How do University Students Approach Digital Technologies: Empirical Results and Theoretical Considerations

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Abstract. One of the consequences of the current wave of changes in information and communication technologies is the development of an intergenerational digital divide, that is taking place between "digital natives" and "digital immigrants". In this paper we present the result of a research performed during the course of 2008 to study styles of media consumption and usage among university students. The methodology was based on a mix of quantitative and qualitative approaches. A survey research was done, on a sample of 1186 students of the University of Milan-Bicocca, based on a questionnaire administrated through the Intranet of the University. A series of focus groups and in depth interviews with students, parents, and new media experts was furthermore performed. The results are consistent with the presence of a strong intergenerational divide. The implications of the results for the future organization of educative systems are discussed in the paper.

Keywords: digital natives, digital immigrants, social networks, education

1 Introduction

The strong transformative power of information and communication technologies, that lies at the basis of the development of the "Knowledge Society", is more and more exerting its influence also on fields that are traditionally quite resistant to changes, such as education. This raises many relevant issues, specifically linked to the need to find a correct balance between tradition and innovation; old models and

processes of knowledge transmission through generations have to be somehow adapted to a new situation, one in which digital technologies are modifying *"... not only the speed at which people deal with and manage information but also how they eventually transform it into knowledge"* [1].

The issues at stake are manifold, and will probably grow in relevance in the next future. One of the ways in which we can try to address this complex issue is by making reference to the concept of intergenerational digital divide. This refers to the fact that, as Papert [2] pointed out in *The Connected Family*, digital technologies can create a deep gap between generations, as long as ways of accessing, using and transmitting knowledge are concerned. Papert underlined the fact that, given their style of "enlarged communication" [3] and their strong technological alphabetization, the Digital Kids (i.e. children that grow up in societies where Internet connections, mobile phones and videogame consoles are readily available) were likely to develop communicative practices and attitudes radically different from those of their parents and teachers. In other words, referring to a well known classification developed by Prensky [4], this intergenerational divide is based on the contraposition between "digital natives" and "digital immigrants". While "digital natives" show a growing enthusiasm for computers and digital technology, this enthusiasm often scares teachers, parents and scholars.

Digital natives, says Prensky, communicate and learn more through the mediation of digital tools, such as computers, video games or online encyclopedias, and this "extended digital environment" often represents their natural learning environment [5, 6]. The diffusion of network technologies and social networking is further emphasizing this phenomenon [1]. On the other side, digital immigrants, more used to make reference to traditional tools such as books and libraries, can have some difficulties in fully understanding the potential of digital technologies in the training field. This not only can result in a diminished efficiency of training processes overall, but can in turn have also dangerous negative effects on a motivational ground, as long as there is the risk of creating a sort of discrepancy between the ways in which learning and communication take place in ordinary life and the ways in which learning and communication take place in formal training environments. This does not hold only for kids and pupils, but it concerns every level of education, as long as also University students have more and more to be considered as digital natives [7]. This is an important element of consideration for all people involved in the educational sector, but how is it possible to assess the plausibility of this type of scenarios?

The first point to underscore is the fact that many different empirical studies have, especially in the last few years, brought relevant evidence in support of Prensky's thesis. For example, a recent research of the U.S. National School Boards Association (NSBA) [8] shows how the number of hours spent at the computer by pupils and college students has now equaled the amount of time spent at watching television; moreover, a significant proportion of this time is not used only for video gaming and purely recreational ends, but also for educational activities such as "studying" or "creating and sharing content". According to NSBA data, the 59% of children and college students interviewed uses the Internet to download or search for texts and educational content and to find information or news related to teaching, while the 50% uses the network as an extension of the group work done at school: to "do the

homework", to connect to virtual classes, to realize collective online works, to receive tutorship and assistance from teachers. Digital natives are more and more using the web also to socialize and as a way of self expression: more than 37% of them update their site every week, the 30% have a blog and the 17% post a new content in it at least once in a week.

What are the possible consequences of this kind of developments, as long as training processes are concerned? According to the most current literature, this increasing rate of usage of digital technologies can translate into a learning process that bears many differences with the traditional, "analogic", one. Some authors point to the existence of a real "anthropological" difference [9] that specifically characterizes the digital natives students of the multicultural and globalized informational society [10,11], as compared with the preceding generation. A new generation of adolescents and students is growing, who are not only characterized by a strong cultural hybridization, but are also "structural technological symbionts" [9], as long as they are getting used to consider digital technologies as a natural extension of their physical abilities.

If this is true, the need to investigate and understand how this phenomenon occurs clearly arises, as this mutation can have deep consequences on the way in which our daily life is structured. As was the case with other previous major technological *and* cognitive revolutions - think for example to the invention of printing [12] - the co-evolution between humans and technology can indeed determine the emergence of new cognitive styles and learning attitudes [13]. The generation that has grown up with the PC and the monitor as the privileged ways of accessing to the world in fact already seems to show a series of peculiar learning behaviors [14,15]: in particular, it learns more through screens, icons, sounds, games, and by "surfing" into virtual environments than through words and texts; information and knowledge, moreover, are transmitted more through the constant contact with the network of "peers" rather than in more hierarchical ways. The communication and learning behaviors of digital natives – including those of college students – in synthesis, seem to be characterized by some specific traits: self-expression, customizing, information sharing and the constant reference to peers.

Multitasking is another significant feature that characterizes the way in which digital natives approach digital technologies [16]: it is quite frequent, for example, for young people to chat and listen to music while studying, and at the same time remaining in contact with the group of peers through Messenger or other instrument for social networking. Indeed, digital natives can actually make use of a large amount of social communication tools, that represent the well known features of the so called Web 2.0: from Habbo to My Space, from Facebook to Twitter, from MSN Messenger to FriendFeed, from Slideshare to Linkedin, from YouTube to Wikipedia, not mentioning the blogs.

What are the possible side effects, both on a positive and on a negative level, of such a radical transition? Surely a certain type of "cognitive overload" problem exists, but it is often resolved through the continuous passage from one medium to another, with a conscious zapping between different sources of learning and communication. Unfortunately, no systematic data are available concerning the possible mid and long term consequences of such practices on learning performances. Some preliminary evidence is anyway available for what concerns the overall impact of ICTs on

learning behavior and results. The New Millenium Learner (NML) Project [1], carried out by OECD/CERI on a representative sample of students (age 6-15) of the OECD countries aims to analyze in detail how digital natives learn by using digital technologies. The research, based on a questionnaire that is administered in addition to the questionnaire used for the PISA research, shows how the use of ICTs can significantly and positively influence the educational attainment of young students.

Among other things, the NML research seems to provide evidence of the fact that access to ICT indeed has an impact on learning performances. On average, students who have access or own a computer in fact get 506 PISA points, while the ones who do not own a computer or are unable to access it from home get 478 points (it must be underlined that on the entire sample the average score is 482 and that scores that are above 500 points are considered as good scores). What is even more interesting is that the best scores are obtained by those students who make an intense use of technologies at home and who make a moderate use at school: *"Probably the most important conclusion of all is that the correlation between home use and academic attainment is greater than in the case of school use in most countries, even when allowances are made for the effects of different socio-economic contexts. In particular, students who do not have access to a computer at home tend to be lower achievers than the others and, secondly, it would also seem to be the case that students using computers at home less often had below-average results"* [1, pag.15].

This kind of evidence not only casts some doubts on the actual efficiency of the ways in which ICTs are currently employed at school, but it also raises the need of exploring more in depth the variables that can play a role in producing such results. The research we present in this paper starts exactly from this point; more specifically, it assumes that, when assessing the impact of ICTs on learning processes, we cannot limit ourselves to a mere quantitative assessment of access opportunity or frequency of use, but we must take a more in depth look at the way in which technologies are actually used. The point is that digital natives and digital immigrants may present relevant differences in their general approach to the Net. It is certainly possible to trace back these differences to the fact that natives use these technologies a lot more than immigrants, but this will represent a superficial analysis of the phenomenon. What is more important is the fact that styles of communication and of technological appropriation may be radically different between natives and immigrants. The theoretical basis of our research hypothesis assumes that the natives, living in a learning environment enriched by technology and reconfigured and extended through the integration of different communication and social networking tools, may develop specific communication practices, that can in turn have considerable effects on the overall processes of communication at a social level and particularly on formal college and university education.

2 The research

2.1 Methodology

In order to support, on an empirical ground, the theoretical framework presented above we performed, during the course of 2008, a research on the "medial diet", and

more specifically on styles of media consumption and usage of university students (18-22 years old). The decision of focusing on this particular population, that is not so far from the fifteen years old students involved in the NML project, was driven by two basic reasons. While there are, as already mentioned, some evidences available concerning the relationships between ICTs and pupils and adolescents, there seem to be quite a lack of data focusing on university students. We believe that, in order to get a full picture of how the transition from the Gutenberg generation to the New Millenium Learner can develop, we must take into consideration, with the same level of attention, all the different ages involved. Another reason that is at the basis of our choice is the fact that one of the variables on which we would like to specifically drive our attention was the diffusion and the profiles of use of social networks tools and sites such as Facebook, MySpace, Twitter and so on. As a matter of fact, the development of these type of tools and utilities can be considered, under many different points of view, one of the most interesting features of the current phase of transition from the "old" Internet to the so-called Web 2.0 [17]. As it is well known, and as many statistics available on the Net seem to confirm, on average the use of these type of tools is more diffused among people from 18 to 25 years old.

The methodology of our research was based on a mix of quantitative and qualitative approaches. A survey research was done, on a sample of students of the University of Milan-Bicocca, based on a questionnaire that was accessed through the Intranet of the University. We restricted our analysis to students frequenting First Level Degree Courses: this gave us a total population of 21054 students. To avoid selection sample biases, we choose to administrate the questionnaire when students accessed the Intranet in order to complete their test on informatics, a compulsory examination that all students need to pass if they want to go on in the course of their study (also for this reason, we choose first level students, as older students might already have completed the test). As the students' registration number was recorded, we were able to avoid the possibility of double answers. Moreover, we also controlled if the sample obtained was statistically significant as long as the distribution of students in different faculty was concerned, and we corrected the biases with a second, more focused, administration of the questionnaire. This was done in order to assure that our final sample of 1186 students was representative of the overall population of students.

Some of the students were also involved in a series of focus groups and in-depth interviews, that were performed in order to collect more information on the motivations that make people connect to the Net, the diffusion of different instruments of social networking, the ways in which digital media are replacing traditional ones and so on. To address the theme of the intergenerational digital divide, we also realized a series of focus groups with some students' parents. A different series of focus groups was furthermore performed, involving a set of qualified experts and practitioners operating in the new media sector, that was instrumental in helping us to understand the point of view of people that are currently involved "from the inside" into the current wave of developments.

2.2 Results

The questionnaire was divided in three main parts: a preliminary section, focused on general data concerning the use of digital technologies and the access to the Internet (What kind of technology do students use? Where? When? For how much time, etc.). The second part was specifically focused on the "medial diet": we collected data concerning the usage of different media, both in the "analogic" (books, newspapers, television, radio) and in the "digital" version (e-books, on-line news, web-tv and web-radio, etc.). In the last part of the questionnaire, we specifically focused on a series of tools and platforms for social networking, trying to analyze their diffusion among the population of students and the reasons that lie at the basis of their use.

By comparing the quantitative results drawn from the questionnaire with the evidence arising from the focus groups and the interviews, we can underscore a few relevant points. First of all, as was largely expected, university students use the Internet a lot more than their parents. If we consider the subjects who never or rarely (less than a hour a week) use the Internet we find that only 6,8% of the students fall in this category, compared with almost 40% of the fathers and almost 60% of the mothers. For students, it somehow seems that the usage of Internet is replacing other, more traditional, media: while the 68,7% of our sample connects to the Internet more than 5 hours a week (with more than a student out of four that connects to the Internet for more than 20 hours and another 24,6% who connects between 10 and 20 hours a week), the rate of usage of television and radio is far lower. Almost three students out of four listen to the radio less than five hours a week, with the 31,7% of students listening less than one hour and only the 2,6% listening more than 20 hours a week. The same seems to hold for what concerns television, even if in this case the rates of use are a little bit higher: the 53,8% of the students watch TV less than five hours a week, with more than a student out of ten watching less than one hour and only 4% watching more than 20 hours a week. For what concerns reading, finally, the 13,7% of our students never read a book (except the ones required for studying) and almost a student out of two reads less than 5 books in a year.

Taken together, these results seem to confirm that, even for university students, the computer and the Internet are quickly becoming the preferred media. Evidences coming from the focus groups and the interviews clearly confirmed this point, also adding some more qualifications, in particular for what concerns the digital divide between generations; for example, we think that this excerpt from an interview is highly representative of the type of relationship that some students are developing with their PC: "I think that my all life could be easily confined within a 4x4 square meter room, with a bed, a WC, a little kitchen and a computer… I wouldn't need anything else". On the contrary, many parents have confessed the great difficulties and discomfort encountered when they have to revert, for reasons mainly linked to working necessities, to the use of computers. Quite curiously, one of the points in which discrepancies between students and parents appear more evident is linked to the different use of e-mail and instant messaging: while parents still largely prefer the e-mail, students are more and more shifting towards IM. Indeed, only a student out of four uses the e-mail every day, while more than half of the sample (the 57%) uses IM every day.

Apart from verifying different frequency of use between generations, our research aimed also, as already said, to ascertain what kind of use do students actually do of

digital technologies, and for what reasons. For this reason, we performed a cluster analysis on the data of our questionnaire, seeking to identify some specific sub-groups of student that can be characterized by having the same type of attitude and behaviors. This analysis allowed us to identify three main clusters[1]; the first cluster (26,3% of our sample) gathers together those subjects that we could classify as "active and creative users" of the Internet and of the new technologies. These subjects have high levels of technology and media consumption in all the categories considered. Furthermore, what characterizes them the most, in comparison with the other two clusters, is the high propensity to create content in an active way and to upload new and original contributions on the Net, in particular for what concerns the use of MySpace, the active participation to communities such as YouTube and Wikipedia[2] and the use of blogs.

A second cluster (19,6% of the sample) is made up of those subjects who present a low level of media and technology consumption overall. These subjects tend to use the Internet much less than the other two groups (the weekly hours of connection to the network varies on average between 1 and 5), are more inclined to define themselves as "basic users" or "beginners" and are not so involved in the use of IM. It must also be underscored that these subjects have, on average, a lower level of media consumption, in particular as long as reading books and newspapers is concerned.

The majority of our sample (41,5%) falls anyway into the third cluster, that gathers those subjects who, while showing a high level of media and technology consumption overall (in some cases even significantly higher than those of the first group), have a very low propensity towards the active creation of contents. These subjects show a very intense use of the Internet, especially for what concerns instant messaging services, and show also a strong willingness to take part in online initiatives[3]: what helps to differentiate them with respect to the subjects of the first group is the fact that they show a very low level of creative involvement with the Net. It should be stressed in fact that, for this group, the propensity to upload new content on YouTube and Wikipedia is very low (even lower than that of the subjects included in the second group, characterized as already said by low levels of media consumption and of Internet usage). The most striking difference, anyway, is to be found in relation to the propensity to create new contents on MySpace: while this propensity is shown by nine

[1] It was not possible to include all the case in the cluster analysis due to the high level of "don't know/don't answer" responses to some specific questions. For this reason, the percentages presented in the text do not sum up to 100%.

[2] From our data, it seems that the percentage of subjects connecting to other type of sites, such as Facebook, Twitter, Flickr and Slideshare and so on are quite lower than could have been expected, if looking to similar research performed in other countries or by comparison with data related to other ages (in particular 14-18 years old). It must be taken into consideration, however, that at the time our research started (February 2008) the overall popularity of some of these sites, in Italy, still had to reach its peak and was actually quite low: this holds in particular for Facebook. It is likely that performing the same research now can offer quite different results: actually, we are working at an extension of our initial research design, by involving also students coming from other Universities.

[3] With "online initiatives" we mean for example the involvement in online questionnaire or market analysis, the collection of signatures to support specific causes, the organization of public events and so on.

subjects out of ten, among those included in the first group, the same holds only for the 4% of subjects included in this last cluster.

2.3 Comments

Taken together, the results of our research seem to highlight a few relevant points. First of all, and this was largely expected, there is indeed a strong digital divide between university students and parents for what concerns the frequency and the type of use of digital technologies and of the Internet. This adds to the already available evidence on digital kids and pupils and confirms that the transition from the Gutenberg generation to the New Millenium Learner might be considered in term of a one-shot discontinuity rather than a continuous and graded transition, as all the younger generations seem to be involved in the same way, even with some specific differences, in this process.

The second point to be underlined is linked to the division of our sample in three groups, that has come up from the cluster analysis, and can shed some more lights on the debate concerning the possible consequences of such a pronounced usages of the Net by young people. In particular, the questions at stake here seems to connect with the fact that an increased use of the computer can hamper the creativity and imagination of youngster. Data coming from our research seem to counter this type of arguments, as long as a significant proportion of our sample seem to be actively involved in a creative use of the Internet. This should not lead us to undervalue, anyway, that the majority of subjects still shows a low level of active involvement in the creation and sharing of new contents. The fact that in some cases these subject are also those that spend most of their time connected to the Internet confirm that the most important variable to look at is not the mere frequency of use, but rather the reasons that motivate people to connect.

3 Conclusions

Our research results clearly outline the fact that Italian university students (18-22) have to be structurally considered as digital natives, as long as they strongly prefer going digital to communicate, search for information, listen to music, and also to study and cooperate together. This is clearly displayed, among other things, by the capillary diffusion of instant messaging and other similar tools and by the rising popularity of social networking.

In which way ought formal education systems to adapt their overall training practices in order to match digital native students expectations and needs? It appears quite clearly that the traditional face to face and “books based” style of teaching is out of date, especially if it is taken as the one and only style and it is not complemented also by other, more advanced, practices and methods. Formal education, primary schools, colleges and University will all have to massively introduce digital tools in their curricula, in order to avoid the risk of incurring in a complete loss of interest in formal education by natives and to close the gap between the learning styles of the natives and the training styles of immigrants teachers and professors. This kind of efforts will

surely require massive investments in digital infrastructure (Internet connections, video projectors, interactive whiteboards, etc.) but the hardware alone is not enough.
A reflection on the way of teaching and presenting contents to students is strongly needed if we want to make an efficient use of the real training potential of digital technologies. It is not enough to simply substitute blackboard and chalk with e-books and the Web, if we don't change our pedagogical models accordingly. It is quite evident that the problem is systemic and admits multiple solutions. In the Northern Europe the digitalization of teaching practices is on-going and is progressing somehow faster than in other European countries, as some international reports seem to show [18]; some steps have been taken also in Italy, as long as the digitalization of colleges and University education is concerned, with the identification of a set of steps as the following ones [7]:

a. definition of a global plan to make the formal education go digital through the massive use of open source Learning and Content Management System , to handle the needs of on-line communication of the natives;
b. adoption of international standard (SCORM) for projecting and building Learning Objects (LO) on the different subjects;
c. allocation of financial resources in a plan for teachers and professors training in education technology;
d. setting up of open content repository of LOs and digital curricula, following good practices in this field as the ones defined by the Open University and by the MIT Open Archive Initiative.

Taken together, all this can be interpreted as a sign of a certain kind of dynamism that is finally manifesting itself even into a system, like the Italian one, that is still characterized by much diffidence and that is, as a consequence, lagging behind in comparison with other systems more prone to innovate in this field. Anyway, we strongly believe that the kind of problems we are talking about are global, as they impact on a global level, that is fully independent from national boundaries between States. For this reason, they cannot be left to the individual initiatives of each single Country – what is needed is a global, European solution, that can define a lists of common priorities and guidelines.

References

1. OECD: New Millennium Learners: a Project in Progress. Optimising Learning: Implications of Learning Sciences Research, http://www.oecd.org/dataoecd/39/51/40554230.pdf
2. Papert, S.: The Connected Family: Bridging the Digital Generation Gap. Longstreet Press, Atlanta (1996)
3 Boldizzoni, D., Nacamulli R.C.D.: Oltre l'Aula: Strategie di Formazione nell'Economia della Conoscenza. Apogeo, Milano (2004)
4 Prensky, M.: Digital Natives, Digital Immigrants. On the Horizon, IX (2001)
5 Ferri, P.: La Scuola Digitale: Come le Nuove Tecnologie Cambiano la Formazione. Bruno Mondadori, Milano (2008)

6 Ferri, P., Mantovani S. (eds.): Bambini e Computer. Alla Scoperta delle Nuove Tecnologie a Scuola e in Famiglia. Etas, Milano (2006)
7 Ferri, P.: E-learning. Didattica, Comunicazione e Tecnologie Digitali. Le Monnier, Firenze (2005)
8 National School Boards Association: Creating and Connecting. Research and Guidelines on Online Social — and Educational — Networking, www.nsba.org
9 Longo, G.O.: Il Simbionte. Prove di Umanità Futura. Meltemi, Roma (2003)
10 Castells, M.: The Information Age. Economy, Society and Culture, vol. I: The Rise of Network Society. Blackwell Publishers, Malden (1996)
11 Castells, M.: Flows, Networks, Identities. In: McLaren, P. (ed.) Critical Education in the New Information Age, pp. 37-64. Rowman & Littlefield, New York (1999)
12 Eisenstein, E.L.: The Printing Revolution in Early Modern Europe. Cambridge University Press, Cambridge (1983)
13 De Kerckhove, D.: Brainframes. Technology, Mind and Business. Bosch & Keaning, Utrecht (1991)
14 Veen, W., Vrakking, B.: Homo Zappiens. Growing up in a Digital Age. Network Continuum Education, London (2006)
15 Veen, W.: A New Force for Change. Homo Zappiens. The Learning Citizen 7, 5-7 (2003)
16 Foehr, U.G.: Media Multitasking among American Youth. Prevalence, Predictors and Pairings. Menlo Park, The Henry J. Kaiser Family Foundation (2006)
17 O'Reilly, T.: What Is Web 2.0, Safari Books Online, http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html
18 E-learning Nordic 2006: Uncovering the Impact of ICT on Education in the Nordic Countries, http://itforpedagoger.skolverket.se/digitalAssets/177565_English_eLearningNordic2006.pdf