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ARTICLE

The Impact of ICTs on Lecturer and Student Interaction in University Education Processes

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Abstract

Interaction is a basic element in any educational process, and it is something that needs to be reconsidered in the light of technology. In order to examine the methodological changes that ICTs bring to teaching from an interaction perspective, a study was carried out at the University of Lleida to observe interaction processes in various face-to-face, blended learning and e-learning subjects. The methodological design was based on three data collection techniques: documentary analysis of subject curricula, lecturer and student questionnaires, and lecturer interviews. The data showed that, as the online component of subjects increased, the lecturers and students used more technological tools to communicate (e-mail, forums, chats, social networks, etc.). Furthermore, we found that the lecturers and students basically communicated for academic purposes. While they hardly ever communicated for personal reasons (guidance, support, etc.), they claimed that closer

contact with a non-academic focus would be preferable. We also observed that the students' work was more individual in e-learning subjects. Although there is still a considerable way to go in ICT-mediated lecturer-student interaction, both the lecturers and students recognise the potential of such technologies, even though they still do not use them as they feel they should.

Keywords
higher education; e-learning; interaction; information and communication technologies

La influencia de las TIC en la interacción docente y discente en los procesos formativos universitarios

Resumen
La interacción, un elemento básico en cualquier proceso formativo, debe replantearse con la irrupción de la tecnología. Con la intención de abordar los cambios metodológicos que las TIC implican en la docencia desde la perspectiva de la interacción que generan, se planteó un estudio en la Universidad de Lérida para observar los procesos que interactúan en diferentes asignaturas en función de si éstas se desarrollaban bajo la modalidad presencial, semipresencial o no presencial. El diseño metodológico se articuló alrededor de tres técnicas de recogida de datos: análisis documental de programas de asignaturas, cuestionarios a profesores y estudiantes y entrevistas a profesores. Los datos mostraron que, conforme aumenta la no presencialidad de las asignaturas, profesorado y estudiantado utilizaban más herramientas tecnológicas (correo electrónico, foro, chat, redes sociales…) para comunicarse. Además, el tipo de comunicación imperante tenía finalidades académicas, mientras que se producía una escasa interacción para aspectos más personales (de orientación, apoyo…); en este sentido, tanto profesorado como estudiantado preferirían un contacto más cercano no tan centrado en los elementos académicos del proceso. También observamos que en las asignaturas en línea se desarrolla un trabajo más individual por parte del estudiantado. Aunque todavía queda camino por recorrer en la interacción docente-discente a través de las TIC, los agentes implicados en el proceso reconocen sus potencialidades, pero aún no las utilizan como consideran que convendría hacerse.

Palabras clave
educación superior, formación en línea, interacción, tecnologías de la información y la comunicación

1. Introduction

ICTs facilitate personal communication and provide access to all kinds of information, implying a methodological change to teaching and a need for both lecturers and students to adapt to the use of such tools (Surià, 2010).

Interaction is a basic element in any educational process. Such interaction, which is always explicit in classrooms due to the face-to-face relationship established between lecturers and students, and among students, is an element that various authors have reconsidered in the light of technology in education.

Dorado (2006) analyses networking as a source of learning, with the idea of going beyond models that centre on technological factors (those focusing attention on the use of tools) and on content

factors (those placing importance on content factors rather than methodological factors), and proposes what he describes as 'quality' models. According to this author, such models are centred on users and on the management of the networks in which they participate, and therefore on the methodologies and potential mediations and relationships that develop between the different people forming part of the environment, who represent the veritable added value of any educational and knowledge management system.

From this perspective, with technology and content relegated to a secondary position, it is in human capital that investment should be made. Indeed, Dorado (2006) states that such human capital is the true driver of knowledge creation in any community because it integrates intellectual, social and organisational capital as a whole.

In online learning, it is worth highlighting Dorado's idea of going beyond the need to centre on technology or content to take the leap of only and exclusively being concerned with the users, with the students who achieve learning by doing a series of tasks and by putting various skills into practice. This idea is also underscored by Fuentes (2009), who suggests that the use of ICTs in educational processes should not make us underestimate the importance of interaction between and among the students and, above all, between students and lecturers, which should always be the basis for every educational action.

Interaction should be a basic element in an educational process. If, in the planning of that process, the face-to-face element is reduced, then we have to place greater emphasis on being able to compensate for the lecturers' non-presence so that students feel accompanied and supported at all times. Avoiding isolation should be a fundamental objective to ensure that students get involved and learn throughout the process. Sher (2009) demonstrated this approach and found that, in e-learning, the students' satisfaction with and perception of learning were directly related to the level of student-lecturer interaction.

Indeed, through studies like the one carried out by Davidson-Shivers (2009), we find that, in online educational processes, what predominates is the development of lecturer-group communication on academic topics (information about the course, content, activities, etc.), mainly by using e-mail or notice board tools. Furthermore, according to Wang (2008), it would seem that technological tools are still incapable of establishing a sense of belonging to a strong community in the way that face-to-face processes do.

Authors such as Moore (1989) and Salinas (2004) emphasise the need to approach the methodological changes that ICTs bring to teaching from the perspective of the interaction that they generate. It is a matter of evaluating the extent to which the interaction between and among the various agents of the educational process also has a place in the e-learning model. Of the various types of interaction, these authors highlight three:

- Student-content interaction. In the design of an ICT-mediated educational process, the way in which educational content is prepared is very important for fostering student motivation. Lecturers may consider replacing the 'paper' format so as to offer students interlinked materials containing images, videos, audios, animations, charts, diagrams, etc.

- Student-lecturer interaction. Online teaching should not imply a replacement of lecturers, but rather a review of their tasks. Besides transmitting knowledge and monitoring the students' progress, lecturers should have the capacity to guide and facilitate learning, to channel individual and group efforts, to solve technological problems, etc.
- Student-student interaction. This is another dimension that we should not overlook; in online teaching too, it needs to strengthened and honed. With ICT tools, face-to-face communication models can be replicated, thus fostering the learning opportunities that are generated when students interact with each other.

On the issue of the student-lecturer communication process, Área (2010) suggests that, in the development of a teaching-learning process that alternates between face-to-face classrooms and the use of virtual spaces, we could combine two modes of communication between these agents.

- First, tutoring through the virtual classroom, which may have a number of formats: personal communication between students and lecturers via e-mail, public communication between students and lecturers via forums, tutoring and inter-student support (also via forums), unidirectional tutoring from lecturers to students via a 'notice board' type of tool for the virtual classroom, etc.
- Second, tutoring in the lecturer's office, mainly consisting in monitoring the students' work and in solving particular queries or problems that each student might have.

Finally, and to conclude this introductory section that allows us to frame the study carried out, we should not forget that interaction facilitates the development of collaborative working. In this respect, the advent of Web 2.0 tools (wikis, blogs, social networks, file-sharing tools, etc.) needs to be taken into account because they allow collaborative learning to take place, and this implies a change to the way in which teaching and learning processes have been conceived and understood to date. According to Dillenbourg (1999), collaborative working develops when students take on an active role in their learning processes and are able to communicate with each other and participate, on an equal standing, in shared tasks. This collaborative exchange of information encourages students to develop more elaborate cognitive strategies, thus enriching the communication between and among group members, and also the acquisition of knowledge from group and individual perspectives (Salovaara & Järvela, 2003). Recently, Jorczak and Bart (2009) observed that collaborative learning takes place when students get involved in the group and communicate with fellow students to solve problems and to construct knowledge jointly. A number of studies on experiences of using tools of this type in teaching (Hugues & Narayan, 2009; Reinoso, 2009; Levis, 2011) highlight the potential and effectiveness of such tools in student learning and the development of teamwork for knowledge construction.

It was from this perspective —connected with the need to reconsider the educational process when technology forms part of it— that a study was carried out at the University of Lleida to analyse the use of ICTs in the development of teaching and learning processes. The study, carried out in the 2007/2008, 2008/2009 and 2009/2010 academic years, focused on observing interaction processes

in various subjects at the university, depending on whether they were offered in face-to-face mode, blended learning mode or e-learning mode. To that end, three variables were considered:

- Lecturer-student interaction (account was taken of elements such as interaction situations, tools used and interaction motives).
- Student-student interaction (how often the students interacted with each other to do various tasks).
- How students were organised to work on the subjects (individually, in pairs, in small groups or whole-class groups).

For the study, data were collected from both lecturers and students.

2. Methodology

The methodological design was based on three data collection techniques. First, an analysis was performed of the course plans for the subjects that were the object of study. This allowed us to get an insight into the educational process before its implementation, and to examine how the use of ICTs affects the various aspects planned by the lecturers. As a guide for elaborating a homogenous record, we used a tool that the University of Lleida had designed for lecturers to plan subjects according to a series of established rules.

Besides the documentary analysis, we considered that it was necessary to develop a technique to allow us to reach a high number of student and lecturer informants. We used a questionnaire common to both groups of informants, designed specifically for this study, which would allow us to compare their respective responses. To create the questionnaire, the first step was to group together the elements on which we wanted to collect data and to elaborate the items for each section.

After it had been designed, the first version was then validated. To do that, there were three different profiles for the validation panel: experts in the use of ICTs in teaching-learning processes, university lecturers and students. The elements that needed to be assessed were the unambiguity and suitability of the items. Quantitative and qualitative analyses of the panel members' contributions allowed us to produce the final version of the questionnaire.

Finally, interviews were used to gather the informants' perceptions and feelings about the educational process, once the process had ended. In this case, individual, unstructured, undirected and open-question interviews were formulated. For the design, a protocol was created, which was validated with the help of experts in qualitative research.va.

2.1. Sources of information

The main criterion for accessing sources of information was to locate face-to-face subjects, blending learning subjects and e-learning subjects at the University of Lleida. To do that, we used data available

in the Support for Teaching Innovation and e-Learning Area, a unit of the Education Sciences Institute – Continuing Education Centre dedicated to providing pedagogical and information technology support to lecturers for the incorporation of ICTs into teaching. Twenty-nine subjects were selected: nine face-to-face, 10 blended learning and 10 e-learning.

After being chosen, the process to get hold of their plans was initiated so that the documentary analysis could be performed. Some were found on the university's website, and others on the Virtual Campus.

The 29 subjects were taken as the basis for collecting data from the lecturers via the questionnaire. Then a process began to seek out other lecturers at different faculties and schools. The criterion continued to be that of locating face-to-face, blended learning and e-learning educational processes.

Through the centres' web directories, a decision was taken to select the lecturers randomly (choosing one out of every five by going down the directory list), without knowing which educational mode they used for their subjects. We knew that a number of lecturers implemented ICT-mediated educational processes, some of whom were also chosen.

We sent the questionnaire to a total of 212 individuals and received responses from 71: 43 men and 28 women (60.6% and 39.4%, respectively). Regarding the educational mode used for the subjects, 39 of the 71 respondents (54.9%) stated that it was face-to-face, 27 (38.7%) that it was blended learning and 5 (7%) that it was e-learning (Chart 1).

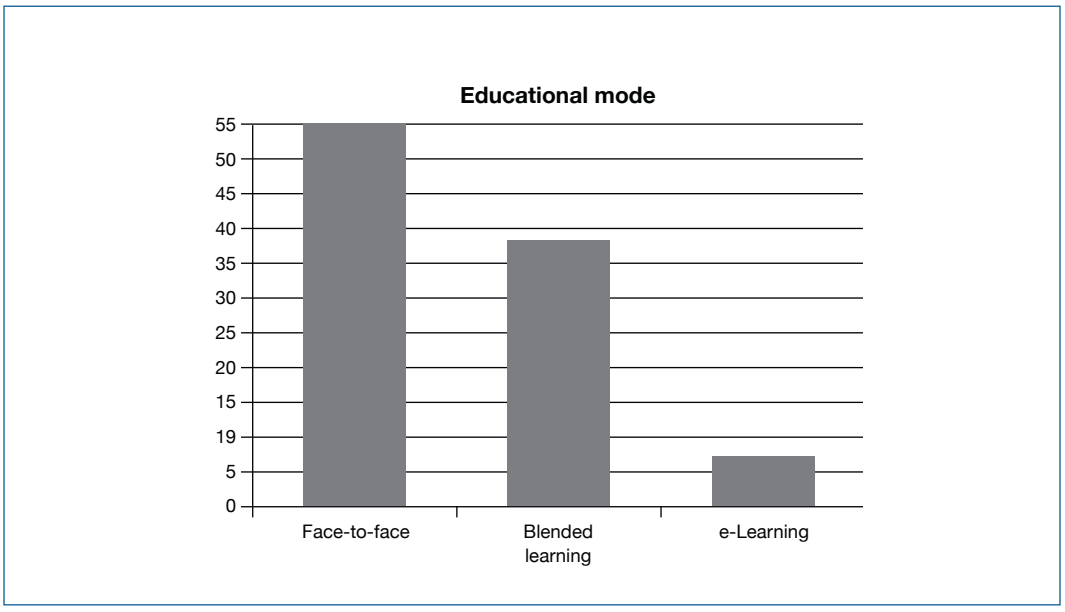

Chart 1. Percentage of subjects, by educational mode (lecturers)

The 29 initial subjects were also taken as the basis for collecting data from the students via the questionnaire. The research team contacted the lecturers in charge and sought their permission to go into the classroom to collect data. A total of 658 responses were received, 163 (24.8%) from men and 478 (72.6%) from women (17 did not respond). Regarding the educational mode used for the subjects, 405 of the 658 respondents (61.6%) stated that it was face-to-face, 181 (27.5%) that it was blended learning and 67 (10.2%) that it was e-learning (five individuals did not answer this item) (Chart 2).

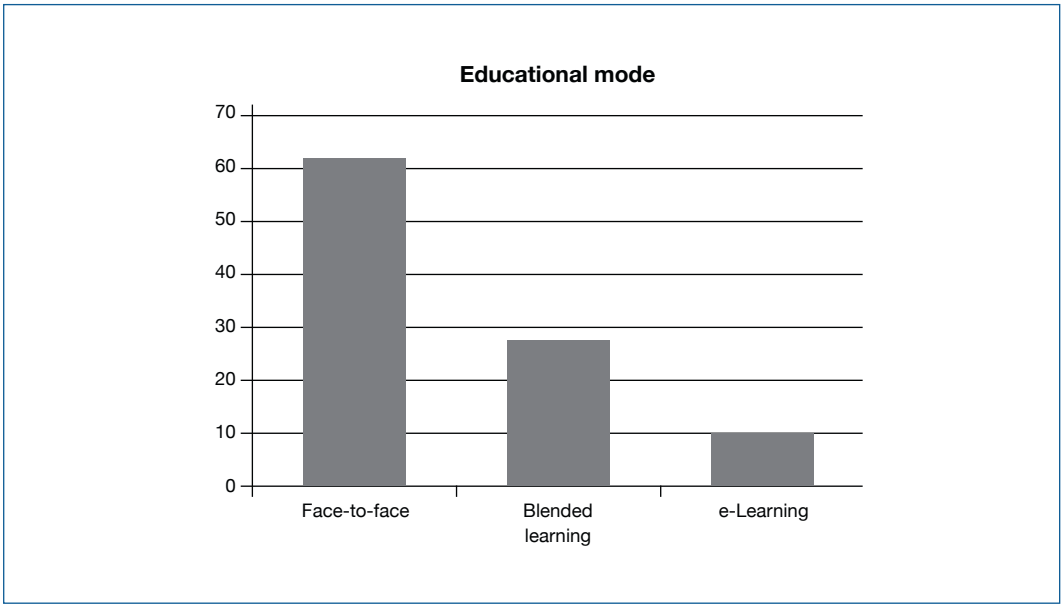

Chart 2. Percentage of subjects, by educational mode (students)

For the 29 subjects, the results obtained from the 71 lecturers and the 658 students were compared.

The 29 initial subjects were taken as the basis for the interviews, though the list of lecturers compiled for data collection via the questionnaire was also used. Finally, 12 lecturers across different centres were contacted. Of these 12, four taught subjects in face-to-face mode, four in blended learning mode and four in e-learning mode. The analysis of the interviews was performed by grouping together the responses from the lecturers in accordance with the variables of our study. In consequence, a comparison could be made between the various techniques used.

3. Results

3.1 Analysis of plans

In the face-to-face subject plans, the lecturers tended to propose assignment tasks in small groups (this option was specified in seven curricula), whereas two of them did not contain any reference to the way in which students should interact with each other.

The blended learning subject plans tended to propose that students should do certain tasks, which they had to solve either individually or in small groups (this interaction formula was specified in seven curricula). Only one plan specified that the assignment should be done individually, and another specified that work should be done by the whole-class group in lectures, and in small groups for other activities. Finally, it is worth mentioning that one plan made no reference to any type of interaction.

Of the 10 e-learning subject plans, two of them made no reference as to whether students should

work individually, in small groups or as a whole-class group. One plan specified that the assignment should be done individually, and another specified that work should be done both individually and in small groups. The remaining plans (six) mentioned that the students should do the tasks both individually and as a whole-class group, using ICT tools such as chats, discussion boards or, in some cases, planned face-to-face meetings.

3.2 Questionnaires

As indicated in the methodology section, the questionnaire designed for this study was subjected to a process of quantitative and qualitative validation by a validation panel. Regarding the quantitative assessments, we obtained high scores for the unambiguity and suitability of the items. More than 90% of the validation panel members stated that they were unambiguous and suited to the study, though the percentage dropped to 75% in some cases. In others, the percentage of positive responses was around 80%.

In many cases, the validation panel members expanded their quantitative responses by adding qualitative comments. The interpretation we made of this (high quantitative score, but also qualitative suggestions) was that, generally speaking, the first version of the questionnaire was more or less clear in terms of the information it aimed to collect, though more work needed to be done on the items to make them more precise.

The comments received from the validation panel members helped us greatly to modify items and elaborate the final version of the questionnaire, which asked the lecturers and students about three types of interaction:

- Lecturer-student interaction.
- Student-student interaction.
- How students were usually organised to work on the subjects.

3.2.1. Lecturer-student interaction

A question was asked about how much time that, while a subject was being taken, the lecturer spent on: transmitting subject content, monitoring the students' progress, solving academic queries, helping the students to do their assignments and solving queries about various non-academic aspects (guidance, solving technical problems, etc.).

The lecturers responded (Table 1) by stating that, while a subject was being taken, transmitting content, monitoring progress, solving queries and advising students on assignments were the items that took up most of their time, though the order varied slightly depending on the educational mode used. Monitoring progress took up much more time in e-learning subjects, in which interaction in non-academic queries decreases

Table 2. Frequency of time spent on the various sections (lecturers' responses, by percentage).

	Transmission			Monitoring			Academic queries			Advice			Non-academic queries		
	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL
Always	43.6	25.9	20	10.3	29.6	40	23.1	25.9	60	15.4	29.6	60	12.8	14.8	40
Often	53.8	55.6	40	35.9	29.6	60	46.2	55.6	40	48.7	37	40	25.6	29.6	20
Sometimes	0	11.1	20	33.3	14.8	0	23.1	7.4	0	17.9	25.9	0	25.6	25.9	40
Not often	2.6	7.4	20	15.4	25.9	0	5.1	11.1	0	12.8	7.4	0	25.6	29.6	0
Never	0	0	0	2.6	0	0	0	0	0	5.1	00	0	10.3	0	0

FTF: Face-to-face subjects; BL: Blended learning; EL: e-Learning

For the students (Table 2), the options 'always' and 'often' also prevailed in their responses, though two rather odd aspects were observed. First, for monitoring progress, in the face-to-face and blended learning subjects, 'sometimes' and 'not often' appeared more often than in the lecturers' responses; this did not happen in the e-learning subjects. Second, the students gave higher responses in the 'always' and 'often' options for time spent on solving non-academic queries, particularly in the face-to-face and blended learning subjects.

Table 2. Frequency of time spent on the various sections (students' responses, by percentage)

	Transmission			Monitoring			Academic queries			Advice			Non-academic queries		
	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL
Always	46.4	38.1	26.9	4.9	14.4	37.3	26.7	36.5	41.8	17.8	29.3	32.8	19.8	23.8	31.3
Often	38.8	37.6	28.4	18	24.3	28.4	39.5	35.9	26.9	36	24.3	22.4	27.7	27.6	22.4
Sometimes	9.1	13.8	26.9	29.9	26	14.9	22.7	17.1	14.9	25.9	23.8	22.4	23.5	23.2	22.4
Not often	4.7	9.4	11.9	32.1	25.4	13.4	8.4	8.8	11.9	14.6	17.7	16.4	20.2	16.6	16.4
Never	0.5	0.6	4.5	15.1	8.8	3	1.2	0.6	3	5.2	4.4	3	8.4	8.3	4.5

FTF: Face-to-face subjects; BL: Blended learning; EL: e-Learning

3.2.2. Student-student interaction

A question was asked about how often the students interacted with each other to: share materials, work on content, do assignments, develop projects or solve problems as a group, solve queries and correct their own assignments or activities.

For the lecturers (Table 3), there was basic student-student interaction in the face-to-face and blended learning subjects to do assignments or practicals (to this question, 69.2% of the face-to-face subject lecturers responded 'often' while 37% of the blended learning subject lecturers responded

'always', so both data are significantly higher than the mean). In the e-learning subjects, interaction for working on content and solving queries stands out. In the remaining sections, the lecturers did not indicate that there was a high level of student-student interaction.

Table 3. Frequency of student-student interaction (lecturers' responses, by percentage)

	Sharing materials			Working on content			Doing assignments			Group projects			Solving queries			Correcting		
	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL
Always	7.7	3.7	0	5.1	22.2	0	7.7	37	20	7.7	29.6	0	7.7	25.9	0	5.1	7.4	0
Often	25.6	37	20	38.5	40.7	40	69.2	48.1	20	23.1	33.3	20	15.4	22.2	40	15.4	25.9	20
Sometimes	33.3	29.6	20	23.1	25.9	20	10.3	11.1	40	23.1	22.2	20	46.2	29.6	0	17.9	25.9	00
Not often	15.4	22.2	20	15.4	7.4	20	2.6	0	0	25.6	11.1	40	15.4	18.5	40	30.8	18.5	20
Never	5.1	3.7	40	5.1	3.7	20	5.1	3.7	20	7.7	3.7	20	7.7	3.7	20	25.6	22.2	60

FTF: Face-to-face subjects; BL: Blended learning; EL: e-Learning

The students' responses differed from the lecturers' in two response blocks (Table 4).

First, in the face-to-face and blended learning subjects, the options 'always' and 'often' were the most frequent responses in all sections apart from time spent on correcting their own assignments or activities, where the number of 'sometimes', 'not often' and 'never' responses increased. The highest data were obtained for time spent on doing assignments: 68.7% of the face-to-face subject students and 76.8% of the blended learning subject students indicated that they 'always' or 'often' interacted in this respect.

Second, in the e-learning subjects, the options 'not often' and 'never' appeared more often, with significant data such as the fact that 49.3% of the students responded that they never interacted to do assignments, 41.8% never interacted to develop projects, 26.9% never interacted to solve queries and 56.7% never interacted to correct their own assignments or activities.

Table 4. Frequency of student-student interaction (students' responses, by percentage)

	Sharing materials			Working on content			Doing assignments			Group projects			Solving queries			Correcting		
	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL	FTF	BL	EL
Always	21.5	32	16.4	16.5	27.1	19.4	27.7	45.9	6	18.5	29.8	10.4	17.5	24.9	10.4	7.2	15.5	4.5
Often	36.3	29.8	10.4	37.8	38.1	10.4	41	30.9	10.4	29.1	36.5	19.4	30.6	34.8	23.9	17.8	21	4.5
Sometimes	25.7	24.3	19.4	28.4	20.4	22.4	24.2	12.7	11.9	28.1	17.7	11.9	28.9	26	20.9	24.4	24.9	11.9
Not often	13.3	8.3	14.9	12.3	11.6	14.9	5.7	5.5	20.9	14.6	8.8	14.9	15.6	9.4	16.4	28.1	18.8	19.4
Never	2.7	3.9	37.3	4.4	1.1	31.3	0.7	3.3	49.3	8.4	5	41.8	6.7	2.8	26.9	21	17.1	56.7

FTF: Face-to-face subjects; BL: Blended learning; EL: e-Learning

3.2.3. How students were organised

The lecturers and students were asked to indicate how they usually worked on the subjects: individually, in pairs or threes, in small groups or whole-class groups.

The lecturers indicated (Table 5) that, in the e-learning subjects, that working individually was the most common form. In the other two modes, there was greater variety in this respect.

Table 5. How students were organised (lecturers' responses, by percentage)

	Individually			*Pairs, threes*			*Small group*			*Whole-class group*		
	FTF	*BL*	*EL*	*FTF*	*BL*	*EL*	*FTF*	*BL*	*EL*	*FTF*	*BL*	*EL*
Always	12.8	18.5	20	5.1	7.4	0	5.1	14.8	0	7.7	0	0
Often	51.3	44.4	80	25.6	48.1	20	38.5	48.1	20	20.5	29.6	20
Sometimes	12.8	14.8	0	41	29.6	0	10.3	7.4	20	17.9	25.9	0
Not often	12.8	18.5	0	7.7	7.4	60	15.4	11.1	0	17.9	22.2	20
Never	2.6	0	0	7.7	3.7	20	23.1	11.1	60	25.6	14.8	60

FTF: Face-to-face subjects; BL: Blended learning; EL: e-Learning

The students agreed that, in the e-learning subjects, they worked individually (83.6% responded by saying that they always did so). In the face-to-face and blended learning subjects, the students agreed that few strategies were used to work with the whole-class group (Table 6).

Table 6. How students were organised (students' responses, by percentage).

	Individually			*Pairs, threes*			*Small group*			*Whole-class group*		
	FTF	*BL*	*EL*	*FTF*	*BL*	*EL*	*FTF*	*BL*	*EL*	*FTF*	*BL*	*EL*
Always	24.2	14.4	83.6	3.5	7.7	0	16	33.1	3	8.1	6.1	16.4
Often	31.4	24.9	13.4	32.1	34.8	3	32.1	38.7	1.5	10.6	11.6	6
Sometimes	16.5	33.1	0	28.6	23.8	4.5	26.4	15.5	3	12.1	24.9	3
Not often	20	17.7	0	18.5	17.1	7.5	14.6	7.2	4.5	22.5	24.3	6
Never	7.2	8.3	1.5	16	13.8	82.1	10.6	4.4	85.1	44.2	29.8	64.2

FTF: Face-to-face subjects; BL: Blended learning; EL: e-Learning

3.3. Interviews

In the face-to-face and blended learning subjects, e-mail was used to receive queries from the students, to solve queries and to arrange appointments with lecturers. Face-to-face tutorials were a strategy that was not often used by the students, either in the face-to-face or blended learning subjects. The strategy of working in small groups was quite often used in the face-to-face subjects.

The lecturers of the blended learning subjects had adverse opinions on a certain kind of e-mail use. For example, one lecturer pointed out that online queries were of no use when it came to solving complicated questions: "*On an electronic level, of forums and so on… I believe that there are certain types of questions that no longer… they no longer bother to ask them, and I guess that's why they think: 'For heaven's sake, it's going to take me forever to explain what..., the query I've got, it'd be easier for me to go and see him.*"

In the blended learning subjects too, other communication tools were mentioned, which were not referred to in the face-to-face interviews, such as the Virtual Campus forum tool.

In the e-learning subjects, an idea present in the lecturers' explanation was they were very satisfied with the students' participation: "*What I like is that people get involved. This allows people to become integrated more quickly, allows an exchange of opinions between..., whether technology buffs or not, allows two groups to participate at the same level: the technology buffs don't get bored and they do participate, and those who aren't don't feel excluded by a strange vocabulary and things they don't understand.*" "*The truth is that I don't need to encourage them, I've never needed to with this group: there's always someone writing to you to ask questions. I can be found on the chat every single day.*"

E-mail was also a highly used resource in the e-learning subjects, particularly for solving queries. Likewise, as mentioned by this lecturer, it was found that the students tended to separate forum and e-mail use very clearly: "*It would seem that they make a quite an odd distinction between the queries they have, that they send me as the lecturer —that they put to me by e-mail or the Virtual Campus mail, individual— and discussion, which they do in the forums. That said, within the forums there is a section for queries they might have on assessment... They don't use it; they'd rather do assessment individually.*" Some lecturers said that when they received a query by e-mail that they considered to be of interest to the whole group, then they would forward it to the class.

In the e-learning subjects, the chat tool appeared as an alternative for communicating with the students, generally for less formal communications.

4. Discussion

The study has shown that lecturers are concerned with aspects such as transmitting knowledge, monitoring learning progress and solving academic queries (Tables 1 and 2). The data coincide with those obtained by Davidson-Shivers (2009), in that interaction takes place more individually between lecturers and students, or more generically, and less so to address small groups. We found that face-to-face tutoring is underused, although tools such as e-mail have enabled greater lecturer-student contact, irrespective of the educational mode.

As the online component increases, so too do the communication strategies used by the lecturers, such as online forum and chat tools, and even social tools such as Facebook. In this respect, we concur with the results obtained in other studies (e.g., Hugues & Narayan, 2009; Reinoso, 2009), which demonstrate that Web 2.0 tools can be useful for communicating during an educational process, and that their use is highly valued by the agents involved in the process.

In e-learning subjects, students tend to work more individually. This aspect was not observed quite as clearly in face-to-face and blended learning subjects, where working in small groups is a fairly common strategy (Table 3 and 4). In today's society, it is important to foster teamwork among students to develop competencies in that regard, which will allow them to cope better in a working environment in the future. It is for this reason that we consider —in line with the ideas posited by Dorado (2006) and Fuentes (2009)— that an effort needs to be made to strengthen interaction in online learning processes, and to try and ensure that at least as much importance is placed on this part of the process as it is on other elements, like technology or subject content for example. In addition, as Sher (2009) indicates, interaction is an important element for learning and for course assessment. Ensuring that interaction in online educational processes is given the weight that it deserves is the only way of effecting the change that the studies indicate: that a face-to-face approach creates a greater sense of belonging than an online approach (Wang, 2008).

Our study has allowed us to observe how lecturer-student interaction decreases as the online component of subjects increases. The same thing happens with interaction between and among students: the use of ICTs and a decrease in the face-to-face component leads the students' work to become more individual. Therefore, we can conclude that ICTs are currently having a negative impact on interaction processes in university teaching.

In short, we believe that there is still a considerable way to go on the issue of interaction in educational processes, and particularly in ICT-mediated e-learning processes. It will be necessary to conduct further research into social tools and their potential in teaching-learning processes. As we have observed, this field remains relatively unexplored, and investigators of this topic must take this into account. Another future proposal arising from the results obtained is to analyse why online education tends towards individualisation, and to attempt to find possible proposals to solve this issue.

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