A blended-learning approach in CAAD

ENHANCING AN ARCHITECTURAL DESIGN STUDIO EXPERIENCE BY USING COLLABORATIVE WEB APPLICATIONS.

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ABSTRACT
This paper is the result of a research project started in 2007 in our architecture school which aimed to adopt a Blended-Learning approach in teaching CAAD to 3rd year architecture students, while integrating the knowledge produced by our R&D Unit on architectural representation and communication techniques and web applications. We present our main conclusions regarding this strategy’s results and the web applications involved to understand if they acted like catalysts for engaging students with their learning process and for promoting a better communication between them and their teachers. The article shows how this strategy created new forms of interaction making communication between teachers and students easier and giving the latter an active role in the learning process. We start with an introduction to CAAD’s pedagogical strategy; we then describe the strategy and model applied to several case studies and the materials and learning tools used. Finally, we’ll discuss the most significant results and draw the main conclusions. The results highlight how the learning process coming from the Blended-Learning strategy and the use of complementary web applications strengthens the student’s and teacher’s capacity to work in a close relationship while maintaining the student’s active role in the learning process.

KEYWORDS: Blended-learning; education in architecture; communication and representation; collaborative teaching and learning; design studio environment.
1. CAAD’s Pedagogical Strategy.
1.1 The E-Learning Centre design exercise.

In the first semester CAAD students start to work on a group exercise that has as objective the design of a Learning Centre. Students are challenged to create a new dynamic learning space that integrates social and study activities and may constitute a strategic relational dimension for all the academic community. It’s a pioneering architectural program and its innovative spatial configuration encourages several forms of group interaction for both socializing and studying activities, thus promoting the interdisciplinary exchange of knowledge and experience. Some key ideas for this design program include anticipation, imagination and versatility of functions, the formation of learning communities and other related concepts and the integration of digital artifacts in its spaces with the objective of encouraging other forms of communication, socialization and interaction. The program of a Learning Centre and set of interactive artifacts has as support the idea that technology has revolutionized our perception of space and of ourselves, assuming a central role in how we understand and relate with the world around us (McCullough, 2004; Bullivant, 2005).

CAAD’s pedagogical strategy answers this challenge in two ways: firstly, by guiding students to use CAAD drafting and modeling software as digital design and research tools able to complement, in a balanced way, other design instruments and working methods that students have learned and developed in previous years, namely the efficient articulation between hand-drawn conceptual and exploratory sketching and geometric design and different types of representations; secondly, by adopting and encouraging the use of several web platforms to showcase student's work but also to promote the interaction between them and their teachers.

The computer – and more recently, the tablets – is, in fact, the medium through which architectural representations become connected to collaborative networks, allowing different levels of interaction and a better communication of the design principles and author's intentions.

1.2 Choice for intuitive drafting and modeling tools.

During the first stage of the Learning Centre design exercise students are guided to focus on the principles of geometric composition in both 2D and 3D space and to explore diverse architectural ideas using intuitive drafting and modeling software. The objective is to make students develop an architectural design project using CAAD technologies along with traditional design methods for representing, exploring and communicating architectural spaces and forms, achieving in this way a balanced use of digital and analogue tools within the architectural design process.

In this way we've adopted intuitive and friendly CAAD software for the earlier conceptual stages of the design process, allowing students to integrate sketching, modeling and image synthesis throughout all the design stages. This explains our choice towards Autodesk's Autocad and Trimble's (former Google's) Sketchup over more complex options such as Autodesk's Revit or Graphisoft's Archicad BIM solutions or Autodesk's 3D Studio Max modeling and rendering suite.
1.3 The use of collaborative web applications and social networks.

The design process of the Learning Centre takes place in a collaborative environment where the interchange of ideas and the students’ communication projects are considered key factors for obtaining an efficient learning environment.

Since 2007, we have been exploring a Blended-Learning approach in teaching CAAD by using several collaborative and educational platforms such as Moodle and, more recently, combining them with social applications on the web such as Facebook, Issuu and Vimeo, each one with specific objectives, but all of them with the aim of promoting the exchange of knowledge between classes and years and facilitating the creation of a collaborative architectural design studio atmosphere. This allowed students to be active participants in a learning process which is best suited for a design course studio work, an idea supported by many authors (Shao, 1997; Broadfoot, 2003; Salman, 2008) that acknowledge the learning, reflection and change theory of Donald Schon (Schon, 1988) and take advantage of the Web 2.0 potentialities for collaborative work. In fact, these collaborative networks have allowed the flow and interchange of the diverse information within the design process, encouraging and facilitating the communication and exchange of ideas between teachers and students, making possible for students to have an active role in the whole pedagogical process. In this way, student’s interest for the course’s content is sharpened, group work and interaction are promoted and their autonomy and responsibility towards developing and finalizing their empirical work is strengthened.

As was already explained, the potential of the School’s internal network and the Internet for students to communicate and share information was an integral part of how the CAAD course was taught and of how the design empirical work was developed.

An important objective to reach, also implied in the adopted pedagogical strategy for practical classes, was to guide students in developing simultaneously design projects with an individual and collective authorship. All this was made possible and reinforced mainly by the balanced and inter-related use of several platforms. In fact, it was important to know if their combined use had, in fact, influenced positively the students learning process and if they had a positive opinion about their use in classes.

As will be seen next, different types of digital material in diverse platforms were employed to support both theoretical and practical classes. We believe that in this way we are answering positively to the
need for a global change of our past teaching and learning processes in Design Studio work (Penttilä, 2003), which was more based on a memory centered technology and culture. The objective now is to embrace the new processing and collaborative potential of computers for design studio intelligence, knowledge and collaborative work.

1.4 AN HEURISTIC APPROACH BETWEEN FACE-TO-FACE AND WEB COMMUNICATION

Architectural design, as we conceive it, is a process that relies on intuition, experience, permanent interrogation and reflexive evaluation of the results. A solution is gradually found by testing and refining previous designs and by incorporating concepts and references onto it, and by constantly analyzing, criticizing and discussing the designs with the students. This heuristic approach, although happening also at a distance through our web platforms, has its best results when used during classes in face-to-face interactions by providing students with an adequate teaching context for them to explore it.

Firstly, the design exercise depends on the production of architectural models and representations which is, by itself, an heuristic approach, since the model is a progressive approximation to the object it represents; then, students have the option to start their design with a concept, an architectural reference, an author, a spatial idea, etc., giving them the freedom to build their own path from the beginning instead of defining a starting point for them; during classes all these elements can and are encouraged to be manipulated, recombined, transformed or even abandoned to eventually sum up into one proposed solution, which is later evaluated in terms of its coherence and clarity of communication.

The web platforms play a decisive role on this heuristic approach since they allow teachers and students to quickly share and comment on other ideas or designs, influencing the development of their designs during classes. It is common for students to, outside of the class, ask questions or show the progression of their work using the online platforms and then use the class' time to clarify doubts or better explain their intentions to the teachers; it is also usual for students to use web platforms during classes as a complement to the heuristic design process, showing previous student’s works when, for example, a students asks a question that was already answered or that was a key question of a previous year design exercise.

Thus, our web platforms are used as an active complement to the activities developed during classes and to face-to-face interactions, reinforcing the efficiency of the heuristic approach.

2. A REFERENCE TO THE ARC+D RD&T PROJECT.

It is significant to mention that it was much important for us to examine the results obtained in the light of our RD&T project ARC+D, which research has led us to test a set of collaborative and educational software such as the ones we use in CAAD classes.

The project aims to create a set of computer interactive visual applications on the Internet to allow structuring, representing, and promoting architecture, city spaces and design contents to several markets from building professionals to the “general public”. One of these strategic market is the Education, and in this way the project intends to offer a platform focused on collaborative design projects for E-Learning and for teamwork in classes (but also professional architectural and engineering offices) allowing the use of different types of images, sounds and spatial or architectural models that can be interrelated in several ways and linked to alphanumeric data to allow a better decision making and communication of the design intentions.

In our specific case of our CAAD course, the interest was to gain critical information in relation to the potential use of the collaborative ARC+D software integrated on an E-Learning platform such as Moodle to support the Blended-Learning approach for teaching in Architecture and Arts courses.
All the studies and experience obtained were coupled with a critical review on existing and significant collaborative platforms that could be used in architectural and art courses. These were analyzed with the aim of better understanding and pinpointing the set of interactive computer visualization operators that would interest most for design collaborative group work and communication (i.e. the functional operators that would allow to create a user-friendly collaborative and interactive platform in Internet focused on the use of digital representation methods, visualization techniques and interactive digital models for E-Learning and Blended-Learning courses related to Architecture and Art), identifying their strengths and weak spots, as we will see in the next pages.

3. Web applications as a way to enhance learning.

3.1 Structuring and making content accessible.

3.1.1 Moodle

At a first stage, all the aspects related with the structure and function of the CAAD course – its objectives, methodology, program, bibliography and online course libraries – were described to the students and made available on the Moodle platform, as well as some tutorials on how to use the software they had to use in order to answer to the class’ exercises. These contents were hierarchically structured and made accessible on Moodle through internal links.

However, links to external repositories on Issuu and Vimeo were also made available for students to better understand the work developed by previous students. These two applications were used to complement Moodle by providing access to two particular networks on the web – Issuu, a digital publishing platform, and Vimeo, a video sharing platform.

In this way students were led to use several online platforms for accessing the didactic materials and theoretical content of the course which facilitated the linking of all those different but integrated domains. We were also leading students to adopt an active role in the learning process, i.e. exploring various types of information and choosing their own references to guide them on their exercises.

Moodle platform was mainly used as a repository of information, as had happened in previous years, and it proved capable of storing diverse information and multimedia resources in a structured way. This means it was used to maintain a database of relevant information for the practical classes, having kept a structured set of information on several key theoretical and practical contents of the course.

Moodle defaults to a hierarchical and vertical layout where the information is structured and is read, generally, from top to bottom, making students scroll down to access the desired contents. Currently, CAAD contents are structured in an orderly manner, starting with the courses synopsis and general program and then going deep into describing each class’s objectives. After this there is a section reserved for the students exercises where information from all stages of the exercise is placed, from the initial briefing and base documents such as 2D plans or 3D models to the completed work submission and upload forms. Finally, there’s also a specific section for accessing didactic material, specifically the one related to the 2D and 3D software in use.

This hierarchical structure is clear for the teachers, but we realized that even though the logic of how information was structured in Moodle seemed to be clear, the use of its various kinds of resources – questionnaires / feedback with resources, design work, forums, etc. – caused some difficulty to students to perceive the organization of information and of how they should submit it. We believe that this has to do with Moodle’s graphic layout that doesn’t provide it’s users with enough visual cues for them to understand hierarchies, priorities, urgent matters, etc. This way Moodle seems to work well as a file repository but when more interactive functions come along (which involve more clicks and separate pages) students get often confused on how to act.
Other problems were detected as well: even though the relationship between calendars, announcements and resources proved to work, it revealed itself a very time consuming and repetitive process for the teachers needs; automatic notifications to student's personal emails were not possible with our version of Moodle, which proved to be somewhat limited; Moodle was also unable to handle large files (although that is more of a server issue than of Moodle itself).

Generally, students did not thought of Moodle as a very intuitive platform. Then, it was unable to produce significant visual environments, comments and annotations synchronously or asynchronously.

It is worth to mention that we have obtained some interesting results from testing Moodle for an intermediate exercise that consisted on the development of a small design project integrated in the global project and its completion at a certain date. This was so because it made the groups adhere and comply enthusiastically to this intermediate exercise and its completion, since they placed and used Moodle with diverse content that they produced and that they considered essential for the significant discussion of the design exercise that took place. This proved that Moodle was clearly identified by students as the place to formally submit their exercises, and we must say that it performed well in that matter, allowing teachers to collect in a single space the student's works and to easily identify missing submissions.

Finally, we have to mention that our University is currently upgrading its Moodle platform and introducing a new set of features and new concepts of use, giving an overall improvement over previous versions of the platform: community hubs, repository support, portfolio support, conditional activities, improvements to existing core features like backup and restore, blogs, messaging, “My Moodle” page, the ability to export data to external systems, new comments blocks, private files, etc. This new Moodle also features a new layout which is expected to be more attractive, intuitive and easier to use (as well as integrated with the new mobile devices) and features the “Turnitin” tool (for detection of originality in academic work) and the “eCup.Mobile” which is linked to Moodle and is a tool that gathers selected information scattered on the University's several websites, thus facilitating the student's access to it's events, maps, the location of it's units and services, student's residences and canteens, etc. – aiming to connect students with their University by enhancing its online presence.

3.1.2 Issuu and Vimeo.

Issuu and Vimeo, the well-known publishing networks, are being used in CAAD classes as a complement to Moodle's role as an information repository, overcoming some of its limitations and connecting the academia with the society. They have allowed the publication of diverse multimedia contents – as digital books or videos, respectively – such as hand drawings, 2D technical, 3D models, sounds, photographs, videos or links to contents on the www. This has determined a fundamental change in the design projects developed during classes since they provided students with clear references of past student's works, which translated into an extra source of motivation.

They also revealed themselves interesting, intuitive and appealing for creating diverse publications and digital portfolios that could reach wider audiences. Keeping the intention in strengthening the connections between applications, Issuu's digital books and Vimeo's videos were also linked or embedded in the already mentioned Moodle platform and, as we will see next, into CAAD's Facebook group, thus keeping in mind the fact that all these platforms on the www are becoming increasingly more interconnected.
3.2 Promoting interaction and making ideas shareable.

3.2.1 Facebook.

Despite being able to structure and share content in an effective manner, the teaching of CAAD was still missing an effective platform to promote a better interaction between students and teachers, and that was the reason that led us to test the usage of Facebook during and after classes.

Facebook is a global social network that reaches millions of people, making it very popular and familiar – between students as well. Facebook’s performance as a comprehensive and popular application capable of offering powerful and intuitive operators for communication and allowing the intuitive publishing of diverse multimedia content was what led us to, in 2010, use it for the first time. The enthusiastic adoption of Facebook by the students was clear: in a few months about 85 publications were made into the dedicated Facebook groups that we created for the CAAD course. Different levels of interaction and communication were recorded between students, teachers and other faculty members: most of them were formal and specifically related to the CAAD program, but there was also much informal interactions, which had the important function of “breaking the ice” between students and teachers.

In fact, the use of Facebook proved to be very positive since, in no time, the students got involved in various discussions related to the course. Students took the initiative themselves and: (1) added their own classmates to CAAD’s Facebook private group; (2) signaled some of the group’s content by using the “Like” button, stating their approval or agreement with them; (3) commented the groups content and added new one, including doubts or questions or answers to the ones places by their colleagues; (4) asked questions about (i) the software used during classes, (ii) Moodle’s usage, (iii) schedules and submission dates, (iv) other doubts on architecture; (5) shared connections to other places on the www related to the classes program, as well as to their own work; (6) asked for approval or recommendations on their work, seeking in this way to obtain a permanent evaluation of their work.

In the meanwhile, teachers were using Facebook to answer student’s doubts but also as a way to encourage their work by commenting their works.

There were, however, some limitations in regard to its capacity for structuring information related to design and architecture, which can be explained because Facebook’s main characteristic is its “wall” of permanently updated contents, leaving less room to structure “old” ones. There was also a minor problem when students didn’t have a personal account in Facebook – student’s recommended the creation of an “alias” profile for the class while assuring the privacy of the group in question (it is important to mention that the Facebook CAAD group was private, meaning that only teachers and students enrolled could access its contents).
In this way, we expect to keep using Facebook as an important communication tool between students and teachers while keeping the classes’ contents structured on Moodle, which gives a positive answer to that particular purpose. We now count with three Facebook groups active (two from previous years) which means that former students can still ask questions about CAAD to their former teachers or talk about any other matter that interests them and is related to the learning of architecture.

3.2.2 Prezi.

This year (2012/2013) students were asked to use another tool for presenting their work on the E-Learning Centre: Prezi, which intent was to complement the other tools and formats – books, posters, keynotes and videos – already in use by students to present their work related to the development of the E-Learning Centre, thus achieving a new dimension in student’s communication capabilities.

During the E-Learning Centre design exercise students are led to use several tools and representation methods to express their ideas and proposals on the theme. Although being an architectural design exercise, the main focus is on communication: students are asked to think and communicate the fundamental concepts of their designs, their references (architectural or non-architectural), early hand-drawn sketches, 2D technical drawings, 3D models and 3D renderings where photography is also involved.

All these singular elements are combined in several “containers”, each one with its particularities: (i) a visual and sequential narrative, which translates into a digital book published in Issuu; (ii) a poster, which is more of a synthesis of the design where the “time for reading it” is compressed, also published in Issuu; (iii) a video narrative where the time, moving images and sounds play an important role in the communication, which is then published on Vimeo; and several presentations/keynotes that are presented in the classes at specific times.

It is on the last aspect that this year we’ve decided to try Prezi since it offered new potentialities that the standard and linear presentations could not: students could freely design their presentation space, instead of being forced into a frame; they could scatter the presentation elements through this space and then present them by using panning or zooming operators, thus enriching the communication by creating relations of hierarchy, dependence, inheritance – in a visual way that traditional presentations cannot address; and also to work collaboratively, since Prezi allowed for students to work on the same “Prezi” and chat or comment on their own or others work.

The result was a new form of communicating and apprehending student’s design ideas, although sometimes an excess of “visual effects” proved to be counterproductive. Nevertheless, this year’s experience has not yet been fully concluded, and it is our objective to continue testing and analyzing it in the upcoming years.


To assess Moodle and Facebook performance during classes, we challenged our students to answer some questions regarding their experience with them.
Facebook is the preferred platform among students by a number of reasons: capability to assist architectural courses informing students about CAAD news (new assignments, bibliography, relevant information on architecture or CAAD software); its communications tools’ potential for clarifying doubts on CAAD and other courses in a fast and easy manner; and to help and be helped by teachers and colleagues on their difficulties. Almost all students refer no weaknesses in Facebook to assist architectural courses (98%) while a few (2%) indicated the impossibility to store files – which is now possible but in a simple way since Facebook was created for live and updated content.

The overall results of the students’ work and feedback were encouraging and are of a higher quality than in the previous years, which is explained by: (1) good momentum between teachers and students, maybe a decisive factor for an increased involvement in the course; (2) adoption of Facebook as a communication tool that made students closer to teachers and created new opportunities for discussing their work doubts; (3) better student’s profile and capacities; (4) main exercise particularities – an architectural program that allows for a more differentiated, free and creative intervention; (5) use of familiar and intuitive sketching and modeling tools, which allowed students to quickly express their ideas.

We noticed as in previous years that new student generations are more familiarized with technology (computer hardware, software, and web applications) and that the learning process through collaborative platforms, when used efficiently, strengthens the teamwork and behaves as a catalyst for a new relation and interaction between teachers and students.

All this has showed that it’s possible to adopt with success a Blended-Learning approach in a design studio environment by using these technologies, with the objective of creating a community of inquiry but not forgetting the importance of face to face interaction between students and teachers (Broadfoot, 2003).
Figure 4 – Blended-Learning strategy where technology complements face-to-face interactions.

It was possible, through the combined use of the platforms mentioned, to develop a learning strategy that (i) facilitated the learning process, (ii) motivated students to work and (iii) promoted communication and interaction between them and teachers. After analyzing the results and the experiences of earlier years’ use of collaborative platforms in CAAD, we can make the following conclusions: (1) a clear online content structure gave students a greater autonomy, flexibility and responsibility in the learning process, playing an active role in this process; (2) the majority of students said that consulting and accessing the didactic material of the course was encouraged by using Moodle and Facebook's structure and interactive possibilities, increasing learning; (3) using digital platforms in CAAD helped to achieve a blend between learning objectives and pedagogical methods.

The most significant of the collaborative platforms used was Facebook because of the dynamic it created between students and teachers encouraging the functioning of the discipline. Its qualities of speed, proximity, enthusiasm, exchange of ideas, potential for answering questions by teachers or students, for the publication of various multimedia contents, links, students work, publishing possibilities and videos were powerful and surprising. To ask questions about procedures through the exchange of software screenshots, to chat between teacher and students, and to publish images and other functionalities made a fundamental change on how students and teachers related and enhanced the design studio environment.

But Facebook had some disadvantages: not all students had an account, although the majority had, and some had privacy concerns. Thus, while Moodle was used to promote communication between students and teachers with its forum, questionnaires and feedback forms, it was generally felt that it wasn't intuitive and appealing enough for the students and its operators lacked flexibility – although it remained a valid repository of information, storing and linking diverse information and multimedia resources. To sum up, Facebook printed a new dynamic to the learning process and functioning of the discipline becoming an important case study and complement to Moodle.

Although being its first year of use, Prezi seems a promising platform to enhance student's learning and communication. However, we noticed student's lack of proficiency for using it to create an effective communication space: Prezi's effects – panning, zooming – were used as “special effects” rather than to express the communication's logic (the difference, weights and hierarchies between whole and parts, the fundamental versus the accessory, etc. Students still have to learn how to design that virtual presentational space efficiently, knowing how to place its objects (texts, images, videos, links...) and how to draw an understandable path between them creating, in the end, an intelligible presentation that acts both as a motion picture (the
movement is a key aspect of Prezi) and a still (that movement will stop at times and frame the desired content). Nevertheless, Prezi has a lot of potential compared with other tools such as Powerpoint or Keynote where this movement and framing is not possible, neither the ability to build an architectural communication design project in a collaborative way.

Taking into account the experience of earlier years by the combined use of several platforms, it is also relevant to point out that these new applications were explored and analyzed with the course's scientific and pedagogical objectives in mind and not the opposite, escaping from any "technological tyranny" and proving the possibility to develop a community of inquiry in a design studio atmosphere within a Blended-Learning strategy, which meant: (1) encouraging and facilitating communication and exchange of ideas between students and teachers through the platform and during classes; (2) making possible for students to play an active role in their learning process, encouraging them to develop group projects and to debate ideas with colleagues and teachers; (3) monitoring the communication projects, helping to integrate in a critical way the technical and artistic components and theory with practice; (4) continuously analyzing the work with the students; (5) analyzing the best ways to use software tools for achieving the objectives of each exercise.

We intend, in the next year, to promote the use of Google Groups in order to solve the problem of connecting Moodle with the personal e-mails of students/teachers and to provide a more effective discussion forum where messages are more easily exchanged by email being, at the same time, automatically structured in Google's forum.

Facebook will be used for its interactivity as a communication tool between teachers and students while Moodle will handle the classes' more formal contents and documents. The existing Facebook groups will remain active, allowing former students to maintain contact with teachers.

It's clear that the pedagogical model behind the subject of CAAD course and the adopted learning modes are linked to the idea of making students an active part of the learning process and on strategies to foster student-to-student and student-to-teacher interaction within a Blended-Learning approach. The learning process efficiency is also the result of the rich cognitive and emotional context created and that quantified tests and evaluation scales should also reflect this richness: the result of an interactive process between students and teachers.

There was a significant concern in trying to explore and use an interactive learning process focused on groups, encouraging critical analysis and feedback and leading students to gain autonomy and play an active role in the learning process. CAAD and design teaching in many institutions already showed us that computers can and must be used as means of expression and not as ends by themselves (Schon, 1988; Shao, 1997; Engeli, 2001; Rudd, 2006; Salman, 2008) and that creative work is enriched if the right conditions for communication and interaction between the main players of the learning process – students and teachers – are achieved (Neuckermans, 1999).

We believe that our teaching context reflects an attitude in which the process is as important as the outcome. It promotes an heuristic design process based in approximations to the final solution, following a non standard path based on intuition, participation, permanent interrogation and intelligent processing. A CAAD course can be a creative environment pointing to collaborative design, promoting multi and interdisciplinarity, stimulating the creation and exchange of ideas, increasing student's autonomy and responsibility in the learning process and setting CAAD as an heuristic learning approach itself supporting an heuristic design research.

To end, all the significant characteristics that have been structured and pointed out in this paper have been informing our RD&T project ARC+D's module for Teaching and E-Learning in Architecture and Arts that will propose, in a near future, a set of software operators committed with the needed specificity for teaching and learning in these fields. It's intended that those operators may be integrated with established platforms in the market such as Moodle, allowing the creation of an enriched collaborative workspace where students and teachers can work within a design studio environment.
References


