Competency-Based Learning in Collaborative Virtual Platforms

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Abstract— Educational entities must face changes which impact directly on the traditional academic model: the ICT′s impact in education and, the advance in the global field of Competency Based Learning (CBL). Transforming the face-to-face courses into virtual ones, requires all the educational institutions to face new challenges: getting teachers to become familiar with the CBL model and, together with students, promoting the ability to adapt to change. In this paper, the creation of a face-to-face course using the CBL model is presented and a plan to transform it into a virtual course is proposed.

Keywords— Collaborative Learning, competency-based learning, Computer Supported Collaborative Learning

I. INTRODUCTION

At the end of the twentieth century, enrolled students were almost 500% more in relation to the middle of the same century. As regards the access to education, the difference in the last 20 years between the industrially developed countries and the developing countries, particularly in the least developed, has worsened [1]. In other words, the more science and knowledge advances and the more the education system develops and expands, particularly the university system, the bigger the difference between developed and developing countries in relation to the way in which these factors are distributed (science and knowledge), increasing inequality and differences.

For this reason, it is necessary that educational institutions contribute to the development of personal, social, cultural, political and economic aspects and, in this way, prepare students to be able to respond to the changing social context.

From the pedagogical point of view, the most relevant characteristic is the acceptance of a university education called "Competency Based Learning". It is a constructivist learning process that is centered on the student's own capacity and responsibility and on the development of their autonomy. That is, a system of university teaching and learning is focused on the student, renewing the previous system excessively focused on the teacher [1] [2]. Another change, that is taking place in the training models are those linked to the impact of ICT in education. Advances in ICT generate great contributions to education, for example, through the creation of computer-assisted learning environments [3] [4] and the development of teaching proposals that begin to be thought from the concept of collaborative work. These perspectives open new doors to technology-mediated teaching proposals in which collaborative learning takes on a fundamental role, allowing the integration of existing tools and thus providing greater potential for training proposals [3].

Consequently, the biggest challenge facing educational institutions is to integrate these two training models, competency-based learning and the computer-assisted collaborative learning model. Although the focus of both models is placed on the student, it is necessary for the the CSCL (Computer Supported Collaborative Learning) platforms to integrate learning models by competencies and modify and adapt the evaluation criteria and strategies motivated by the CBL model. [4].

II. RELATED WORKS

The model proposed above integrates the CSCL model with competency-based learning. Of each of these two concepts, there are many research works that support them.

First, the CSCL model that emerges from the integration of ICT and collaborative work is explained in [20]. The author defines, in a precise manner, that a triangle of the vertices is composed of the following elements: technology (platform or surroundings), the contents and services, essential characteristics that make up and articulate the collaborative learning proposal. And it affirms that, by altering the weight of each of said components, several platform models are obtained.

The next aspect to consider is related to competency-based learning. There are several authors who refer to the

concept of learning by competencies, focusing on the transformation of the curricular model based on competencies. In this sense, in the works [6], [21], the authors analyze and synthesize the fundamental elements to address the term competency. They analyze several definitions of the term and address the fundamental characteristics of the competency-based curricular model. Philippe Perrenaud [22], indicates that to form real skills during the general school stage represents a considerable transformation of the relationship between teachers and knowledge, their ways of "teaching", their identity and of their own professional competencies. In his work, in addition, he has an explicit reference to the consequences of the teacher's work, in a pedagogical model based on competencies.

Tobón [23] [7], clearly explains the theoretical basis of the learning based on competencies and the change in didactics and evaluation from the social aspects of training, focusing on the evaluation of competencies such as the process of assessment.

Finally, the integration of these two concepts (CSCL and competency-based learning) does not present significant bibliography. In particular, in [24] they expose the experience of the application of a competency-based training model, implemented in a virtual learning platform.

In general, the works linked to the concept of learning based on competencies that are used in virtual environments do not deal with the aspects related to the collaborative or cooperation processes developed between students and teachers.

III. COMPETENCY-BASED LEARNING

The university must prepare the student in an environment of generic and specific competencies that allow them to face the problems posed by this changing society. McClelland [5], in the search for an alternative to traditional aptitude and intelligence tests, specifies the concept of "competency" defining it as an underlying characteristic of a person that allows him to demonstrate superior performance in a given position, role or situation , making the difference between people with excellent performance versus people with average performance [6]. Linked to the above, the CBL requires to establish the competencies that are considered necessary in the current world and that cannot be solely determined by the universities without consultation and participation of labor and professional entities.

As a result of this collaboration, a proposal of transversal or generic competencies has been born trying to delimit the essential competencies in the different professions for which the university qualifies and prepares.

Therefore, the CBL is based on a teaching and learning system that progressively develops students' autonomy and their ability to learn to learn.

In this way, CBL implies a profound change in universities. This change necessarily implies a methodological, pedagogical and technological renewal, which can introduce the necessary innovation to transform universities into learning centers rather than teaching centers. That is the reason why before implementing the competency approach in a particular educational institution, there must be a participatory construction of the pedagogical model within the framework of the institutional educational project [7]. In addition, the adoption of virtual learning systems must adapt to the pedagogical model, which implies a deep organization of teaching and learning processes and environments, taking as reference the competencies to be developed [8]. This transformation also promotes the reformulation and adaptation of evaluation criteria and strategies to be used under this system [4].

Aligned with the competency-based learning model, it is also necessary to define a set of assessment instruments focused on the student: autonomous learning and self-evaluation. For this, other artifacts should be considered, such as those based on feedback and rubrics [9]. The latter must coexist with traditional ones. It involves the significant alternation of procedures, tools and ways of evaluating knowledge through purely descriptive or conceptual processes by others [8].

IV. COMPETENCY-BASED LEARNING IN COLLABORATIVE VIRTUAL PLATFORMS

Distance education is understood as the pedagogical and didactic option where the teacher-student relationship is separated in time and / or space during all or a large part of the educational process, within the framework of an integral pedagogical strategy that uses material supports and technological resources and information and communication technologies [10]. In this framework, the training process mediated by technology should consider the incorporation of collaborative activities [4]. In this sense, collaborative work is the way in which diverse people (students and teachers in this case) perform a task in a coordinated manner and share a specific objective. On the other hand, the impact of ICTs in education allowed computing to provide an ideal space for this form of work to be carried out ubiquitously, that is, at any time and place.

This paradigm is called CSCW (Computer Supported Collaborative Work) [11]. This technology, applied to

information and communication, also opens new doors to learning media, which, when integrated with distance learning environments, create CSCL environments.

The CSCL model is a learning approach based on the psychology of social interactions, the pedagogy of teaching, and computer science. This means, building knowledge from the knowledge and skills of other process participants in computer-assisted environments. In this sense, del Dujo [12] assures that it is important that during the process of inserting technology in education, a pedagogical perspective should be constructed to understand the processes of social interaction and the impact on training. In detail, CSCL environments are based on the integration between Collaborative Work, ICT and learning environments. This integration is based as follows: on the one hand, collaborative work supported by the concept of the Zone of Proximal Development (ZPD) proposed by Vygotsky at the beginning of the 20th century [13] and, on the other hand, ICT within the framework of the proposals of e-learning or blended learning. The growing development of ICT together with the concept of collaborative work make up the CSCW environments. This concept, integrated into teaching and learning environments, gives rise to CSCL environments (See Figure 1).

Figure 1. CSCL Model

V.   CBL AND CSCL

In the global scope, the last years were of constant changes in education. In the Argentine Republic, we analyze the impact from two different approaches. In the first place, from resolution 2641-E / 2017 of June 2017, the institutions that dictate face-to-face careers were able to incorporate the use of ICT as a complement, without this implying a change in the modality of the career. Thus, "The minimum hourly attendance must be greater than fifty percent (50%) of the total workload, the remaining percentage being able to be dictated through non-contact mediations". However, careers in which the number of non-contact hours will be between 30% and 50% of the total, must

undergo an evaluation of the Institutional Distance Education System in order to guarantee quality in the training process [10].

Secondly and taking into account the next implementation of the new standards for the Accreditation of Engineering Careers in the Argentine Republic (CONFEDI Red Book) [14], and in line with the underlying proposal, the CSCL environments should base the materials of study and evaluation tools on CBL. The implementation and use of CSCL environments for CBL, should restructure didactic methodologies and plan a project that allows to transform existing models so that they can be used by teachers without experience in the use of the underlying technology. The latter will be the responsibility of the educational institution, supported by a CSCL tool for CBL.

In the framework of the academic proposal of the Universidad Abierta Interamericana (UAI) [15], the IT Faculty (TIF) is carrying out an ambitious plan, which includes the adoption of a high component of classroom work in the distance mode, in their face-to-face careers and, simultaneously, the adoption of the CBL model. The plan includes the following stages:

A. *Evaluation of the institutional system of education mediated by technology*

As part of the comprehensive plan, deans and career directors agreed that face-to-face courses can be developed with a load of time in the distance mode, without exceeding 50% of the total workload of the career. To achieve this, the distance education system called UAI Online [16] had to be submitted to an evaluation process, which concluded with favorable results, being able to be used in this modality. Although for several years the system has been used in purely virtual courses, it was necessary to submit the system to this evaluation process in order to comply with the requirements of the ministerial resolution [10].

B. *Adaptation of management systems*

In order to integrate the distance education environment into the face-to-face model in the courses that are defined in this new modality, it was necessary to adapt the current academic management system so that these courses could have the distance workload, allowing access from the face-to-face students to the virtual platform, to evaluate the activities that are carried out in that context and to complete the attendance requirements so that it can be verified that the students comply with the percentage of hourly

load defined at a distance, within the total required to regularize and complete the course. This phase of the project was carried out successfully and currently the two systems are integrated.

C. Teachers training

It is necessary that all the academic teams be trained in the role of tutor that is proposed by this pedagogical model of distance education. For this, a course was developed in the online mode to be completed by all teachers by the year 2022 and so that they could teach subjects at a distance.

D. Adoption of the BLC Model

The entire faculty participates in five faculty meetings where different technical and pedagogical training activities are carried out. Since 2018, these activities are directly linked to training in the CBL model.

On the other hand, activities are carried to allow teachers to participate in the definition of the competencies (generic and specific) that each subject should consider. For this, the first activity consisted of dividing the teachers into work groups organized by subjects. Each group was provided with the list of competencies defined in the CONFEDI Red Book, with the aim of achieving consensus on which of these competencies should be considered, and then the teaching results were first explained and justified by the teaching team.

In addition, by virtue of working in an education centered on the student, it is also important to determine the characteristics of each student in terms of their learning processes. Learning styles are those cognitive, affective and physiological traits that serve as indicators of how individuals perceive, interact and respond to their learning environments [17]. Particularly Hederich and Camargo [18] point out that the concept of style refers to general modalities for the reception, organization and processing of information, modalities that manifest themselves in variations of the strategies, plans and specific paths that a person follows when carrying out a cognitive task. For this reason, students must solve a test in order to understand the different learning styles of each student and to be able to establish didactic strategies adapted to each particular style.

E. Adaptation of Virtual Education Systems to the CBL model

Adapting the current distance education system, considers the need to create new training activities in the framework of the CBL model. These activities should consider collaborative work as well as the evaluation methods of the model [4]. For this, there is a plan to transform the system. In addition, the possibility for students to perform their own activities of collaborative learning and the assessment tools will be included. This last point considers the creation of rubrics that will be used for self-evaluation and co-evaluation activities used in the CBL model.

This is currently in the definition stage of the project and waiting to obtain concrete results of the first courses that are dictated in the CBL modality.

VI. RESULTS

A. Context and Initial Results in the implementation of the CBL model

Currently, the first classroom course is being carried out using the CBL model. This curricular space is called "Sistemas de Representación" (SR). This subject, initially dictated on the basis of the traditional model, was transformed into the CBL model, as an initial experience to achieve the objectives set out in the integral transformation plan.

For this, transformations were made in its academic program and it is considered as an exclusively practical subject. Problem Based Learning (PBL) is used for the development of competencies and rubrics to evaluate the scope of the same. In order to achieve these objectives, competencies (generic and specific) and capacities to be developed are specified from the reserved activities from our terminal established by CONFEDI. In particular, the "competencies to specify, project and develop information systems" and the following capabilities will be developed: Be able to identify and organize the data pertinent to the problem; Be able to generate various alternatives to solve a problem already formulated; Be able to perform the design of the technological solution, including modeling; Be able to listen and accept the existence and validity of different points of view; Be able to express oneself clearly and to socialize ideas within a work team; Be able to express oneself in a concise, clear and precise manner, both orally and in writing.

For the realization of these objectives, the following strategies are used: (1) Technique: Problem Based Learning (PBL). (2) General Dynamics: (a) Presentation of engineering problem. (b) Resolution in a group and collaborative manner of the proposed problem. (c) Oral presentation of the solution found. (3) Evaluation through different rubrics linked to the concepts related to the signature.

In addition, in relation to practical work, from an engineering problem, in each unit and subunit a solution will be developed using UML. Once the solution proposed by each working group has been developed and discussed, it will be presented orally along with a deliverable document. The evaluation

process will be through the 360 evaluation concept [19]. Currently we have no concrete results, because the course is being carried out. We are working on an appreciation model that allows to obtain indicators based on group work, evaluation model, pedagogical model and learning outcomes. The aim of this is to gather experience and, in addition, propose improvements on the results so that the adaptation plan can be continued in other subjects of the career.

B. Expected results in the implementation of the semi-face modality

Currently, the first courses are being developed in the semi-classroom modality, with a relatively small component of remote workload. These courses are developed by teachers who, in addition to participating in the face-to-face modality, are tutors in various courses of the distance modality. In this context, it is expected that, at the end of the corresponding academic stage, we can obtain learning results based on making an empirical comparison with other courses dictated in a full face to face mode, and based on the assessment of students in terms of their experience.

VII.   CONCLUSION AND FUTURE WORKS

- Perform a quantitative analysis that allows to compare the traditional method of teaching and learning in respect to CBL in collaborative virtual environments.
- The common practices that are developed in the classroom must also be able to be done in virtual environments, since they generate a significant contribution to the construction of knowledge. That is why the transformation of the traditional pedagogical model to a competency-based learning model should consider all the activities developed in a traditional way with the approach proposed by the competency-based learning model. These activities related to the collaboration between teachers and students during the evaluation processes and the collaborative processes that students develop during the social construction of knowledge must be able to be done transparently within these CSCL platforms for CBL.
- Use learning analytics that through the measurement, collection and analysis of student data during the teaching-learning process, detect the most common errors and provide a real-time response to the student.
- Use learning outcomes to personalize teaching strategies in the teaching and learning process. Adapt the existing virtual platform, so that it can be used in courses developed under the CBL modality, including the evaluation and follow-up tools required.
- Analyze the learning results of the courses developed in person under the CBL model, and those that are developed in a traditional way in the semi-face mode.
- Use the Delphi method to achieve consensus in self-assessment activities of working groups.

VIII.   REFERENCES

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IX. BIOGRAPHIES
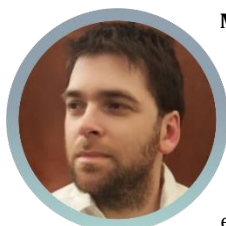
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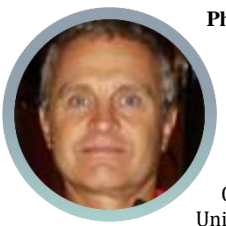
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