THE DIGITAL DIVIDE AMONG UNIVERSITY FRESHMEN

Associate Prof. Dr. Carmen Ricoy
Corresponding Author:
Faculty of Education, University of Vigo (Spain)
Avd / Castelao, s / n 32004 Ourense, Spain. Email: cricoy@uvigo.es

Associate Prof. Dr. Tiberio Feliz
Faculty of Education, National University of Distance Education (Spain)
tfeliz@edu.uned.es

Prof. Maria João Couto
Faculty of Education, University of Vigo (Spain)
mjoaocouto@uvigo.es

ABSTRACT
Use of new technologies in university training is an ongoing reality today. However, the inequalities that exist among university students are the source of an important problem. Such inequalities need to be detected and analyzed and therefore a study of college freshmen can be very valuable. This qualitative study intends to analyze the digital divide of such freshmen by using techno-autobiographies, i.e.; the students' account of their situation. A total of 91 such students from the University of Vigo, Spain, participated in this research. Results obtained show the presence of asymmetries in the use of ICTs and indicate the presence of a digital divide. Such inequalities with respect to technology imply fewer ICT resources for some of these newcomers and difficulties to access the Internet. Worth highlighting is the fact that not all university freshmen use digital technology in a standardized manner for academic purposes but they nevertheless use such technology more frequently for private purposes.

INTRODUCTION
Within the Spanish university context, the teaching methodology needed to adapt to the European Higher Education Area (EHEA) requires the integration of Information and Communications Technologies (ICTs) into the training process. Salmon and Jones (2004) sustain that the inclusion of ICT in syllabi acts as a driving force for learning and brings about educative innovation. Research into ICTs is found at the different educational levels, is derived from innovative experiences and highlights the relevance of ICTs for collection and dissemination of information, communications within the educational community, online collaboration, etc. Cavusa and Kanbulb (2010) indicated some of the advantages of using e-learning platforms such as for sending and receiving work/ exercises, providing immediate feedback in tests, communicating with teachers and other colleagues, accessing training information and carrying out collaborative work. Other authors pointed to the importance of ICTs to follow-up learning, develop communications and plan the teaching process (Cavus, 2010; Lonn and Teasley, 2009).

An analysis of the available ICT resources, their usefulness and the training needs of students can provide important information to teachers, the scientific community, institutions and politicians. Of special interest to the development of the training process, is the adaptation of methodological strategies to incorporate ICTs, in order to respond to the expectations and demands of contemporary society.

This study researches the digital divide of university freshmen with respect to obstacles experienced by them for using ICTs. The central objectives of this study are as follows:
  · Identification of ICT resources available to students for training and personal use.
  · Identification of nature of ICT use by students; whether academic or personal.

What is already known about this topic:
  • ICTs have a transformation potential that can contribute to reducing social, cultural and economic inequalities.
  • Insight into student's literacy with ICT can be a starting point to gauge their level of digital competences and to explore or learn about the influence of such competences both at academic and personal levels.

What this paper adds:
  • A digital divide has been found among university freshmen within the context that has been analyzed.
  • The inequalities faced by university students towards technology are evident when we look at the scarce ICT resources available to some of them and what they are used for.

Implications for practice and/or policy:
- • In order to be able to define teaching strategies and integrate ICTs within an academic setting, one must first detect and analyze the presence of such digital divide among students.
- • University institutions should reinforce their available ICT resources and dynamics in order to minimize the handicap that arises from such digital divide.

RELEVANT LITERATURE

Digital divide is known to be linked with digital literacy and the limitations experienced by people in the use of ICTs. For the UNESCO (2008), digital competence comprises mastery of the several capacities of students to search, select, analyze and evaluate information rather than just technical operation of technological equipment. This means that they must be creative and efficient at using digital tools, communicate and collaborate with other people, and produce and publish materials and information. They must also be able to solve problems, make decisions through technology, be responsible and contribute to enriching the knowledge society.

The Organization for Economic Co-Operation and Development (OECD, 2001) defines the concept of "Digital Divide" as the inequality of access to ICTs among geographic areas and people from different socio-economic levels. A double dimension is therefore accepted, i.e., socio-economic and territorial. Zhang, Wang and Kolodinsky (2010) widen the scope of this expression to the skills needed for effective and real use of ICTs. Archibugi and Coco (2004; 2005) suggest the creation of digital divide indicators by analyzing: creation of technology, existing digital structures and development of abilities for using the same, at the local scale. Cantwell and Iammarino (2003) considered regions as important study areas for the digital proficiency of people.

Digital divide is a problem that affects students from all over the world to a greater or lesser extent. Therefore, scientists have tried to analyze this phenomenon at different stages of a student's life in an attempt to discover the underlying problems and seek explanations and possible solutions. For example, Waycott, Bennett, Kennedy, Dalgarno and Gray (2010) identified differences in the use of technology in higher education and in the daily lives of teachers and students in Australia. They justified such differences based on individual motivations and social norms that promote the use of ICTs. The study revealed that teachers are the ones who most resist use of ICTs as against students who are receptive and enthusiastic. The study also showed that teachers mostly focused on using ICTs for institutional matters and pedagogic application while students used the same to organize their social life.

For Edmunds, Thorpe and Conole (2012), researching into students' experience with ICTs is a valid method to explore the influence and the attitudes related to their use in academic, social and leisure contexts. They also state that an analysis of the use of ICTs by students and their interactions can contribute to the future use of ICTs in apprenticeships. This study also provides an insight into the student's previous knowledge and can be a starting point to channel the development of innovative methodological strategies.

Even though Goode (2010) affirms that ICTs are part and parcel of the daily life of university students in the USA, their findings however indicated the presence of differences associated with technological skills. The study pointed to the need for incorporating teaching and policy dynamics in order to permit higher education students receive training through the integration of ICTs. It furthermore indicates that institutions should be the ones responsible for providing such ICT support.

THE STUDY

This research followed a qualitative methodology wherein information was collected as techno-autobiographies of students from two degree programs and also through a virtual forum that lasted one month. Students from other degree programs were also interviewed. Based on the ideas of Watulak Lohnes (2012), the discourses and social constructs of experience were considered to be useful for knowing and understanding the different perceptions, through the particularities that make up the life of human groups in specific contexts.

Due to space constraints, the work presented herein focused on students from two classrooms, as sub-cases (Stake, 1995). It was framed within the perspective of *narrative inquiry* through techno-autobiographies. This narrative technique permits students to describe their previous experiences on a specific subject or problem, which is the purpose of the study. In this sense, Swindells (1995) states that such narration permits the creation of space for the protagonists themselves in which their voices can be heard, however, the researcher should take on an important role in the analysis of the information and the interpretation of results. The strategic

methodology used places emphasis mainly on the descriptive and interpretative facets in order to provide a comprehensive vision of the reality through the eyes of the protagonists.

Research context and participants

The study was part of a research project undertaken by the University of Vigo, located in the NW of the Iberian Peninsula. This institution was created in 1990 and is regionally organized into three university campuses, located in the cities of Ourense, Pontevedra and Vigo (Spain). It has modern facilities and infrastructures are still being expanded and consolidated. The University has state-of-the art technological devices and offers the university community Internet connection through cable and wifi on campus premises. Even though such equipment can generally still be improved, it is nevertheless quite appropriate for carrying out teaching and research activities.

Ninety-one first year students registered in the University of Vigo (academic year 2012-2013) participated in the recording of the techno-autobiographies. In September 2012, students from two degree programs from the Faculty of Education Sciences also joined the study. These were students of *Technological Resources in Social Education* and *New Technologies Applied to Pre-School Education* (from the *Social Education* and *Pre-School Education* degrees respectively). There were 79 females and 12 males aged between 18 and 46 years (Table 1), whose average age was 21 years. The number of female participants was by far higher than male participants. This is because education studies in Spain are mostly chosen by female students.

Table 1. Age and gender distribution of the participants

Age	18		19		20		21		22		23		24		25		38		46		Total
Sex	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	
Frequency	23	2	14	2	11	1	12	1	7	4	7	0	2	0	0	1	2	1	1	0	
Total	25		16		12		13		11		7		2		1		3		1		91
Per cent	27,5		17,6		13,2		14,3		12,1		7,7		2,2		1,1		3,3		1,1		100%

Legend: M = Male; F = Female

Data collection and analysis

One of the researchers of the project, who is also a teacher in the said disciplines, promoted the development of reflexive narrations from students through techno-biographies, in which students talked about their individual experiences with the use of ICTs and the problems experienced within their academic and personal fields. This was done with a two-fold objective (students were informed of the same), namely; to obtain insight into the initial level of use of ICTs and ascertain the presence of digital divide. Students prepared their narration privately and away from classrooms. The techno-autobiographies were first written using a word processor and then submitted by the students via the e-learning platform.

A qualitative analysis was performed based on definition of the different categories of the research objectives. Content analysis facilitated the determination of the different sub-categories derived from both the objectives and the set of information obtained. Such analysis was carried out systematically and in detail following the procedure described in Bardin (2007). The text version of the software *Analysis of Qualitative Data* (6.0) was used for such analysis. This program furthermore permits the generation of summary tables which, upon using a spreadsheet, permit the production of figures to show the results obtained. These figures show a preponderance of the obtained sub-categories frequency (f) and percentage (%). The purpose of representing these quantities is illustrative and is aimed at revealing the sub-category trend. It does not intend to emphasize the numerical component because this is a qualitative study.

In order to facilitate comprehension of the data provided, the results section also contains some extracts that exemplify the narrations (R) generated by the student's techno-biographies, and indicates the number attributed to them for analysis purposes, together with the gender and age of each participant (Example: R1, female, 18 years).

RESULTS

Results are shown for the following general categories based on the above mentioned objectives:
- ICT resources available to students.
- What students use ICTs for.

ICT resources available to the student

University students can avail of a variety of ICT resources for their training and personal use. They normally use a desktop computer, a laptop, cell phone, digital camera, audio/ video player and TV (Figure 1).

A small group of students was found to be well versed with technological updates evident from the amount and variety of resources that they had at their disposal for personal use. Some of the participants used more than five new technological devices on a daily basis, which is large within a Spanish context. Besides the above, some of them also had access to smart phones, tablets, e-readers, GPS's and videogames consoles.
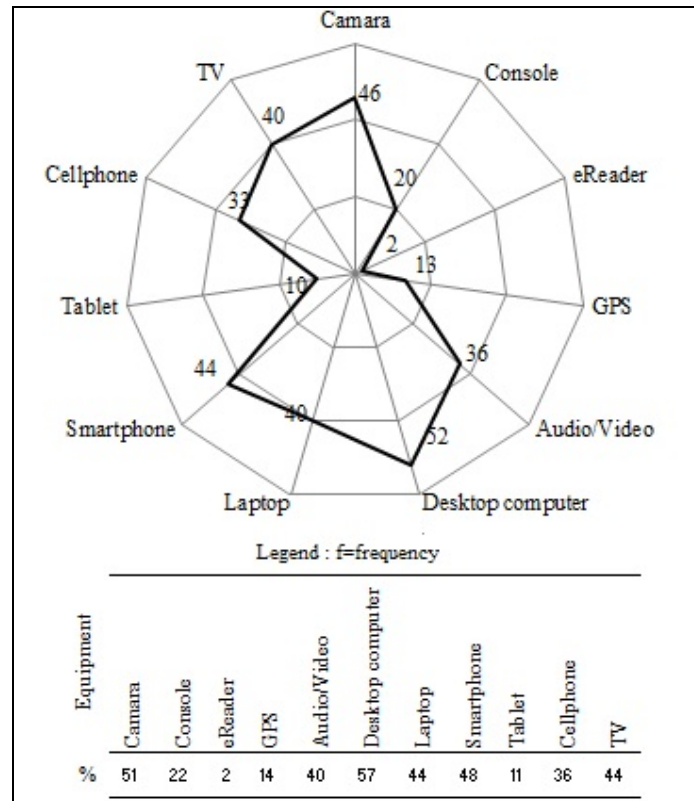

Figure 1. ICT devices that students have

The narration of some students is reproduced hereunder:

"I currently have a computer, a cell phone, a videogames console and I furthermore share 2 TVs at home with my family. The device I use most is my computer because I can use it for many things such as searching information on the Internet, doing academic work, accessing my social networks and playing games." [R_{35}, male, 18 years]

"Later on I began using a laptop for class and academic work, and my e-reader to look at study books and articles. There are 3 TVs at home which we share among family members, and a desktop computer, two laptops, two cameras (one digital and another analog), one e-reader and my Smartphone." [R_1, female, 18 years]

Some students feel that the knowledge demands of the ICT resources are proportional to the possibilities they offer in return. Students associate state-of-the art equipments with high economic cost. In fact, most students state that ICTs are beyond their reach. They also mention their shortfalls in mastering certain technical skills needed to operate some devices and their economic limitations to access the Internet. These aspects point to digital divide indicators which are substantial obstacles for university students. The following extract shows a student explaining her problem:

"I usually use the computer, social networks and the cell phone. I use the wifi connection available on campus because we cannot afford Internet connection at home. This creates problems academically because when I need to do some academic work through the Internet, I have to do so in the library or in areas with free wifi access." [R_{41}, female, 20 years]

Generally speaking, only middle to upper class families can afford to purchase the latest technology in Spain. It is quite uncommon for students to have access to the latest devices both at institutional and personal levels since they are beyond their economic reach. This in turn negatively affects the level of digital skills acquired. These aspects also point to the presence of digital divide in higher education students.

Use of ICTs by students
The results obtained generally show that university freshmen have a good technical command for handling the different ICT equipment. They normally use a variety of digital applications, different softwares and diverse virtual scenarios. In as far as software and digital applications are concerned, they present different intensities and experiences insofar as the students' academic and private lives are concerned (Figure 2). An extract taken from the techno-autobiography of one of the students is reproduced below as an illustrative example:

"My experience with new technologies in the academic field is basically related to preparing work for university such as the creation of videos, power point presentations, blogs, web pages, etc. For example, in one subject, students created a blog for the class in which we pasted links to news, images, films, etc. At other times, we presented our class assignments using power point, and did activities with Photoshop, Word, Excel…" [R$_4$, female, 18 years]

Worth highlighting is that one group of participants only had limited experience in the use of ICTs. The main reasons were the few activities they did using ICTs at school and problems to access the Internet. In fact, inequality among students becomes evident with respect to type and amount of ICT resources used and the heterogeneity expressed in the use of the same.

Students revealed that the activities they carried out in the university context were related to performing several tasks, which at times required Internet connection. They linked such tasks with information search, publication of content, translations, work performed on the e-learning platform, consulting their exam results and administrative tasks such as registration and formalization of their university enrolment. The applications for which they did not require Internet connection were text edition, creation of videos, presentation of assignments in the classroom and spreadsheets (Figure 2).

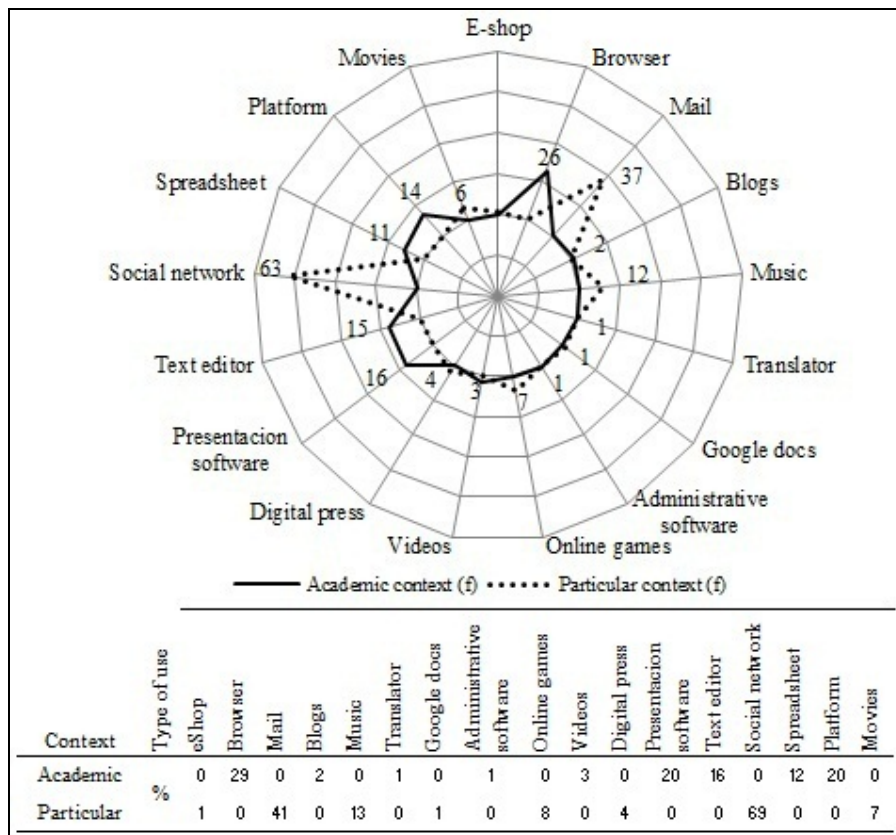| Context	Type of use	eShop	Browser	Mail	Blogs	Music	Translator	Google docs	Administrative software	Online games	Videos	Digital press	Presentacion software	Text editor	Social network	spreadsheet	Platform	Movies
Academic	%	0	29	0	2	0	1	0	1	0	3	0	20	16	0	12	20	0
Particular		1	0	41	0	13	0	1	0	8	0	4	0	0	69	0	0	7

Figure 2. ICT devices that students have

At a personal level, students associated ICTs mainly with leisure activities and connection to the Internet. They highlighted use of the Internet for communicating with family and friends (through email and social networks), downloading and listening to music, watching films and playing games online and for reading newspapers (Figure 2). The results show that students prefer to use some digital applications for communications but not for academic use. These facts point to asymmetries in the use of ICTs on the personal and academic fronts. And therefore, digital divide becomes more pronounced in the academic use of ICTs.

CONCLUSIONS AND DISCUSSION

Within a Spanish context, the results presented in this paper point to the presence of digital divide indicators among students that have just joined university. Several inequalities between students were observed insofar as the amount and diversity of ICTs used by them. This consequently affected the type of activities they performed with such ICTs. There is therefore a need to introduce palliative measures to boost a generalized use of such technology with a view to avoiding negative effects in academic training. Brown and Czerniewicz (2010) state that the so-called "digital natives" are an elite lot because of their familiarity and experience in the use of ICTs rather than because of their age. Lohnes Watulak (2012), on the other hand, feels that we will be able to increase the number of ICT users by reducing the tension experienced when they have problems using ICTs.

Most students own several digital devices and use them with great ease both for academic and private purposes. However, the study reveals that a small group of people have economic limitations for acquiring such devices while another group lacks digital competence. Goode (2010) alerts about the high costs of technologies and states that students who do not have enough resources and experience would probably lose out on training opportunities. Such conclusion can be extended to university freshmen from our study since they do not have a standardized use of ICTs. Therefore teachers must provide strategies to students in order to orient training via supporting tools that will help them to train in both academic and digital contexts (Hwang, Chu, Lin and Tsai, 2011). In like manner, university institutions should in great measure provide initiatives to ameliorate inequalities between students by providing provisional loans of digital mobile devices, increasing class times, increasing quality and bandwidth of the Internet signal, etc. Students should also be given supplementary digital lessons in order to reduce currently existing asymmetries.

The study revealed that college freshmen use some digital applications (social networks and email) for personal purposes but do not use them for academic purposes. To that end, Terras and Ramsay (2012) state that the use of ICTs can stimulate both formal and informal learning. This study has generally revealed asymmetries in the use of social networks: presence within personal contexts but absence within academic contexts. The same trend was also observed in a study carried out on university students in Russia and Germany (Porshnev and Giest, 2012).

ACKNOWLEDGEMENTS

REFERENCES

Archibugi, D. & Coco, A. (2004). *New Indicator of Technological Capabilities for Developed and Developing Countries (ArCo). CEIS Working Paper 44* [WWW document]. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=487344

Archibugi, D. & Coco, A. (2005). Measuring technological capabilities at the country level: A survey and a menu for choice. *Research Policy*, *34*(2), 75–194.

Bardin, L. (1977 1st edn, 2007 1st edn quadrige). *L'analyse du contenu*. Paris: PUF.

Brown, C. & Czerniewicz, L. (2010). Debunking the "Digital Native": Beyond digital apartheid, towards digital democracy. *Journal of Computer Assisted Learning*, *26*(5), 357-369.

Brown, G. & Yule, G. (1998). *Discourse analysis*. Cambridge: University Press.

Cantwell, J. & Iammarino, S. (2003). *Multinational corporations and European Regional systems of innovation*. London: Routledge.

Cavus, N. (2010). The evaluation of learning management systems using an artificial intelligence fuzzy logic algorithm. *Advances in Engineering Software*, *41*(2), 248-254.

Cavusa, N. & Kanbulb, S. (2010). Designation of Web 2.0 tools expected by the students on technology-based learning environment. *Procedia Social and Behavioral Sciences*, *2*, 5824-5829.

Edmunds, R., Thorpe, M. & Conole, G. (2012). Student attitudes towards and use of ICT in course study, work and social activity: A technology acceptance model approach. *British Journal of Educational Technology*, *43*(1), 71-84.

Goode, J. (2010). Mind the gap: The digital dimension of college access. *The Journal of Higher Education*, 81, 5, 583-618.

Henwood, F., Kennedy, H. & Miller, N. (2001). *Cyborg lives? women's technobiographies.* York: Raw Nerve Books.

Hwang, G., Chu, H., Lin, Y. & Tsai, C. (2011). A knowledge acquisition approach to developing mindtools for organizing and sharing differentiating knowledge in a ubiquitous learning environment. *Computers and Education*, *57*(1), 1368-1377.

Lohnes Watulak, S. (2012). I'm not a computer person: Negotiating participation in academic discourses. *British Journal of Educational Technology*, *43*(1), 109-118.

Lonn, S. & Teasley, S. D. (2009). Saving time or innovating practice: Investigating perceptions and uses of learning management systems. *Computers & Education, 53*(3), 686-694.

OECD (2001). Understanding the digital divide. Paris: Organisation for Economic Co-operation and Development.

Porshnev, A. & Geist, H. (2012). University students' use of information and communication technologies in Russia: A focus on learning and everyday life. *Seminar.net*, *8*(1), 27-53. Retrieved from http://seminar.net/index.php/component/content/article/75-current-issue/184-university-students-use-of-information-and-communication-technologies-ict-in-russia-a-focus-on-learning-and-everyday-life-

Salmon, D. & Jones, M. (2004). Higher education staff experiences of using web-based learning technologies. *Educational Technology and Society, 7*(1), 107-114.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks: Sage Publications.

Swindells, J. (1995). *Introduction. The uses of autobiography.* London: Taylor and Francis.

Terras, M. M. & Ramsay, J. (2012). The five central psychological challenges facing effective mobile learning. *British Journal of Educational Technology, 43*(5), 820-832.

UNESCO (2008). *ICT competency standards for teachers*. Retrieved from http://unesdoc.unesco.org/images/0015/001562/156210e.pdf

Watulak Lohnes, S. (2012). I'm not a computer person': Negotiating participation in academic discourses. *British Journal of Educational Technolog, 43*(1), 109-118.

Waycott, J., Bennett, S., Kennedy, G., Dalgarno, B. & Gray, K. (2010). Digital divides? student and staff perceptions of information and communication technologies. *Computers & Education*, *54*(4), 1202-1211.

Zhang, G., Wang, Q. & Kolodinsky, J. (2010). The digital divide in Internet information searching: A double-hurdle model analysis of household data from Vermont. *First Monday*, 15, 11. Retrieved from http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/3118/2649