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Information versus Communication in Course Management System participation

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ABSTRACT

Web resources in Latin American higher education institutions have been reported to show a much stronger emphasis on Information than on Communication. A Course Management System (CMS), according to Social Constructivism framework, is an opportunity for fostering learning through interaction in a virtual environment for learning; hence, stimulating the use of a CMS for communication purposes seems quite appropriate. A quantitative analysis of 63.06% of the virtual classrooms was conducted, using the users log database to describe five variables: Participation, Informational Interaction Level, Communicational Interaction Level, and the use of Informational Resources and Communicational Resources in the CMS. An assessment of the first 2 years of implementation of Moodle in a campus confirmed prominence levels of interaction and resources that favor Information over Communication purposes in the use of the CMS. It is not conclusive whether this necessarily implies more or better learning; a profound qualitative study would be needed to answer these questions. Teachers and students show different behaviors in the face of this new ICT campus resource, while faculty members appear to have behaved in an erratic manner, students show steady levels of CMS usage.

1. Introduction

1.1. Regional and local perspectives

A growing awareness that academic institutions should do much more than provide hardware, increase Internet access and develop Web portals, has advanced at different paces in the world. In Latin America, in a similar manner as happened to early adopting countries before (Bates, 2001; Bates & Poole, 2003), a predominantly technological approach resulted in some experiences that could not meet the optimistic expectations (Facundo, 2004). Successful use of learning technologies depends on multiple factors that must be considered, most remarkably, human factors such as fostering a cultural change amongst the academic community and institutional policies (Bates, 2001; Facundo, 2004; Blin & Munro, 2008; Heilesen & Josephsen, 2008; U.Virtual-Reuna, 2003).

ICT have a widespread use in Latin America's higher education institutions, as was reported by a series of cross-national studies from UNESCO/IESALC (2004), done throughout 19 countries of the region. A great majority of these institutions have Web technologies put into operation. Nevertheless—the question is—for what purpose. At the time of that study (2002–2004) the infrastructure was mainly oriented toward information rather than communication, according to the following profile: 10% granted a presence in the Web with no interaction, by publishing only general information about the institution; 55% provided Informative Interaction, with supplementary information about faculty members or practical information about courses; 20% allowed Consultative Interaction through some form of database; 10% consisted of Communicative Interaction through synchronous or asynchronous channels; and 5% offered Transactional Interaction, such as enrolment, buying books, or participating in e-Learning or Blended Learning through Web technologies. These categories used by Silvio, Rama, Lago, et al. (2004) , draw a scale between the most unilateral forms of presenting content by the institution to the most interactive forms that imply a great diversity of exchanges between the different roles of the academic community or outsiders. The findings of this analysis suggested that conservative attitudes toward new paradigms in higher education, in academic communities in Latin America, have hindered the adoption and development of Virtual Environments for Learning (VEL). By 2004, no more than one third of the universities in the region had adopted full-scale virtual education systems (Silvio et al., 2004) as part of their academic offer.

One of the local studies that constituted the UNESCO/IESALC cross-national survey, pointed out that virtual higher education in Chile presented weaknesses along three axes (U.Virtual-Reuna, 2003): a lack of Research and Development that could allow a previous reflection

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about the suitability of ICT in local educational reality; a shortage of specific know-how and competencies in several fields required to develop meaningful virtual education processes; and last—perhaps the most difficult aspect to tackle—a resistance to adopt new perspectives in the face of pedagogical processes.

Despite unfulfilled expectations, it may serve as a consolation and as a source for greater understanding, the knowledge than some of these resistances may not only be local, but that can be related to early stages of development and adoption of new technologies (Norman, 1998) to unreasonable "technological imperatives" (Bates, 2001) or, to even more recent evidences, the consideration that Web-based learning may not be the panacea for the whole world (Asunka, 2008; Baggaley, 2008; Motlik, 2008).

Nevertheless, the presence of ICT in education is a fact that cannot be overruled by these considerations, whereas all kinds of daily practices in academic life are embedded with these technologies (Oblinger & Hawkins, 2006), individuals make use of them in their daily life, transferring its habitual use to formal and informal learning. Chile is no exception to this case due to an above average level of ICT usage in the region, as the World Telecommunication/ICT Indicators Database (2000–2007) or UNESCO/IESALC (2004) point. These statistics do not necessarily result in appropriate use of ICT for improving learning outcomes, as Sánchez and Salinas (2008) has reported government large-scale Enlaces network program.

1.2. Adoption of a CMS

It is in this general context, that our research focuses on a specific case in higher education, that of FAU – Facultad de Arquitectura y Urbanismo (Faculty of Architecture and Urbanism), one of the 14 Faculties that constitute Universidad de Chile, the oldest university in the country. Located in Santiago, it encompasses the School of Architecture, School of Design, and School of Geography, in a single campus.

Under a national program funding, for the improvement of quality and equity in higher education (MECESUP UCH 0217), FAU developed a project of "Modernization of the teaching–learning process in architecture, design and geography by means of integrated systems of simulation", which reflected and articulated three fundamental axes: (1) transversality between theory and practice; (2) teaching and its methods; and (3) use of digital media in teaching (Díaz Bonilla, Marchant, & Vergara, 2006), the present study can be referred within the scope of the latter two axes.

Within the range of MECESUP-FAU project the question of a Learning Management System (LMS) or a Course Management System (CMS) arose. Firstly, Claroline and WebCT were evaluated for smaller periods; later, Moodle was chosen and implemented during the academic years 2005 and 2006 (Díaz Bonilla et al., 2006). Nevertheless, for the year the 2007 FAU decided on a fourth LMS: U-Cursos.

The Coordinator of FAU's Digital Media Unit (UMD), Pedro Soza, offered us some clues to this process. Before 2004 a few—rather isolated—initiatives made use of WebCT in FAU. In the first semester of 2004, UMD encouraged an intensive use of WebCT, accomplishing 60 courses and requiring two teacher trainings. However, this interest in use of WebCT implied growing licensing costs. In the perspective of budget limitations, Open Source solutions seemed a more convenient alternative to be considered. MECESUP-FAU program had already begun to experiment with other platforms, particularly with Claroline. Later, UMD Coordinator obtained approval for the installation of Moodle CMS and a Web server was set up. However, costs considerations were not unique; 80 computer systems (LMS and CMS) for education were compared, and Moodle obtained a high rating amongst other CMS. One of the expectations was, that being Open Source, Moodle presented a potential for customization, which could satisfy FAU's own fields requirements, such as handling images, GIS and CAD files, through future in-house development of additional features (Soza & Céspedes, 2005). Nevertheless, these expectations were very difficult to fulfill. For Soza, the main obstacle to the appropriation of Moodle was—its being so rich and robust in features—the CMS turned out too complex to dominate by the academic community at large, making the learning curve much too steep. The initial expectations lacked to consider that in FAU, many faculty members still had trouble handling basic daily procedures like sending an email. Additionally, the commitment from departments and schools was not strong enough to drive a widespread adoption of Moodle. Part of the faculty members thought that this type of ICT resources could be detrimental to teaching, maybe still an alien element that could hinder the learning of students and posed a menace to their role. They where aware about the fact that some students had greater digital literacy than them and this could undermine their role (Hamuy, 2005).

But Soza sharply differentiated attitudes toward the LMS, between faculty members and students. In the case of the latter, they showed a great ability to manage Moodle as their own communication medium in a crisis conjuncture (Soza & Céspedes, 2005).

The complexity of managing all the elements involved, such as e-Learning technology (server management, Web and instructional design, custom features development and evaluation systems), plus promoting and providing help desk support for the usage of the CMS, surpassed the role of the UMD. Hence, there was a lack of a steering committee which could lead the challenge posed by the impact of digital technology in all its scope, including higher education in the fields of architecture, design and geography.

Considerations obeying chiefly to the administration and management sphere of FAU, lead the Dean in the 2006 to resolve for the implementation and promotion of U-Cursos as the main CMS as of 2007. The adoption of the new resource was said to be an effort to support a platform that had been developing successfully in-house during 10 years by the Faculty of Physical Sciences and Mathematics (FCFM). One of the promises in favor of this choice was that it would offer customization of the CMS to fit the specific requirements of FAU, in hands of the team of developers from U-Cursos. Although, it had a proprietary code with a commercial license distribution, the engineers that develop it were handy. Perhaps the determining aspect was to have interoperability between the CMS and the FAÚs student enrolment databases. However, only the latter of these expectations were partially fulfilled. U-Cursos resulted simpler to use, in the sense that it offered a more limited number of features: fewer types of activities or resources (15 versus at least 24 in the default Moodle installation, and many more that can be downloaded) with less configuration options; a standard interface that offers few options for customization and icons that are larger than Moodle's default theme. U-Cursos is presented as a resource that aids face-to-face teaching, while Moodle claims to help educators create effective online learning communities. Although, both may present many standard CMS features, such as the ability to manage course groups, calendars, documents, links, forums and messages, they clearly show different emphases. While Moodle is highly customizable, full of features than are regularly enriched by an international community and built with a philosophy of learning communities in mind, U-Cursos offers teachers a limited set of tools they can come to deal with after a shorter period and facilitating a more traditional teaching role.

At the time of data collection (2007), 320 courses had been created in Moodle, around 2400 users had registered, and served the three undergraduate schools, in addition to graduate courses. Instead, U-Cursos hosted only 55 courses and was intended mainly for first-year

courses. Although, Moodle remains until now (2009) in operation, it has become the secondary resource for undergraduate courses and a primary resource only for graduate school. The reasons for this choice are probably more casual than a deliberate policy. At the time of this writing, there are no reliable statistics, but informal talks with UMD Coordinator suggest that the distribution of courses is now inverted, U-Cursos hosting the majority. These continuous changes of CMS options (four different ones in 4 years) suggest a difficulty in committing to a specific resource within a long-term policy, something that could help foster development of virtual pedagogy within FAU. Another element that draws an even more scattered panorama is the fact that several courses, particularly architectural and design studio courses in FAU, are relying on having their own blog as a virtual accompaniment to the face-to-face courses, as they find in them a more dynamic, interactive and stimulating teaching–learning resource (Serres, Soza, & Hamuy, 2008).

The course of events brings into mind the weaknesses highlighted by U.Virtual-Reuna (2003): lack of previous consideration on the role of ICT; shortage of specific competencies required to develop suitable virtual education in a local context; and resistance to adopt new pedagogical perspectives.

1.3. Problem

Bearing in mind that at the time this research project was put together:

- Four different CMS had been implemented in FAU.
- Only a very limited assessment of the outcomes of any of them existed, none involving systematic analysis.
- That Moodle had already been in use 2 years, already a longer period than the other CMS.
- That Moodle was a CMS with worldwide relevance, in continuous development and update.
- That a lack of clarity amongst faculty members about the most appropriate strategies for ICT curricular integration had been reported (Hamuy, 2005).
- That Moodle offered a wide range of specific resources and that its application could not be solved only from the technical perspective of the software, but rather, it required further understanding of methodological aspects of teaching.
- That some literature reported about Latin America (and Chile was no exception) a trend in higher education teachers to resist to pedagogical innovations that involved the use of ICT, on the one hand; and on the other hand, the usage profile given by universities to its Web platforms was characterized as being of a low level of interactivity, with an emphasis in information services rather than in communicational or transactional ones.

It seemed relevant then, to approach the study of this set of problems with two questions, centered in educational practices in the use of the Moodle CMS in FAU:

In what degree was the use given to the Moodle CMS in FAU during 2005–2006 in the hosted virtual classrooms, an information resource and a communication resource? And in what degree did teachers implement resources and activities that could manage to generate interaction and communication between participants?

2. Theoretical framework

2.1. Interaction in Virtual Environments for Learning

Some authors point out that education faces a radical change, a new stage in which we journey from the paradigm of the Transmission/Reception scheme to the paradigm of Interaction (Silva, 2005). The massive entrance of digital media and networks into education, in a similar way as to the rest of society, may boost the possibility of this change of paradigm by means of greater connectivity, speed of processing and multimedia translation to binary formats. Nonetheless, interaction is by all means an essential component in an educational environment: be it face-to-face in a physical classroom, be it e-Learning mediated by ICT in distance education, or a mixture of both, as in Blended Learning. Interaction is fundamental for the acquisition of knowledge and the development of skills—cognitive, as much as motor skills—in a learning process. Woo and Reeves (2007) have proposed to re-conceptualize interaction in Web-based learning environments, from the perspective of Lev Vygotsky's Social Constructivist's learning theory. From this approach, interaction makes sense as meaningful interaction, or in other words, when students develop learning inside of a virtual community where the educational interactions, between teachers and students or students and their peers, lead them to do an active and shared building of knowledge (Woo & Reeves, 2007). From this point of view, a CMS is more than a space to gain access to and place information. It is a place to communicate interactively and to build knowledge. Asynchronous communication can promote the reflection and the development of ideas (Marcelo García & Perera Rodríguez, 2007). Under this understanding, the use of a virtual classroom exclusively or predominantly for content publication purposes may not be sufficient. If teachers' have the aim of fostering learning through the CMS then it is essential that they adopt a strategy that generates interaction and communication between the participants.

Information, Communication and Interactivity are polysemic concepts that are widely used, closely related and sometimes fused, thus we will differentiate them. For the purpose of this study we will understand Information as the contents published by users in the CMS and Communication as the processes that embody exchanging these contents between users through the CMS. A review of different approaches toward Computer Mediated Communication (Marcelo García & Perera Rodríguez, 2007) reveals there is a range of different possibilities that may be considered as CMC. Some satisfy the criteria of being "computer mediated" transmission of information, others demand that in addition to this transmission, intentionality be present, and that an exchange must occur between users, mediated by the computer. Thus the concept of interactivity between users comes into play. An understanding of Interactivity also requires clarification since it can convey different depths of meaning. According to Yacci (2000), the concept of interactivity in distance learning and computer based training, involves four major attributes: "Interactivity is a message loop; Instructional interactivity occurs from the learner's point of view and does not occur until a message loop from and back to the student has been completed; Instructional interactivity has two distinct classes of outputs: content learning and affective benefits; Messages in an interaction must be mutually coherent" (Yacci, 2000, p. 2). We are

well aware that in order to confirm the presence of *Interactivity* as understood by Yacci, a thorough qualitative analysis of the contents generated by users' communication through the CMS (to confirm if they truly accomplish a full "Interactivity Loop") would have to be conducted. This has been the aim of other studies that have focused in Discourse Analysis (Marcelo García & Perera Rodríguez, 2007) and very well be a next stage for our research.

UNESCO/IESALC's cross-national research was considered a relevant reference. On the one hand, it offered categories that could help classify different levels of interaction, establishing broad—but nonetheless significant—differences between information and communication. And on the other hand, it had applied these categories to a wide range of culturally similar higher education institutions (Silvio et al., 2004), obtaining data that could later be compared.

Silvio had used (amongst other analysis categories) five levels of interactivity to describe universities' Web sites in Latin America and Caribbean. Nevertheless, these categories were processed in a context and with a goal to a certain extent different from the one posed by our research. In his case, those five categories allowed a description of all kinds of contents and services published in university Web servers, not restricted to a CMS. According to Silvio's categorization, a CMS—as a whole of—is Transactional, that is to say it belongs to the highest level of interaction, since it allows participating in a VEL. However, the fact is that there is no guarantee that indeed that Transactional Interaction happens inside. According to our empirical observations, many virtual classrooms in a CMS continue unfolding an Information (Transmission/Reception) emphasis, rather than a Communication (Interaction) prominence that can foster knowledge building within a group of learners. For these considerations, we proposed to occupy the same system of categories, but adapted their scope in a manner that could help us examine the internal profile of a CMS.

Hence, we made an adaptation for this study of the five levels of interaction proposed by Silvio and grouped them in two broad categories:

A. *Informational Level would encompass: Presence—the* most basic level—(delivery of data or information that is limited to the syllabus of the course in the virtual classroom); Informative Interaction (offering some additional data on the operative and practical processes of a course, such as calendar and announcements); and Consultative Interaction (accessing information contained in databases of the virtual classroom without feedback possibilities, such as downloading or linking readings, presentations and statistics).

B. *Communicational Level would encompass:* Communicational Interactivity (allowing the user to access spaces of synchronous or asynchronous communication); and Transactional Interaction (making complex interactions that support social construction of knowledge, such as forums, assessments or chats) through resources in a CMS or VEL.

Each one of these levels allows is a deeper level of interaction than the previous one. Our aim is to expand this analysis in future investigations.

CMS, LMS and VLE are related terms that would be convenient to differentiate (Martín-Blas & Serrano-Fernández, 2009). While all three refer to software designed to facilitate learning assisted by computers each might emphasize different aspects. Virtual Learning Environment is the more general term that encompasses the other two. We prefer to call all these, forms of a VEL, a Virtual Environment for Learning, because in this manner we may convey the idea that it is the resources and the meeting place that are virtual (not face-to-face) but not the learning, which is real. A LMS is a software solution that is associated with software for managing corporate training programs (Martín-Blas & Serrano-Fernández, 2009). Instead, a CMS is associated with software that facilitates the creation and management of courses in traditional education institutions. The first may allow more control over the learners' workflow. Instead, the second may facilitate multiple content-developers in a same course, such as may be required by an academic collaborative environment. In the real world, both may do very similar things, and what will be even more decisive is the strategy and aims set by developers and teachers. Here we simply refer to Moodle as a CMS.

3. Method: analysis of the digital vestiges

The research design was non-experimental, ex- post-facto, of descriptive nature, and analyzed correlation of some variables. A simple random sample of 70 virtual classrooms (63.06%) without distinction of the fields of study was extracted. The study population was defined as 111 courses, since other 82 did not fulfill our filtering criteria—thus qualifying as a real course—of having teachers and students, publishing at least 1 resource during at least one of the cross section or having been used for the purpose of teaching; a course in the sample had to fulfill the criteria in at least one cross sections. We tracked down that many virtual classrooms in the CMS had been created only by request of some administrative authority without a commitment form the teachers, even though it might have received hundreds of visits form students (that found nothing inside). Other CMS courses fulfilled other objectives, such as hosting a research work group.

Moodle allows tracking down the use of the CMS's resources in terms of Actions associated to different Modules. Each click of the user is a log record in the database. Each record happens to be a sort of *digital vestige*, a trace of events and actions happened in the CMS, which can later be analyzed and interpreted, even though the objects to which they make reference (contents of the course, learning discussions in the forums, activities, etc.) may no longer be present in the CMS. To conserve, to analyze and to interpret those records enables reconstructing an important part of the weave of interactions that take place in the teaching and learning processes that occur in a virtual classroom.

Moodle provides *Reports* interfaces that allow tracking down the logs and visualizing this information, these tools have evolved, offering more devices for analysis in later versions (for example, 1.9). The CMS studied used Moodle 1.5 installation, which offers a standard report of five headings: *Course*, *Time*, *IP Address*, *Full Name*, *Action*, and *Information* (Fig. 1). Some data mining was conducted through queries of the MySQL database in order to filter the logs within studied parameters, such as: time cross sections, sampled courses, students and teachers. However, the log entry analyzed maintained the standard report structure plus one category not present in the standard report, Module identification. Each category provides discrete information: *Course* identifies the virtual classroom or CMS home level; *Time* records the precise moment of the user's click; *IP Address* identifies the origin of the client PC, however, due to the complexity of networks this information was not considered as useful in this study; *Full Name* gives the identity of the user logged, for blind analysis purposes we used the number indexed to that user instead of his name; *Module* distinguishes what type of Moodle resource or activity was involved in the click (forum, assignment or a published resource such as a PDF file); *Action* describes the task related to the module, for example if the assign-

MoodleFAU » Administration » Reports » Logs

Sitio FAU de Educación a Distancia (Site) Displaying 196 records

Course	Time	IP Address	Full Name	Action	Information
MoodleFAU	mié 24 de junio de 2009, 09:20	146.83.44.251	Eduardo Hamuy Pinto	user login	460
MoodleFAU	mié 24 de junio de 2009, 09:18	146.83.44.251	Eduardo Hamuy Pinto	course view	Sitio FAU Educación
MoodleFAU	mié 24 de junio de 2009, 09:16	146.83.44.251	Eduardo Hamuy Pinto	user login	460
AE-406_2	mié 24 de junio de 2009, 09:12	146.83.44.251	Luz Alicia Cárdenas Jirón	course view	Urbanismo Avanzado 1

Fig. 1. Moodle's standard Logs Report.

ment was viewed only or was submitted; and *Information* gives the unique instance of a module, such as what particular assignment or forum topic was viewed.

Romero, Ventura, and Garcia (2008) have described a much more elaborate process of combining data mining techniques with Moodle's database that may enable instructors to identify relationships within more precise records, for example associating quiz results to learning problems. Our aim was more macro; to provide a global picture of the type of the choices being made by teachers and their involvement in the face of this newly implemented campus wide ICT resource, together with establishing a comparison with the students' response to it.

The Modules, in each log, were classified according to the affordance of the two general categories in the stock of possibilities that Moodle offers to a course editor (teacher): *Resource* (a file to be viewed or downloaded, an online text or a Web link) or *Activity* (forums, chats, quizzes, assignments, etc.), and relate these to the potential of interaction they allow (Fig. 2).

While an input in the calendar or the publishing of a Grade were considered as a potential informational resource, a forum or an assignment were considered as means that allowed a feedback between teachers and students, or among peers, therefore, a potential communicational resource. In a similar manner, Actions when distinguished by their affordances; a log that shows "Add Discussion" (to add a subject of discussion in a forum) is very different from one of "view discussion" (to read a post in a forum). The first may be a sign of an active intent of arguing, negotiating or sharing knowledge (Woo & Reeves, 2007) from the participant. The second is more passive and indicates a range of possibilities that may go from a keen reading to a casual and distracted staring at the screen. We understand the limitations of this approach, because we cannot guarantee *a priori*, that every "Add Discussion" is truly a contribution to the course's meaningful interactions (Woo & Reeves, 2007), and that an "Add Post" is a coherent response that closes the "Interactivity Loop" (Yacci, 2000), because any of these could simply "nonsense" posts. Notwithstanding, we sustain that an "Add" action has a higher potential of interactivity than a "View" action. While an "Interactivity Loop" must be composed of both active (emitting) and passive (receptive) sides, interactivity could not be present only with receptive actions, such as viewing content. On the other hand, although, finding only emitting actions (such as only adding content in the form of posts or submitting assignments) is not possible because there is always some form of viewing (at least a course viewing) before an adding, many receptive tasks may simply occur on the user's side and not be recorded by the log, because the receptive process is internal to the user.

The logs of participants (faculty and students) were analyzed so as to measure the presence of five variables: Participation (Pa), Informational Interaction Level (IIL), Communicational Interaction Level (CIL), Informational Resources (IR) and Communicational Resources (CR), with quantitative instruments. *Pa* was measured by the number of log entries from students or teachers, as an indicator of their presence and use of the CMS. *IIL* measured the number of log entries from students or teachers, which denoted Module/Actions centered mainly

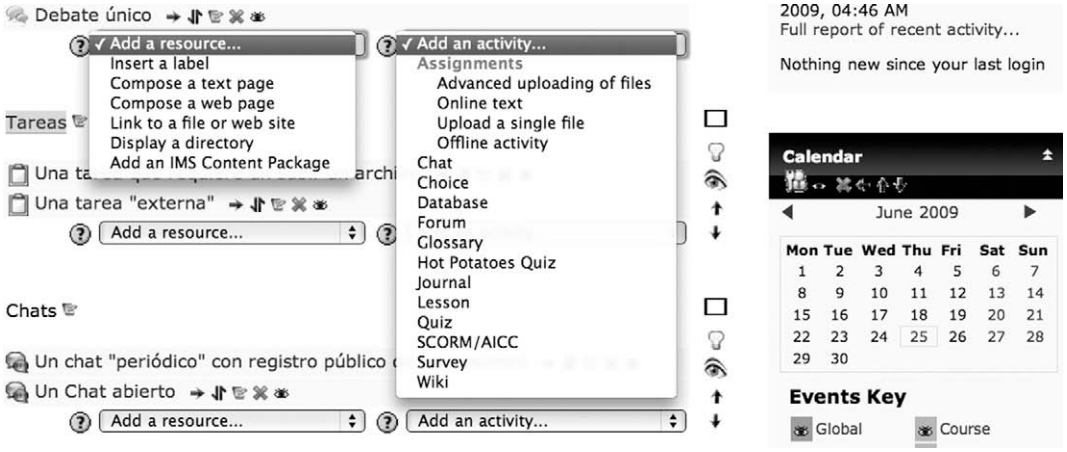

Fig. 2. A Moodle's course in editing mode, resources an activities menus.

in the reception of content or posting of content without feedback, with a potential of reaching only Informational Level of interactivity (Table 1), offering Presence, Informative Interaction or Consultative Interaction.

CIL measured the number of log entries from students or teachers, which denoted Module/Actions with a potential of Communicational Level (Table 2) by allowing content exchange such as, Communicational Interactivity or Transactional Interaction.

IR were measured by the number of log entries from teachers, which denoted Module/Actions centered mainly in adding or modifying Modules for content publishing or posting of content without allowing feedback (Table 3).

CR were measured by the number of log entries from teachers, which denoted Module/Actions centered mainly in adding or modifying Modules that allow content exchange such as (Table 4).

Table 1
Log codes for Module/Actions that were counted as IIL.

Module	Action
Appointment	Add, view, view all, view
Assignment	View, view all
Attendance	Add, update, view, view all
Book	Print, view, view all
Calendar	Add, edit
Chat	Report, view, view all
Choice	View, view all
Course	Add mod, delete mod, edit section, enrol, guest, new, recent, recent, unenrol, update, update mod, user report, view, view
Dialogue	View, view all
Exercise	View
Forum	Mail blocked, search, user report, view discussion, view forum, view forums, view subscriber
Glossary	View, view all
Hotpot	View, view all
Journal	View
Label	Add, update
Quiz	Report, view, view all
Resource	Add, update, view, view all
Scheduler	Add, add session, move slot, new seen, save choice, save move, save seen, save session, schedule, update, view, view all
Scorm	View all
Survey	View all, view form, view report
Upload	Upload
User	Change password, update, view, view all
Wiki	Info, links, sitemap, view, view all
Workshop	View, view all

Table 2
Log codes for Module/Actions that were counted as CIL.

Module	Action
Assignment	Add, update, update grades, upload, view submission
Book	Add, update
Chat	Add, talk, update
Choice	Add
Dialogue	Add, add entry, closed, open, update
Discussion	Mark read
Exercise	Add, open, submit
Forum	Add, add discussion, add post, delete discuss, delete post, subscribe, update, update post
Glossary	Add, add entry, delete entry, update, update entry
Hotpot	Add
Journal	Add, add entry, update entry, update feedback, view responses
Lesson	Add
Questionnaire	Add
Quiz	Add, attempt, review, submit, update
Survey	Add, update, view form
Wiki	Add, attachments, edit, update
Workshop	Add, update

Table 3
Log codes for Module/Actions that were counted as IR.

Module	Action
Appointment	Add
Attendance	Add
Calendar	Add
Course	Add mod
Label	Add
Resource	Add
Scheduler	Add
Upload	Upload

Table 4
Log codes for Module/Actions that were counted as CR.

Module	Action
Assignment	Add
Assignment	Upload
Book	Add
Chat	Add
Choice	Add
Dialogue	Add
Exercise	Add
Forum	Add
Forum	Add discussion
Forum	Add post
Glossary	Add
Hotpot	Add
Journal	Add
Journal	Add entry
Lesson	Add
Questionnaire	Add
Quiz	Add
Survey	Add
Survey	Add
Wiki	Add
Workshop	Add

Table 5
Each column shows the number of users and courses sampled for each semester's cross section.

	Cross sections			
	A	B	C	D
Number of students	999	1091	1745	1631
Number of teachers	42	47	85	87
Number of courses				

The statistical analysis of data consisted of describing and establishing relations between the variables throughout 2 years and two cross sections per year (a total of four semesters): A – 2005/semester I; B – 2005/semester II; C – 2006/semester I; and D – 2006/semester II.

4. Results

The sample showed a growth in the number of users throughout the 2 years studied (Table 5). The number of Resources published (Fig. 3) considered every teacher's click associated to adding, uploading or upgrading IR or CR resources or activities. Clearly, there was a greater number of IR than CR published for each semester, expressed as total or percentage (Fig. 4). Even though in the second year there were a greater number of courses, the Z Test (critical value of $z = \pm 1.96$) applied to the measurements of mean resources published by teachers, showed no significant differences between year 2005 and 2006 for each kind of resource: IR ($z = 0.69$; p-value = 0.49) and CR ($z = 0.84$; p-value = 0.40).

The IIL and CIL where measured by the mean number of clicks for each cross section and kind of user (Fig. 5). For both kinds of users the IIL is higher than the CIL. It is clearly shown that the average teacher reports much more activity in the CMS than the average student. The Z Test (critical value of $z = \pm 1.96$) applied to the different measurements of Interactivity Levels showed a single significant difference between year 2005 and 2006: the Level of Informative Interaction of teachers was greater in the 2006 ($z = -2.3$; p-value = 0.02). No significant differences showed in the CIL for teachers or IIL and CIL of students.

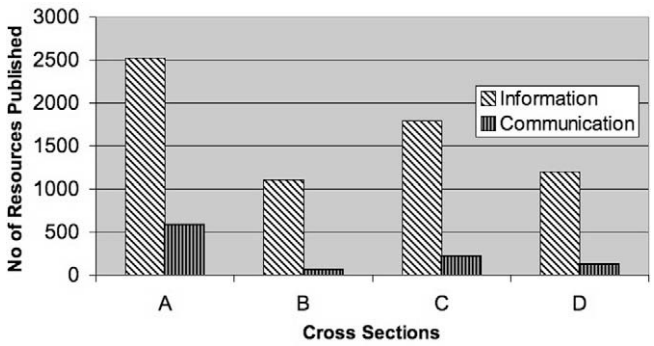

Fig. 3. Number of Information or Communication Resources for each cross section.

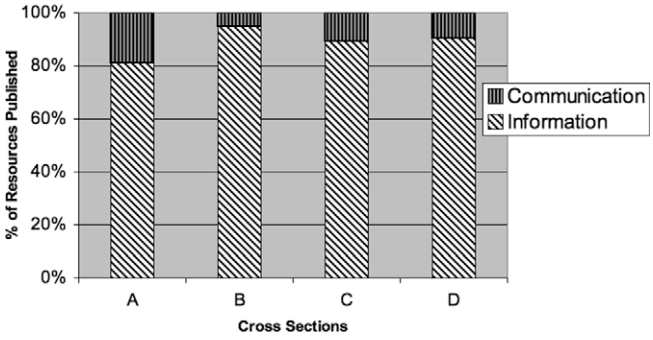

Fig. 4. Percentage of Information or Communication Resources for each cross section.

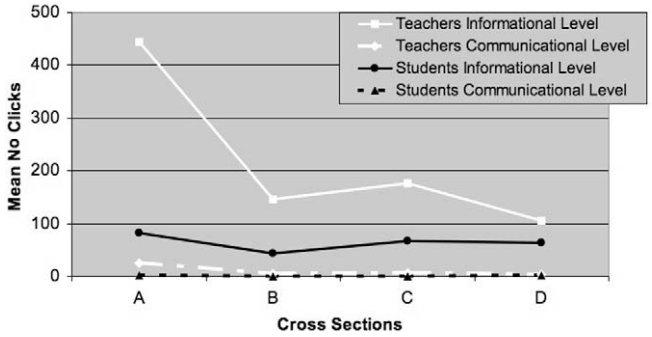

Fig. 5. Informational or Communicational Interactivity Levels for each cross section.

Table 6
Pearson product–moment correlation coefficient, *r* values.

	IR	CR	IIL *s*	CIL *s*	IIL *t*	CIL *t*
IR	1.00					
CR	0.54	1.00				
IIL *s*	0.51	0.69	1.00			
CIL *s*	0.16	0.39	0.58	1.00		
IIL *t*	0.74	0.92	0.67	0.32	1.00	
CIL *t*	0.56	0.95	0.66	0.48	0.89	1.00

A Pearson product–moment correlation coefficient test was applied to the following variables ($-1 \leqslant r \leqslant 1$), as shown in Table 6: IR; CR; IIL for students (IIL *s*); CIL for students (CIL *s*); IIL for teachers (IIL *t*); and CIL for teachers (CIL *t*). The value of each correlation coefficient was assessed according to the following scale: 0.00–0.20 = Null; 0.21–0.40 = Low; 0.41–0.60 = Medium Low; 0.61–0.80 = Medium High; 0.81–1.00 = High.

All correlation coefficients are positive, thus if a variable grows the other also or if one decreases the other also decreases (direct relation). However, High correlation is found only between CR-IIL *t*, CR-CIL *t* and IIL *t*-CIL *t*. The correlation between IR-CIL *s* falls in the Null range. All the other ones are found in the Medium and Low ranges. Scatter Diagram analyses showed greater concentration of data close to origin and a few isolated values tended to increase the *r* value.

5. Conclusions

According to the gathered data, certain patterns are suggested. For example, higher values in first semester cross sections (A and C) are consistently observed, respect to second semester (B and D). This may be hypothesized as a higher level of motivation during the first half of the year, after vacations, where teachers and students spend more energy in their academic tasks.

Cross section A shows higher values, more intensive use of the CMS in the first semester, more than in no other of the studied semesters, particularly with teachers. It would be interesting to know if a loss of motivation happened in teachers and to investigate which would be the causes. Technological innovations begin with more marked levels (“Hawthorne Effect”) but usually level with time in form of a plateau below the initial peak. Students’ averages present more stable levels through out the four cross sections. Could it be that the new resource (CMS) presents a more familiar environment for them, closer to other Web technologies used daily, hence, the behavior was more stable?

The measurement of the IR and CR variables come close to the results described by Silvio at a Latin American scope. While Silvio measured an Informative Use of 85% and a Communicational Use of 15%, the use of the CMS at FAU marked Informative Resources 89% and Communicational Resources 11%. Thus even a greater emphasis on Information.

Correlation Coefficient values show scattered data and an absence of correlation between students’ interaction level and other variables. However, an almost null *r* value between IR and CIL *s* is remarkable, but not absurd. The use of more IR does not stimulate communication

interactivity in students. However, CR shows a bit higher correlation with IIL *s* and CIL *s*. The only high *r* values show between the ranges of teachers' activity in the CMS: CR-IIL *t*, CR-CIL *t* and IIL *t*-CIL *t*.

Results are clear about a greater emphasis on Information rather than Communication. But they are not conclusive whether this implied more or less interactivity among participants and as a consequence, if we could expect more learning, according to Social Constructivism. Nevertheless, a few hypotheses may be raised. Teachers' activities on the CMS (publishing resources or interacting in various forms) had a greater effect on themselves than on students. The introduction of this new teaching and learning device produced a more erratic behavior in teachers than in students, hence, a greater need for the later to understand and discover how a CMS can help and improve their academic practices.

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