning process, the relevance of the teaching method and learning materials as well as manuals plays a very important role in achieving the objectives of the training. In addition to these two factors for the success of an e-learning project, there exists another deterministic factor which is the motivation of learners and teachers. This last point gave rise to some new practices concerning e-learning such as Serious Game or the Music Listening [Arnab et al 2012]. Adding to the motivation of actors of the E-learning, there are other factors that can influence the quality and delivery of training such as the time allocated to training, the rigor in the evaluation of prerequisites, the means and resources allocated, the mastery of ICT tools by the different actors of the training as well as the autonomy and sense of responsibility.

The online collaborative process proposed in this paper should enjoy from the adoption of collaborative Web 2.0 tools by younger generations within their learning community. It is created to integrate the possibilities of sharing and collaborative writing by several hands to pass from cooperation towards collaboration in a professional learning environment.

It could also benefit from the advantages of the online questionnaire and its effectiveness in educational assessments and adjustments since it gives immediate results with zero cost.

Finally, this process takes benefit of the advantages of hybrid cloud computing by integrating a large number of the most popular, often free, services such as office tools, messaging, storage and restoration within a complete learning platform.

Our online collaborative learning process consists of transporting the contents of a course generated within a class managed by a private cloud computing toward its learning community managed by a public cloud computing and offering a platform of web 2.0 tools and online questionnaires.

It aims to mix the advantages of private and public cloud computing and benefit from the wide participation as well as collaboration of different users of the learning community and the sharing and dissemination of assorted contents in order to improve the educational course content within a classroom in the frame of a preliminary training or distant training.

Once the contents is enriched by the web 2.0 tools used by the learning community on the public cloud computing, they can be returned to the private cloud computing of the class as educational materials tested and revised, which allows for their re-evaluation and rectification based on the best proposals and opinions expressed by the learning community. The following figure illustrate the process of exchange of content between the classroom and the learning community using the hybrid cloud computing.
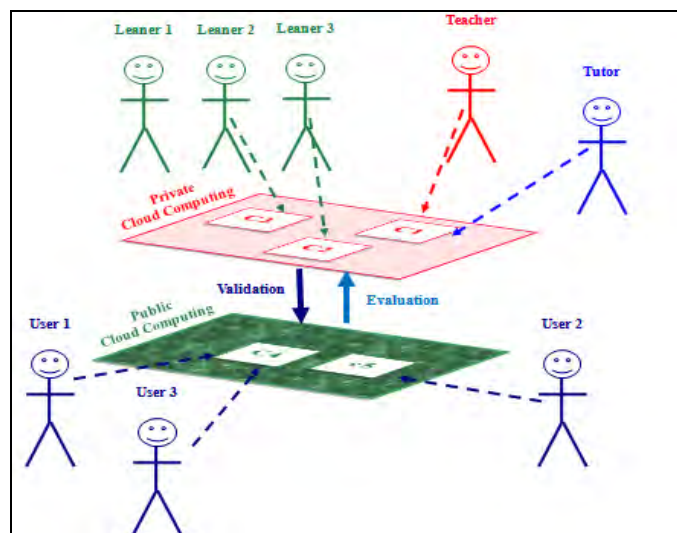

Fig. 2. Migration and return of the contents between the class and the community of training

Our process consists of three iterative phases and can be repeated several times in spiral way until obtaining a correct version of the course contents. The first phase concerns the production of the course content by the learners in the class private cloud computing. The second phase concerns the evaluation of the course contents produced in class by the learning community and the formulation of proposals of supplements, comments, opinions and criticism in the public cloud. The third and final phase concerns the comparison of assessments and, hence, the improvement of the course contents.

A. Phase 1: Creating course content in class

In the first step of this phase, the teacher defines the general and specific objectives of the training as well as the competencies to be attained providing them with a detailed schedule which determines the beginning and the end of each step of the course. He later devises the outline of the course content and its different sections assigning each section to a learner. He subsequently proposes a rich and focused bibliography for each learner according to the assigned section of the course and the initial level of the learner based on the evaluation of the prerequisites. In the second step each learner, using his bibliography and some individual research from the library and the internet or through direct discussion on the forum, will propose a content to be published as the course of the class. In the third step, these contents will be validated and some suggestions for improvement will be made by the teacher in the private cloud computing of the class that stores all the data produced. Finally in the fourth step of this phase, the teacher and learners will evaluate anonymously the proposed and validated content through an online questionnaire hosted on the private cloud of the class. Afterwards, the teacher will regroup the contents of the course and will make several copies in audio and video format.

Once the contents of the course are grouped, validated and evaluated by all actors of the class, the tutor will ensure their transfer to the public cloud of the learning community to guarantee a wide visibility and sharing.

B. Phase 2: Assessment and community proposals on the published content

In this phase, our aim is benefiting, the maximum possible, from the collaboration of the learning community through the use of web 2.0 tools. In the first step of this phase, the course contents will be duplicated by the tutor to the three important web 2.0 tools which are blogs, wikis and social networks with the three formats which are text and image, Podcasts and Videocast. In the second step, the users of the community interested in viewing specific content will be required to complete a questionnaire for assessing the content used. In the third step, the users of the community will participate in the enrichment of the proposed content by the collaborative complements in the form of comments, additions and deletions, adjustments, criticisms and opinions through collaborative web 2.0 tools. These remarks may be as tickets on the blog or social network or complements of

content on the wiki. To motivate users, we give them an access depending on the frequency and quality of their participation. In the fourth and final step of this phase, the tutor will identify, group and sort the comments and criticisms annexes to the course content. He will later resend them to the teacher within the private cloud computing to ensure the implementation of the learners' comments on the content.

C. Phase 3: Comparison of assessments and adjustment of contents

In the first step of this phase, the teacher will compare the assessments given in the class and those given by different users of the community on the course content. It is possible that the assessments can be convergent or divergent depending on each case. He will try to understand the causes and take the necessary steps to detect and solve the problems. In the second step, the teacher will ask the learners concerned to rectify their contents according to the opinions and criticisms made in the second phase. In the third step, based on the reviews expressed and collaborating with the learners of his/her class and the teacher, each student will propose a new part of course content for validation. In the fourth and final step of this phase, the teacher will revalidate the course content and the adjustments. Then she/he will ensure that the new contents of the course are in conformity with the remarks and improvements suggested. The following table shows the details of the three phases and their steps:

TABLE IIIII
Phases and steps of the online collaborative process

Phase 1: Creating course content in class
Step 1: Defining the objectives of the training
Step 2: Production of content by learners
Step 3: Validation of content by the teacher
Step 4: Assessment of content by learners and teachers
Phase 2: Assessment and community proposals on the published content
Step 1: Publication of course content on the web 2.0 tools
Step 2: Assess the current course content by the community
Step 3: Enrichment and complementation of courses by collaborative contents
Step 4: Grouping and classification reviews and remarks by the tutor
Phase 3: Comparison of assessments and adjustment of contents
Step 1: Comparison of assessments between the classroom and the community
Step 2: Distribution of criticisms to each learner concerned
Step 3: Proposal new contents
Step 4: Revalidation and improved the content

At the end of the third phase, the validated contents will be available to current and future learners of the class. In this context, we propose to accompany each course content with text and image format, with a duplicate form as video and integrating the text at the bottom of the screen. This video can be adjusted according to the current pace of learner. At the end of each part of the course, an obligatory online questionnaire concerning the knowledge assessment appears and stops the video until this questionnaire will be filled to100% score by the learner. In this way, the learner can be able to follow the course according to his/her pace before taking the final exam. The following figure shows the distribution of the time allocated for the course by different learners where each one works at his/her pace.
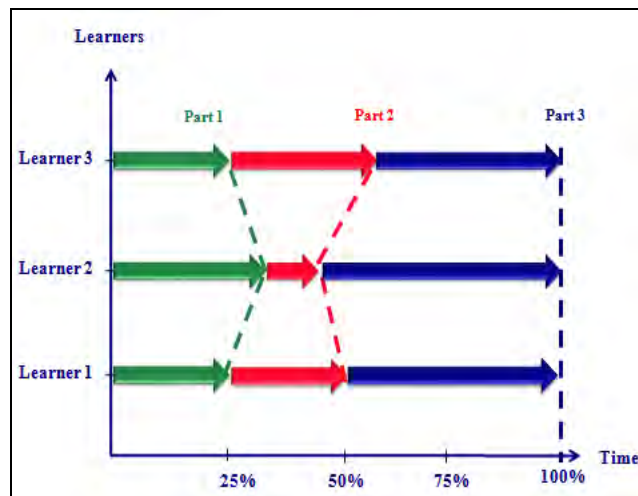

Fig. 3. Distribution of the time allocated for the course

In this context, each learner works according to his/her own pace and will be supervised personally by the teacher. When the skills of one part are acquired and validated by online questionnaire, the learner will be able to pass to the next section until the completion of the course. At the end of the course, the tutor will administrate an online questionnaire to the class learners to measure the effectiveness and satisfaction of the learners with the learning process.

V. CONCLUSION

In this paper, we proposed a collaborative process that aims to use the hybrid cloud computing, web 2.0 tools in addition to the online questionnaire to improve the quality of the course contents in class. This choice is justified by the benefits of cloud computing which proposes a prototypical, simple and collaborative teaching environment by meeting the needs of training while controlling time and costs with maximum efficiency. It also aims to exploit the maximum use of the collaborative approach from the collective intelligence of the learning community composed of specialists and experts in the field to improve and promote the content of the training. This flexible and very promising approach can be used in a spiral way until obtaining a reasonable quality of the course contents. It also allows informing the class within its community and creates a professional network that increases in a chronological manner and focuses on a particular specialty. It can be used in the context of one or more courses in preliminary or distance training, and it can be used in the context of brainstorming and to encourage scientific research in developing countries. As a perspective of this work, we propose to:

- Apply the concepts of this approach on the ground;
- Compare the assessments of the class and community;
- Provide a standard data transfer between all types of cloud computing;
- Apply this process to organize brainstorming and collaborative projects.

REFERENCES

[1] M.Armbrust, A.Fox, R.Griffith, A.Joseph, R.Katz, A.Konwinski, G.Lee, D.Patterson, A.Rabkin, I.Stoica and M.Zaharia, "A View of Cloud Computing",in *Proc* of the ACM, Vol. 53 No. 4, pp 50-58,April 2010.
[2] S.Arnab,R.Berta,J.Earp,S. de Freitas, M.Popescu, M.Romero, I.Stanescu,M.Usart, "Framing the Adoption of Serious Games in Formal Education", Electronic Journal of e-Learning, Volume 10 Issue 2, pp159-171, April 2012, [Online]. Available: www.ejel.com, [last accessed 24/04/13].
[3] L.Bardin, "L'Analyse de contenu ", Paris : Presses Universitaires de France, 2001.
[4] N.Benkeltoum, "Open source : Sortir des idées recues", in ParisTech Review, Paris,2011.
[5] R.Buyya, J.Broberg, M.Andrzej and M.Goscinski,"Cloud Computing: Principles and Paradigms",John Wiley & Sons, 2010.
[6] H Cakir,"Use of Blogs in Pre-Service Teacher Education to Improve Student Engagement", Computers & Education, Elsevier, 2013.
[7] S.Cynthia, W.Joshua, P. Belknap,Wikis: A Knowledge Platform for Collaborative Learning in ESL Reading,TESOL Journal,Volume 4, Issue 2, pages 360–369, June 2013.
[8] S.Downes, "E-learning 2.0", ACM eLearn Magazine, 2005, [Online]. Available:
http://www.elearnmag.org/subpage.cfm?section=articles&article=29-1, [last accessed 14/04/13].
[9] L. Gillam,"Cloud computing",Springer,2010.
[10] R.Hickey and R.Donnelly, "Instructional Videocasts: Facilitating Learning in a Mobile World", The online journal of the Centre for Education in the Built Environment, vol 8, issue 2, Dec 2011.
[11] F.Hussher and al,"Le nouveau pouvoir des internautes", Timée-Editions, 2006.
[12] A.Leh, J.Kremling and M.Nakayama," Use of the Blog and Discussion Board in Graduate and Undergraduate Classes". In R. McBride & M. Searson (Eds.), in *Proc* of AACE, pp. 2214-2217, Chesapeake, 2013.
[13] ONG, " Greenpeace rapport 2010 sur l'impact écologique du secteur informatique ", 2010 , [Online]. Available: www.greenpeace.org, [last accessed 22/05/13].
[14] T.O´Reilly," What is Web 2.0. Design patterns and Business models for the next generation of Software", 2005, [Online]. Available:http://www.oreillynet.com/lp/a/6228, [last accessed 18/04/13].
[15] C. Safran, D.Helic and C.Gütl," E-Learning practices and Web 2.0", in *Proc ICL 2007*, Villach, Autriche Sep 2007.
[16] B.Sbihi and K.El kadiri,K.(2010). " Towards a participatory E-learning 2.0: A new E-learning focused on learners and validation of the content", International Journal on Computer Science and Engineering, Vol 3, No 1,2010.
[17] B.Sbihi, K. El Kadiri, and N.Aknin, "E-learning 2.5: Towards a collaborative distance learning process based on Web tools 2.0 and questionnaire ", International Journal of Computer Science Research and Application, Vol. 3, Issue.2, pp. 23-29,2013.
[18] B.Sbihi, K. El Kadiri and N.Aknin,"Towards a mixed methodology based on the groups of Vblog and Vwiki to the collaborative E-learning",ARPN Journal of Systems and Software, Springer,Vol 3, No.3 March-April 2013.
[19] Syntec, Livre blanc du cloud computing par le Syntec numérique, 5 mai 2010. [Online]. Available:http://www.syntec-numerique.fr/actualites/liste-actualites/publication-du-livre-blanc-cloud-computing-de-syntecinformatique, [last accessed 18/04/13].
[20] X.Wang, P. Love, R.Klinc, M.Kim and P.Davis ,"Integration of E- learning 2.0 with Web 2.0", ITcon Vol. 17, Special Issue E-Learning 2.0: Web 2.0-based social learning in built environment , pp. 387-396,2012.