STUDENTS' ATTITUDE TOWARDS ICT LEARNING USES: A COMPARISON BETWEEN DIGITAL LEARNERS IN BLENDED AND VIRTUAL UNIVERSITIES

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Introduction

The introduction of information and communication technologies into university classrooms has been crucial to university teaching and learning. Various studies [1,2] highlight the possibilities offered by ICT and the turning point they represent for traditional learning environments, giving rise to virtual learning and blended learning. In the case of virtual learning, we are referring to online teaching and learning environments delivered via technological platforms [3,4], in the case of blended learning, we are referring to learning environments that combine face-to-face teaching with the use of ICT [5,6,7].

Whether in one type of environment or other, it seems that technologies go hand-in-hand with students who, as digital natives, have developed new study and learning skills and have highlighted the need to open up classrooms to new sources of knowledge and new ways of learning. The main argument that supports the 'net generation' discourse is that through frequent use of technologies students become competent users and this makes them capable of transferring their digital skills to learning with the support of technology. However, most studies suggest that although today's students come to university with some digital skills, the use of digital media for studying might be quite different and the transfer of these skills is not automatic [8,9,10,11]. Moreover, some characteristics, such as their ability to simultaneously process multiple channels of information, can have negative effects.

Some research studies suggest that age differences concerning perceptions and experiences of technology-mediated learning are important, but other demographic characteristics, such as gender [12] and academic discipline [10] may also be important. To account for this broader aspect, an emerging discussion in the literature has been to distinguish between "learning" and "living" technologies [10]. This differentiation suggests that although today's students come to university with a wide repertoire of skills in using digital media, the use of these tools for study might be quite different and the transfer of these skills for learning is not automatic [10,11].

Helsper and Eynon [13] analysed the different aspects of what a digital native is by exploring whether acting like a digital native is determined by age; experience or breadth of use, independently of their age or experience. The conclusion is that the degree of digital expertise is related to the confidence in the use of technologies, the use of the Internet as a first port of call for information and the use of the Internet for learning as well as other activities [13].

Taking into account that the use of technology to support learning in higher education is becoming more and more relevant, the debate must focus on real evidence about students' attitude towards ICT uses for learning purposes. Our study focuses on the analysis of students' ICT uses and perceptions in academic contexts comparing two groups of students: those attending to an online university versus students at traditional universities that provide access to a virtual campus and offer some blended courses.

This paper aims to clarify issues relating to the types of activities that technologies support in everyday and academic life for both groups of students. The initial hypothesis is that the use of technology to support learning is related with the type of actions and tasks being carried out on a daily basis and therefore it is also influenced by the academic learning context, in this case the university model (online or face-to-face/blended).

Methodology

The main research questions of the study are as follows:

1. What kinds of activities are supported by technologies in everyday life and academic life among university students?
2. In which way does the university model (blended or online) affect academic ICT use and preferences of students?
3. How the university model (blended or online) shapes students' perceptions about ICT learning uses?

To respond to these questions we have elaborated and applied a questionnaire to a sample of students from five universities with different characteristics (one of them offers online education and four offer face-to-face with LMS teaching-support environments)[1].

[1] The online university is the Universitat Oberta de Catalunya (UOC) and the traditional/face-to-face universities are the University of Barcelona, the Polytechnic University of Catalonia, the Vic University, and the University of Lleida.

The analyzed population is the total number of students enrolled during the 2010-2011 academic year along their first and fourth years of study at Catalan universities. The final sample of participating students was a total of 1,042 people (error 5 %, confidence interval 95.5 %) and the selection was random.

The independent variables considered in this analysis are: age, gender, university institution of origin (model: virtual or face-to-face), and area of knowledge. The dependent variables considered are:

1. Informal use of ICT: type and perception of competence.
2. Academic use of ICT (teacher-led): type, frequency of use and perception of usefulness.
3. Academic use of ICT (decided by the students).
4. Perception and evaluation of the use of ICT.

The questionnaire, based on the research of Kennedy et al. [10], is divided into two parts, the first is designed to characterize university students' uses of technologies (both in formal and non-formal learning contexts) and the second – based on a Likert-type scale (1-5 values of agreement) – aims to analyze the students' perceptions of the use of ICT in different learning dimensions. To create the second part of the questionnaire, we elaborated a set of indicators of ICT use, from the perspective of its perceived utility for students. In doing so, we tried to represent each of the dimensions or presences proposed by Garrison, Anderson and Archer [14] in the CoI model (cognitive, social and teaching). This framework articulates the processes required for knowledge construction through various forms of "presence", which are teaching, social, and cognitive. However, it's important to take into account that although the same terminology is used, the CoI model was not directly applied in this study. In the formulation of those items we emphasized the role of technology as a mediator of different processes related with teaching and learning in a broad sense; that is to say, either in virtual or blended environments, with different methodological approaches and both led by teachers and decided by students. This resulted in a scale formed of 30 items shown in Table 2.

To analyze the reliability of the scale, Cronbach's Alpha coefficient was applied and the result was 0.944, which shows high reliability. After checking the appropriateness of the scale factor analysis (test of Kaiser-Meyer-Olkin (KMO) = 0,950. Barlett test of sphericity: χ^2 = 17,552, 84; df = 435; $p < 0.001$), and Moreover, the sample size is adequate (+ sample 5 units per item), an exploratory factor analysis (principal component, varimax rotation) was performed. The results show 5 different components that account for 61.9 % of the variability found in the data (Table 1).

Table 1: Perception of ICT uses in academic tasks. Factor analysis

Component		Autovalors inicials			Sumes de les saturacions al quadrat de l'extracció		
		Total	% de la variança	% acumulat	Total	% de la variança	% acumulat
dimension0	1	11.745	39.149	39.149	11.745	39.149	39.149
	2	2.999	9.998	49.147	2.999	9.998	49.147
	3	1.523	5.076	54.223	1.523	5.076	54.223
	4	1.210	4.035	58.258	1.210	4.035	58.258
	5	1.100	3.668	61.926	1.100	3.668	61.926

Table 2: Perception of ICT uses in academic tasks. Factor analysis

	Component				
	1	2	3	4	5
30. ICT help to show me the way I am	.785				
26. ICT help to generate a pleasant atmosphere in the classroom	.778				
28. ICT facilitate my social relationship with the group	.757				
25. ICT help me to explain my problems to the teacher	.717				
27. ICT help me to ask others questions	.702				
23. ICT allow me to express my emotions more freely	.690				
29. ICT allow me to publicly show what I do for the subjects	.671				
24. ICT enable the teacher to pay more attention to us	.636				.406
13. ICT help the teacher to guide the working methodology		.736			
14. ICT allow me to plan my work		.717		.316	
15. ICT allow me to better evaluate my progress in the subject		.626		.513	
17. ICT facilitate the presentation of content		.594	.413		
12. I like teachers to use ICT in the subjects		.540	.428		
16. ICT enhance the pace of work		.538		.399	
20. ICT facilitate the integration of knowledge from different sources		.528			.438
1. ICT help me to gain knowledge related to the subject			.679	.319	
5. I use ICT when I want to know more about a topic			.679		.308
3. ICT help me to do my academic homework faster			.653		
4. ICT help me to do my academic homework better			.622		
2. ICT help me to develop skills related to the subject			.613	.419	
7. ICT allow me to exchange ideas with my colleagues			.494		.464
10. ICT allow me to apply the acquired knowledge				.644	
8. ICT make it easier for me to pass the course				.634	
11. ICT facilitate my self-assessment processes		.310		.623	
9. ICT help me to follow the course			.437	.496	
18. ICT facilitate the diagnosis of my learning mistakes	.362	.431		.476	
22. ICT allow me to better communicate with my teacher	.313				.725
19. ICT help me to receive assistance from the teacher		.350			.668
6. ICT allow me to exchange ideas with my teacher				.436	.628
21. ICT help me to resolve my doubts		.379	.305		.513

The emergent factors are related with the next groups of processes:

1. Social support 1: Communication, expression of emotions and working climate.
2. Didactic support: Introduction and monitoring of content and activities.
3. Cognitive support 1: Efficiency in the development of knowledge and skills.
4. Cognitive support 2: Perception of learning and self-regulation.
5. Social support 2: Teacher and peer support through interaction.

In the following section we present the results obtained from different types of analysis. Firstly, we detail the main characteristics of the sample of students participating in the study. Secondly, using a segmentation analysis (model selection criteria), we present the most characteristic and differentiating features of the two groups of students (one comprised of students from an online university and the other from various traditional face-to-face/blended universities) taking both the independent and dependent variables identified into account. Finally, the analysis focuses on the students' attitudes and perceptions of the use of ICT in the university, in the two groups mentioned earlier. To do this, a Student's t-test analysis was applied.

Analysis of the results

Characterization of the sample

Of the total 1,042 participants in the study, 36.9 % are male and 63.1 % are female. The knowledge areas they are carrying out their studies in are Social Sciences (43.9 %), Technical (25.6 %), Humanities (25.7 %) and Natural Sciences (4.8 %). Of the total number of participants, 74 % are in their first two years of study and 26 % between the third and fifth year. Almost half of them, 45 %, also work.

In general, the level of access to technologies is high. The majority of the students typically connect to the Internet in their usual place of residence (77.7 %), followed by the family home (47.3 %), the workplace (36.9 %) and the university (30.9 %). The frequency of connection to the Internet is more than once a day in 82.9 % of cases and 13.5 % connect just once a day. Only 3.6 % connect to the Internet less frequently.

Emerging differences between virtual and face-to-face/blended universities

By using a segmentation analysis model criteria (program spad, descriptive analysis, based on a chi-square) we present the most characteristic and differentiating features of the two groups of students, taking both the dependent variables

previously mentioned into account. Segmentation refers to the process of partitioning a population into sub-groups according with the criterion variable. Treating the information in this way allows us to detect the most characteristic and distinctive features of each group. We should highlight that what appears most associated with one group are not the characteristics presented by all of the components, nor are they only ones, instead they are the characteristics that emerge as differentiating features of one group compared with the other in a statistically significant way (in this case, $p < .001$).

With regards the profile of students at the online university, a feature that stands out is that many are studying social sciences, are over the age of 23, have computer equipment, connect to the Internet regularly and work. The students in face-to-face/blended environments are studying natural sciences and technical subjects, are under the age of 22 and do not work.

The informal use of ICT (Table 3), not connected to their academic work, identified by each group shows that the students at the virtual university use technologies for mainly informative and educational purposes, while among the students in face-to-face/blended environments the predominant use of technologies is for leisure and communication purposes.

Table 3: Informal use of ICT

Students in face-to-face/blended environments	**Students in online environments**
Daily - Use Internet to chat	Daily - Use Internet to send and receive email
Daily - Use Internet to participate in a social network	Daily - Use Internet to access the virtual campus
Daily - Use Internet to download software/films	Daily - Use Internet to search for information for academic purposes
Daily - Use Internet to listen to music	Daily - Use Internet to search for general information
Daily - Use Internet to stay in contact with friends	Daily - Use Internet to access communication media
Daily - Use Internet to make friends	Daily - Use Internet to read content/ syndicated news
Daily - Use Internet to share mp3 files	Daily - Use Internet to translate texts
Daily - Use a mobile telephone to listen to mp3 files	
Daily - Use a mobile telephone to take photographs or video	
Daily - Use a mobile telephone to play games	
Daily - Use a mobile telephone to make video-calls	
Daily - Use a computer to listen to music	
Daily - Use a computer to play games	

With regards the autonomous ICT use (not teacher-led) in their academic activities (Table 4), what stands out among the online students are less uses and more confined to the tools found in a virtual campus, while among the students in face-to-face/blended environments we see greater diversity in the use of technologies. This may be due to the great dispersion and diversity among the approaches used by the four face-to-face/blended universities that we are considering as part of the same group.

Table 4: ICT uses in academic tasks

Students in face-to-face/blended environments	**Students in online environments**
I use social networks in my academic work	I use forums in my academic work
I use information repositories in my academic work	I use blogs in my academic work
I use a mobile telephone in my academic work	
I use YouTube in my academic work	
I use online documents (Google Docs) in my academic work	

With regards the students' use of ICT at their teachers' suggestion (Table 4), we see that the online students make frequent use of a greater number of technologies, with a more clearly educational use and one associated with Web 2.0 than in the case of students in face-to-face/blended environments.

Table 4: Teachers' led ICT uses

Students in face-to-face/blended environments	**Students in online environments**
Frequently - Use of virtual campus	Always - Use of virtual campus
Always - Use of mobile telephone	Always - Use of repositories
Always – Social networks	Always - Use of forums
Always - MP3/MP4	Always - Use of Google Docs
Always – YouTube	Always - Use of Internet searches
	Always - Use of wikis
	Always - Use of blogs

Finally, the perception of competence in informal uses of ICT is also different and coherent with the previously described uses. Among the students in the virtual environment we can see greater perceived competence in the use of most technologies, while among the students in face-to-face/blended environments there is a perception of having an average level of competence. Moreover, very different uses of technologies appear once again between both groups.

Students' perception of ICT uses regarding different dimensions of teaching and learning

In this section we present the results about the students' perception of the use of technologies by comparing both groups with regards to each one of the dimensions or components previously identified. The next charts show the comparison between the mean values for the level of agreement (from 1 to 5: totally disagree, disagree, neither agree nor disagree, agree, totally agree) expressed by the students regarding ICT usefulness. Each chart corresponds to one component.

For uses included in component 1 (social support 1) the Figure 1 shows that agreement with the assertions is higher between students in the online university, especially regarding communication with peers and social outreach. It's important to take into account that face-to-face/blended students are close to disagreeing with the assertions.

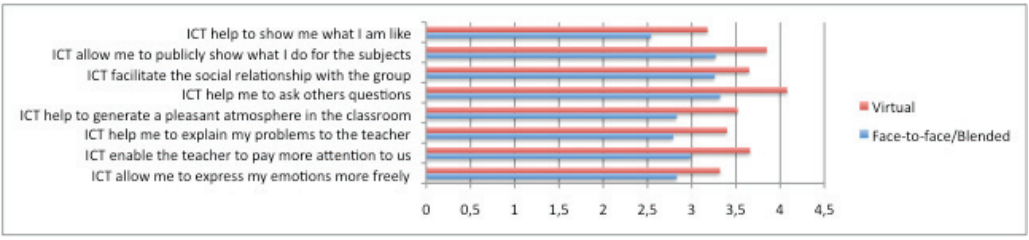

Figure 1. Perception of ICT uses in virtual and face-to-face/blended contexts. Social support 1

The perception of usefulness of ICT regarding the component 2 (didactic support) is quite high in both groups although it is notably higher among the students at the online university in a quite homogeneous way (Figure 2).

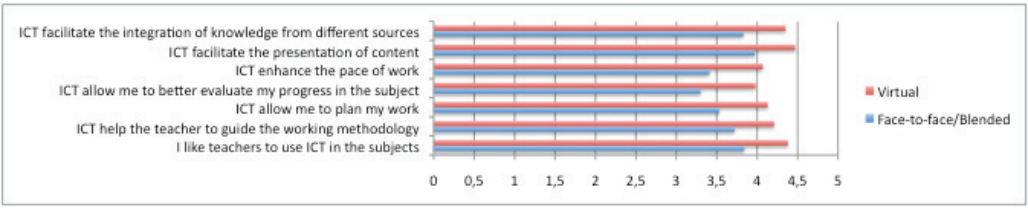

Figure 2. Perception of ICT uses in virtual and face-to-face/blended contexts. Didactic support

In the case of the component 3 (cognitive support 1) the level of agreement is very high in both groups except for the assertion "*ICT help me to do my homework better*", where the level of agreement of online students is quite lower than in the other group (Figure 3).

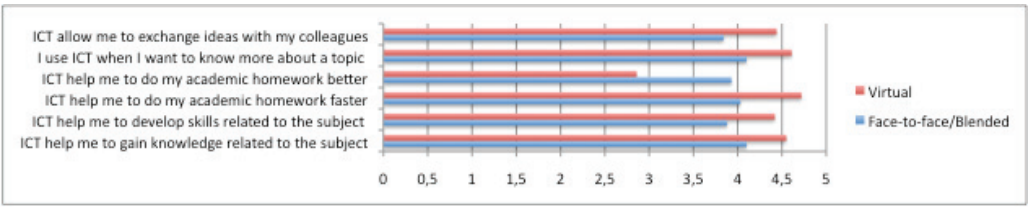

Figure 3. Perception of ICT uses in virtual and face-to-face/blended contexts. Cognitive support 1

Component 4, related to students' perception of learning and self-regulation issues, registers very high levels of agreement in both groups and especially in the case of students in the online model.

With regards to social support 2, considering interaction with the teacher or with peers, we can see the same situation again. All ratings are quite high in general, but the students at the online university express a higher level of agreement than the other group.

Finally, in order to confirm the statistical significance of these differences, a Student's t-test has been applied in order to compare the perception of ICT use between both groups of students regarding the university model (face-to-face/blended and online) for each of the 5 emergent components. The results (in Table 5) show significant differences between both groups in all components except for the third one (marked in red), corresponding with cognitive support 1 (efficiency in the development of knowledge and skills). The mean values allow us to confirm that the differences point to higher values in the responses by students at the virtual university.

Table 5: Students' perception of ICT uses in virtual and face-to-face/blended universities. Student t-test results.

Components	**T-Student**	**Virtual univ. (factorial mean score)**	**Blended univ. (factorial mean score)**
1. Social support 1	(t (1,040) = 4.942; p<0.001)	0.329	-0.070
2. Didactic support	(t (1,040) = 4.641; p<0.001)	0.309	-0.065
3. Cognitive support 1	*(t (1,040) = -0.653; p>0.05)*	*-0.044*	*0.009*
4. Cognitive support 2	(t (1,040) = 8.654; p<0.001)	0.563	-0.119
5. Social support 2	(t (1,040) = 9.476; p<0.001)	0.613	-0.130

Discussion and conclusions

This research confirms many of the general points found in studies outside of Spain in relation to the level of technology access and use. Students use mainly the Internet to search for information and their universities' virtual campuses as a gateway to the learning material for their courses [15,16]. They perceive themselves as fairly competent in most areas (communication, creation, etc.) although the data do not indicate that these competences are necessarily reflected in their regular performance of academic tasks, which is much more restricted.

Out of the academic context, general types of technology (computers, mobile telephones and the Internet) are used for rapid communication and convenient access to services and information. However, if we look beyond these technologies and well-established tools, we find considerable variation in patterns of access, use and preference for a wide range of different technologies [10]. This evidence seems to suggest that although most university students have a basic set of technological abilities, these do not necessarily translate into sophisticated skills in the use of other technologies or information literacy in general.

Although access to and use of ICT is widespread, the influence of university model seems to be an important factor to take into account. For academic purposes, students seem to respond to the requirements of their courses, programmes and universities. In all cases, there is a clear relationship between the students' perception of usefulness regarding certain ICT resources and the teachers' suggested uses of technologies. The most highly rated technologies correspond with those proposed by teachers. Here we concur with the study by Margaryan and Littlejohn [17], which argues that there is little variety in the use of ICT for learning and that these uses are conditioned by teachers' suggestions.

On the other hand, there are differences between students at face-to-face/blended universities and at online universities, both in terms of technology use, levels of perceived competence and utility in these uses. While the students in virtual environments use technologies mainly for informative and educational purposes, students in face-to-face/blended environments tend to use ICT for leisure and communication. Furthermore, the results obtained demonstrate significant differences between the online students and those at face-to-face and blended universities. The perception of ICT support from the cognitive, social and didactic perspective is generally more positive among the students at the virtual university. It could be argued that the results are connected to the fact that online students are heavily dependent on ICT in order to do their courses, however it is interesting to note that differences are not significance regarding the perception of effectiveness in ICT support in developing knowledge and skills. Moreover, greater

use of technology in academic settings seems to condition the students' informal use and not just the reverse.

It is also interesting to remark that social dimension in component 2 (related to general communication, expression of emotions and working climate) is valued lower than the other dimensions by both groups of students. It remains to be found out if the reason is their minor interest in this kind of ICT support during learning processes or the lack of adequacy of university virtual environments to bring support to these social aspects.

The results obtained cannot favour the idea of online learning environments being superior to blended learning environments in terms of development of students' digital competence, as more research should be carried out into the educational model used in the different universities. However they do lead us to suggest the need to consider that technology-rich learning environments foster students' digital competencies (and not the other way round). Namely, it seems that we shouldn't rely on students' digital competences to foster ICT supported learning practices at the university.

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