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UAI CASE: AN UCASE-CL MODEL IMPLEMENTATION

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Abstract

The new models of teaching and learning have their focus on technology, especially on issues related to ubiquity. The impact of ICT in education generates new learning opportunities: the mobile or ubiquitous, which open new doors to technological environments that allow students to learn at any time and place, providing, in addition, tools that give the possibility to perform collaborative work and learning. The integration of a ubiquitous virtual teaching and learning environment with collaborative work forms the Ubiquitous Computer Supported Collaborative Learning model. What has been mentioned before allowed us to understand the importance of making a specification of this model that provides the possibility of using a tool for professional use in the Software Engineering during the teaching and learning processes, including the specific activities of evaluation and monitoring of works. These tools, called Computer-Aided Software Engineering, must be an active part of the uCSCL model. This integration, forms the model proposed in our work, called uCASE-CL. A prototype of the implementation of the model was developed, which we have called UAI Case. This solution is a proposal to cover the need to have tools that can be used in the teaching of the SE, and which allow the student to acquire and strengthen the academic learning.

Keywords – CASE, CSCL, Information and communication technologies, Software engineering.

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1. Introduction

The constant innovation of Information and Communication Technologies (ICT) has significantly modified different social and cultural aspects, and education is one of the areas that received the most impact and contributions from this technological disruption. The ability to have devices that allow access to information at any time of the day, having tools such as chats, forums, blogs and access to networks that promote interaction between people, allows a change of approach in teaching methodologies and learning (Lavigne, Vasconcelos-Ovando, Organista-Sandoval & McAnally-Salas, 2012).

So much it is so that collaborative work, ICT and teaching are integrated to create collaborative learning environments assisted by computer (CSCL). This integration is based on the social impact of collaborative work and ICT in education. Both collaborative works supported by the concept of Zone of Proximal

Development (ZPD) proposed by Vygotsky in the early twentieth century And ICT supports the concept of the proposed e-learning or blended learning.

The growing development of ICT together with the concept of collaborative work, make up the environments of Computer-Assisted Collaborative Work (CSCW). This concept, integrated into collaborative teaching and learning environments, gives rise to the Computer-Supported Collaborative Learning (CSCL) environments.

The theoretical study of Software Engineering (SE) is not enough to understand and solve the cooperation and collaboration problems that arise during the development of a computer project. Usually students focus their efforts on technical aspects and assume that the problems associated with teamwork will not impact the project (Bouillon, Krinke & Lukosch, 2005).

By virtue of solving the previously raised problem, Daniele, Uva, Martelloto and Picco (2010) propose, to improve the communicational aspects, the integration of CSCL platforms with specialized environments in the resolution of practical and technical problems in a software development project; In addition, this proposal enhances the SE learning and it allows the development of professional and systematic skills in software development.

On the other hand, the SE raises areas of specific knowledge that require the use of complex tools such as it happens, for example, during software modelling through the use of specific tools called CASE. While the SE has traditionally supported modelling initiatives with tools that allow the editing of different types of diagrams (including the range of UML diagrams) (Zapata & Arango, 2007), the use of UML in software modelling may be ambiguous in some cases, especially when it is linked to a teaching and learning process (Flint & Boughton, 2005). The challenges of teachers are multiple: the complexity that implies the ambiguity in the interpretation of models is compounded by the difficulty in teaching the use of professional tools (expensive in some cases) that, in addition, have functionalities unrelated to the process of teaching, such as, for example, those that allow the evaluation of results in software modelling problems.

In the same way that happens in the face-to-face or traditional teaching processes, in the CSCL environments the evaluation plays a very important role. According to the study carried out in a prior survey (Battaglia, Martínez, Otero, Neil & De Vincenzi, 2016), in the teaching and learning model of the technology-mediated SE, students play a greater role and responsibility and, consequently, teachers assume a new role when it is the student who acquires greater autonomy in their learning process, through virtual environments.

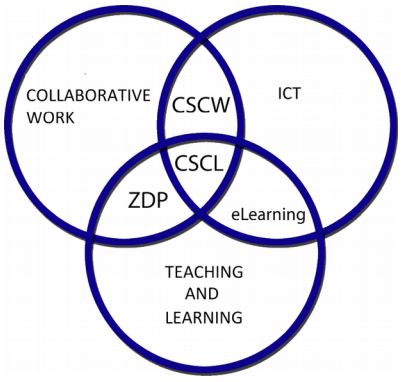

Figure 1. Main concepts

In this context, evaluation is understood as a process that promotes learning with a formative purpose, rather than as a process of controlling results. Therefore, a specific process of teaching and learning in a collaborative virtual environment also requires a process of evaluation, self-evaluation and follow-up

according to the collaborative learning paradigm proposed by the CSCL concept (Battaglia, Neil, De Vincenzi, Martínez & González, 2017).

In this work, we will focus on the teaching and learning of software modelling and use the UML standard as a language to specify, build, visualize and document the artefacts of an object-oriented software system. Furthermore, from now on we will use the term "CASE" to refer to the set of tools that support any activity within the SE, including modelling activities.

2. Integration of Concepts

SE teaching in virtual collaborative environments depends on a multidisciplinary work that involves pedagogy, psychology, computer science and ICT. To these pillars, which make up the CSCL platforms, it is necessary to add one more: a CASE modelling tool, with the necessary characteristics to be used during the teaching and learning process (Battaglia, Neil et al., 2017).

By virtue of the above, we propose the uCASE-CL model (Battaglia, Neil et al., 2017) which aims to define all the functional and technical blocks required for the proposed solution to have a conceptual basis that allows:

- Understand the domain where it is used (in this case software modelling).
- Adapt to the media that provides ubiquitous access to information.
- Define technological aspects.
- Formalize the collaborative learning, evaluation and self-evaluation processes.

A specification of the CSCL model is necessary to allow the use of a specific domain tool to be used during teaching and learning, including the specific processes for evaluating and monitoring jobs.

In this line, during the software modelling process, CASE tools that are used for this purpose are not integrated with teaching and learning environments. This is opposed to the accelerated growth of ICT and its constant application in those types of environments, which are increasingly integrated with the classroom, generating mixed environments that make the most of the potential of technology applied to education.

Currently, computer-assisted collaborative learning models have their formative processes impacted by an educational paradigm developed in any space, place, time and device. These are immersed in a ubiquitous technological universe, based on communication technologies. This model was named uCSCL by Coto, Collazos and Rivera (2016), Collazos, Yandar, Moreno, Vicari and Coto (2013) and by Yandar and Moreno (2015), among other authors.

We understand that the CSCL model with its three dimensions (Computer Science, Psychology and Pedagogy) is affected by a fourth dimension to which we will call communication sciences, representing the underlying technology that allows the concept of ubiquity to materialize. The proposed transformation is reflected in the following diagram.

It is necessary to integrate learning environments with those tools of professional practice. These tools should have collaborative resources not only for the main activity of the subject, but also for pedagogical activities that should be used during the learning, such as collaborative evaluation and self-assessment of work teams. This gives rise to the active participation of the teacher in the environment and the possibility of exploiting learning to the maximum using ubiquity not only to learn, but also to evaluate.

We propose to integrate the uCSCL model with a CASE tool (in our case, UML modelling) with all the functionalities required by the industry and those specific teaching, learning and evaluation functionalities related to the SE. We call this model uCASE-CL (Ubiquitous CASE Collaborative Learning) (Battaglia, Neil et al., 2017), (Battaglia, Martínez, Neil & De Vincenzi, 2017).

This model requires four interrelated dimensions: computer science, communication science, pedagogy and psychology. To be able to carry out the design and a subsequent implementation of a uCASE-CL platform, it will be necessary to include all these factors.

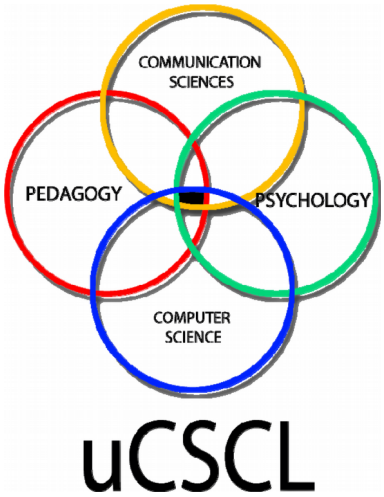

Figure 2. Model CSCL raised with its four dimensions

3. UAI CASE

UAI Case is aimed as a proposal to the need to have tools that can be used in the teaching of the SE, and to help the student acquire and strengthen the academic content developed. In addition, it provides a space that facilitates both their peers and the teacher to collaborate with each other, without getting away from the way of working with the tools of the market and with the necessary characteristics to meet the teaching objectives of UML modelling.

In this sense, we understand that the uCASE-CL model previously proposed meets this need. The proposal is designed within a mixed academic environment, where the tool does not replace the face-to-face model, but provides a space for coordination and collaboration that allows optimizing the relationships between teachers and students, as well as the evaluation and monitoring of work developed and getting the results ubiquitously.

UAI Case is a prototype that has an uCASE-CL model implementation. This model aims at the SE, taken to the teaching, and which is focused from a collaborative environment. This development of software models, aims to unite the traditional academic environment with control and evaluation (Battaglia, Neil, De Vincenzi & Martinez, 2016).

This project strengthens the work of curricular integration developed in the Faculty of Information Technology of the *Universidad Abierta Interamericana* (UAI). The UAI Case tool implementation will allow students to enrich themselves with knowledge oriented to Software Engineering within a collaborative project. This project will have essential characteristics to an iterative and incremental methodology (Neil, De Vincenzi, Battaglia & Martínez, 2016).

Next, the three dimensions of the model are explained.

3.1. Technological Dimension

This dimension is the detail of the implementation model of the solution proposed in the UAI Case prototype. Here is the detail of the technology specifications required to achieve a ubiquitous collaborative environment that meets the requirements agreed in the uCASE-CL specification.

The implementation of the specifications related to this technological dimension was carried out in virtual servers financed by the IBM company through an academic agreement between IBM and UAI, through which a credit was granted to use the company's infrastructure called Softlayer [SOF17], said agreement is renewed every six months based on the progress of the project.

In Figure 3 the technological dimension is shown.

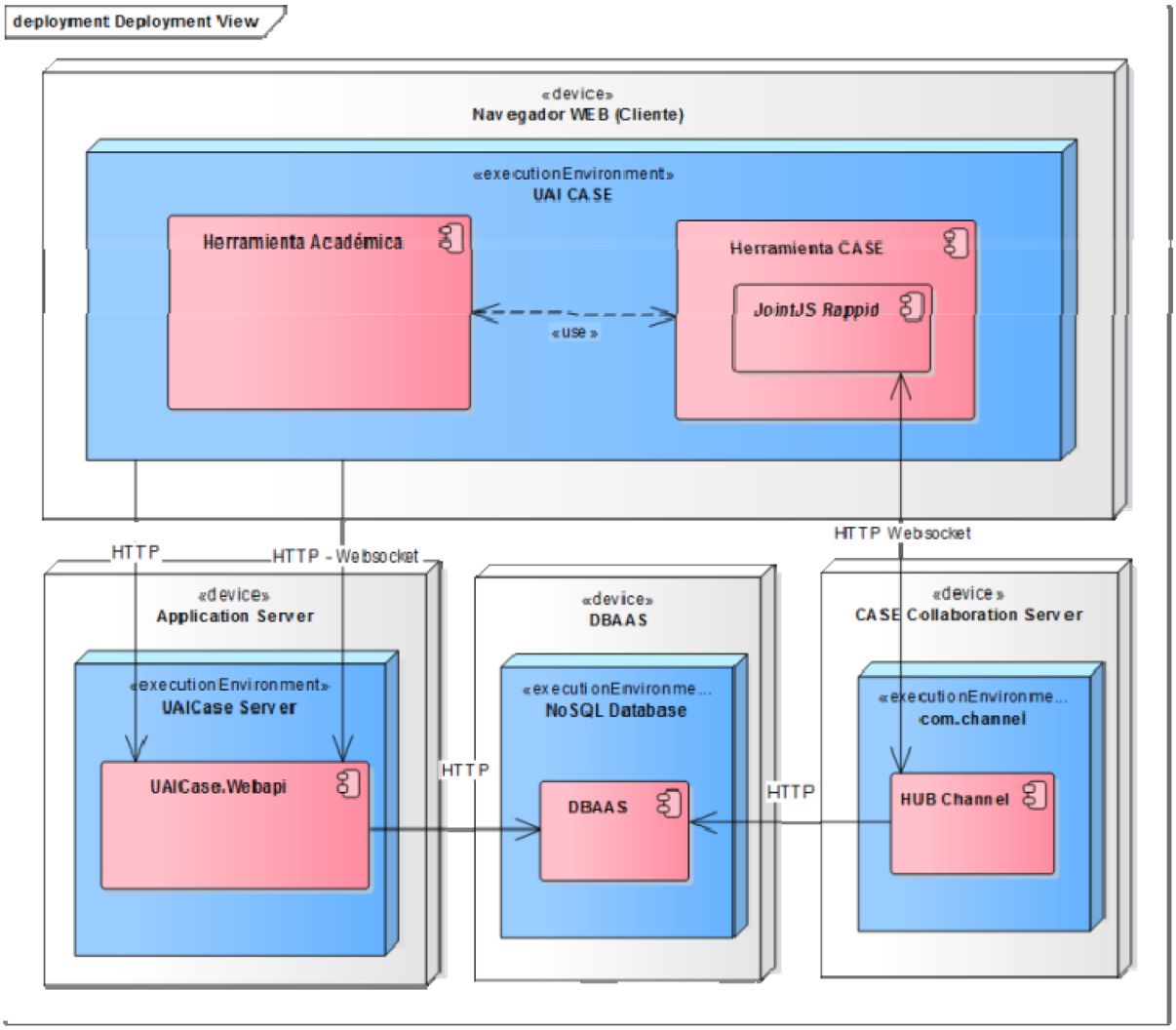

Figure 3. The technological dimension

3.2. Pedagogical Dimension

The pedagogical dimension proposes different activities related to the training of the student and the model oriented to the SE. This relationship leads to the use of collaborative processes that define the context of the model.

The tasks that are carried out at the collaboration level, may be the following:

- Activities pending to be carried out in the project.
- Means of communication through a chat channel.
- Internal messaging among project participants.

Due to this, the following essential activities to be taken into account in this dimension have been:

- UML collaborative modelling.
- Collaborative evaluation in the UML Models.

The collaboration in the projects is done through the following interface that allows sharing and accessing the shared resources of CASE.

Figure 4 shows the project management of the UAI Case prototype.

In addition, other generic collaborative activities such as chat channels, forums, to do list (ToDo's) are grouped in specific work spaces for students and even for teachers to interact with their peers. Figure 5 shows the group chat of a project implemented in the UAI CASE prototype.

Figure 6 shows the To-do list with its contextual information (awareness) to the UAI CASE prototype.

Figure 4. Project Management of the UAI Case prototype

Figure 5. The group chat of a project implemented in the UAI CASE prototype

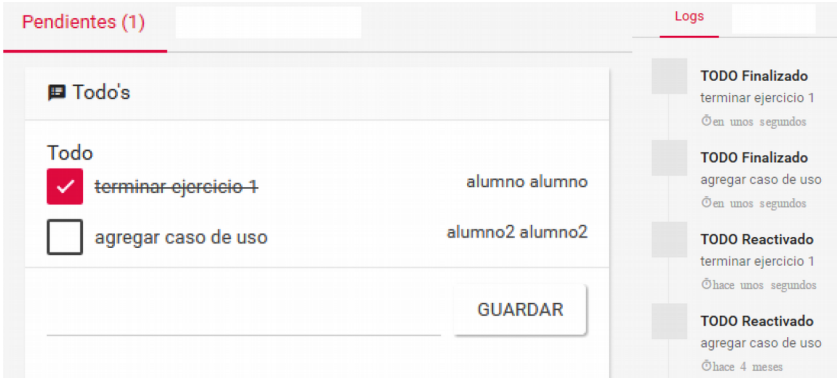

Figure 6. To-do list with its contextual information (awareness)

3.3. Psychological Dimension

To develop the collaborative activities involved in the aforementioned teaching and learning processes, we use a formal specification technique proposed by Rodríguez in (Rodríguez & García-Martínez, 2012), this proposal focuses on the diagnostic analysis of a task, and the detail of the evaluation of the activities to perform to carry out this task. It is important to perform a correct decomposition in order to reduce the complexity of the tasks and to carry out a validation of the error-free design.

4. Application Example

In this work, UAI Case is presented as a concrete application of the proposed uCASE-CL model. Aligned with the model of teaching and learning focused on the student, it proposes the use of a collaborative virtual environment to be used during the learning of software engineering concepts (in particular, during software modeling). In this way, and combined with a set of tools to carry out collaborative activities and for evaluation purposes, this application integrates the multidisciplinary work in the area of psychology, pedagogy and technology, proposed in uCASE-CL. On the basis of this, it can be considered a teaching and a learning process a based on a problem, in which the students (as a team), develop a software model based on UML to correctly solve, the problem initially raised. For this, the students will have all the collaboration and coordination tools, to be able to do the work together. The next stage corresponds to the interaction with the tutor, where they will be able to use evaluation tools and propose discussion spaces so that the team will continue with the process and resolve possible technical and conceptual errors. At the end, the working group will have a set of rubrics available and agreed between the students and the tutor, which will serve to perform, at first, an individual self-evaluation and then, a group self-evaluation, also supported in the discussion and the debate. In this way, the student participates actively throughout the training process, including the evaluation stage.

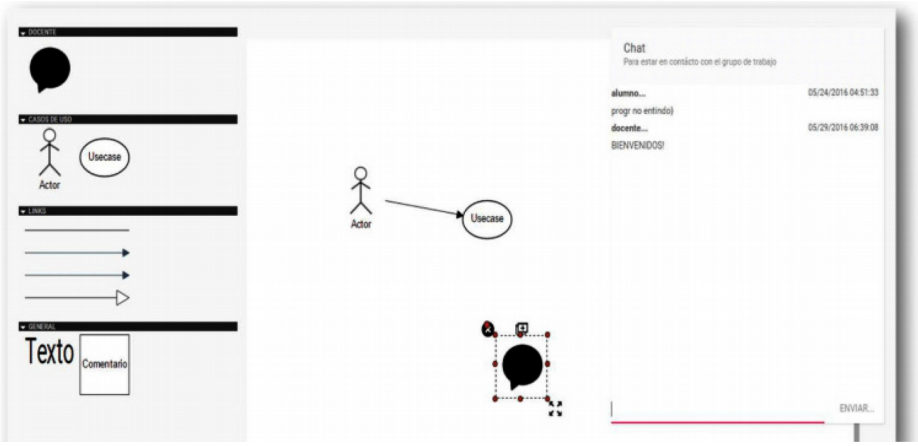

Figure 7. Use Case model with proposed discussion point

5. Conclusion

The current trend of migrating educational models to a semi presencial or virtual level involves many changes in areas of knowledge that require specific tools to work. It is necessary to consider aspects of collaborative work and its implementation in areas of teaching and learning in order to design the tools that allow to carry out computer-assisted collaborative learning and provide the necessary flexibility for courses, for example, SE, can be carried out in a virtual, ubiquitous and collaborative field and thus exploit to the maximum ɵ the benefits of ICT applied to education.

In this sense, we understand that the teaching of software modeling requires the active participation of teachers' sharing experiences with groups of students, but also relates to knowledge and experiences, CSCL also requires techniques and applications related to evaluation and monitoring of works supported in collaboration as the main tool for the generation of knowledge, too.

Future Works

UAI Case continues in the prototyping stage, and we hope for the next semester to perform the empirical evaluation of the prototype of the tool through the definition of an evaluation method based on metric issues. In the first instance, to evaluate the two groups of students in UAI Case, in the other (control group) we will use the traditional teaching-learning format. The objective is to measure learning gain that allows us to evaluate up to what extent the use of the tool is an instance that overcomes the traditional method.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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