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Madrid (Spain) 19th - 21st of November, 2012

CONFERENCE PROCEEDINGS

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NEW WORLD, NEW MINDS: CHANGING THE LEARNING PROCESS THROUGH THE USE OF NEW DEVICES

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Abstract

The arrival of new mobile devices has changed the way we perceive and understand the world around us. The ability to connect and interact anytime and anywhere through these devices has changed the way we process the information. These devices have the same functionality as the conventional PCs and have revolutionized the world of telecommunications and therefore the way we communicate. As a result, this new form of technological communication has influenced everything around us; our personal lives, our work and our academic life. The main importance of this technological revolution in education lies not only in content by itself but also in the own technology. The device that provides us the contents determines the manner in which our brain learns. Also, another very important key fact is that the user interface has been altered. In the case of tablets, the typical mouse and keyboard has been replaced by a touch screen. Depending on our student's profile, the touch screen will present a set of advantages (or disadvantages). On the other hand, the population of elderly people and the use of computers and the Internet are both growing at extraordinary rates in the European Union. The potential exists for elderly people to improve their own lives as well as the lives of others by making more use of this technology. However, the elderly are currently among the lowest users of computers and the Internet. In this paper we show how, through the use of new devices, we have instructed elderly from barely use a computer to managing social networks independently.

Keywords: Tablets, Elderly, TICs, Innovation.

1   INTRODUCTION

The rapid increase of the elderly population in Western societies has led to a development of new policies and strategies in order to keep their minds as health as possible. The best path to achieve this aim is trough education. The first World Assembly on Ageing was organized for the first time in Vienna in 1982, with the purpose of establishing the policies on ageing. The "Vienna International Plan of Action on Ageing" included detailed recommendations which can be summarized under five headings: independent living, participation, care, living with self-esteem, and self-realization.

Educators consider learning as an active process leading to the acquisition of knowledge, which is long lasting, measurable, and specific to changes in behavior (OECD 2007). The main function of learning is to encourage the individual to become a problem solver and a critical and creative thinker. Thus, a conclusion that can be deduced from the "Vienna International Plan of Action on Ageing" is that the same education that helps us to develop good citizens can also help us in order to promote an active ageing. This active ageing is essential to provide a good quality of life for this group of people. To educate elderly must be a very innovative process, we can't afford go to the basics (mathematics, language, science, and so on) if the elderly students already know them. Perhaps a training process can be very interesting in order to train their mental skills, but the real fun about learning is to discover things you did not know before. We need to identify needs and cover them. The way to discover theses needs depends on the teacher's pedagogy approach. Following this "technological road" we find the innovation as a way to introduce a new tool in an educational sphere. Innovation is very important, the way people learn is very different from each other. This difference is accentuated when we talk about different generations, so an effective teaching style for university students needs not be efficient for senior's students. A teacher can develop an interesting pedagogical methodology that helps older people to learn new things. However, the instrumentation can be a channel pedagogical favoring the development and integration of these persons. It is important to clarify that the instrumentation is only one educational channel and should never be the center of the educational process.

Rapid advancement of information and communication technologies enables to produce more mobile devices. In using this term we encompass both the ubiquitous mobile (or cellular) phone and also a range of information processing devices ranging from Personal Digital Assistants (PDAs) to more media-orientated gadgets such as Tablets. Technically, we are entering a period of very rapid change for these devices as smaller, faster hardware technologies coincide with development of new applications and also the development in the delivery of Internet access through wireless networks and 3G cellular phone networks. All these devices share the key characteristic of mobility and, to varying degrees, they can process digital data and digital media. Moreover, ever greater numbers of these devices are becoming Internet-enabled. Increasingly, staff and students within educational institutions own and make use of these devices, particularly, in the case of students, in the main target age group of 18 to 24 years. However, the benefits of using these devices on the elderly group can far exceed the opportunities that represent for younger people

That is reason this paper aims to present the experience achieved in a course which made use of tablets for educational purposes in an elderly group. After the course we obtained some interesting conclusions about the importance of the kind of devices used during the learning process. However, the most important fact is that older people have been able to absorb this new technology quickly, dynamically and effectively. It has also been a significant improvement in the learning curve of these people.

1.1 Mobile Devices

Mobility is currently a leading idea for all of the producers in the area of information and telecommunication technologies. In fact, if we check the market, we can observe that most of the new technological devices should be as mobile as possible, but at the same time, they should make our daily life easier. It has an irreversible and viable impact on everyday life, making it much easier and more efficient in terms of productivity.

Figure 1. Mobile devices on the market. [20]

The word 'mobile' stands for the ability to be easily transported. There are several levels of mobility depending on the device's size. For example, laptops (those with a screen greater than 15 inches) and huge communication devices are included inside theses kind of devices even if they provide relatively small level of mobility. These devices are suitable only for transfers. Better mobility is given by mobile machines called PDA (Personal Digital Assistants) or Tablets. The advantages are mainly small dimensions, relatively long working time, instant response to user commands, software and hardware extensibility and communication abilities. Similar devices are called communicators or smartphones. They are cellular phones with sophisticated operating systems that allow to their owners the possibility of downloading a large variety of useful applications. These devices besides the communication services are capable of similar possibilities like PDA.

In 2004, Alan Livingston wrote an interesting article on mobile devices. In this paper he defines them as "being small enough to fit comfortably into a purse, pocket or holster, so you can conveniently keep it with you at all times." Well, he is obviously referring to those devices that provide us a large level of mobility. In Table 1 an interesting classification of these mobile devices depending on their mobility can be appreciated.

Table 1. Classification of mobile devices depending on their mobility.

Mobility	Devices
High	PDA, cell phones, smartphones.
Medium	Tablets, laptops (<= 14 inches screen), notebooks.
Low	Laptops (>14 inches screen).

However, an extensive debate is generated when we try to make an exactly definition of the term "mobile technology". An acceptable hybrid definition built upon several sources is described as 'a portable device which, by using the wireless network, acts as a normal telephone whilst allowing the user to move over a wide area'. Livingston categorizes mobile phones according to their level of sophistication: standard voice-only, Web-enabled, extensible and smartphones. Standard voice-only mobile phones provide a simple form of voice communication and SMS text facilities. Early, Web-enabled phones that use the Wireless Access Protocol (WAP) to gain access to Internet content are being rapidly superseded by extensible phones which can access the Internet and download new software applications, thereby extending the functionality of the phone (Livingston, 2004).

Thus, smartphones are a mobile phone built on a mobile operating system, with more advanced computing capability and connectivity than a feature phone. According to some sources [18] a smartphone is 'generally considered any handheld device that integrates personal information management and mobile phone capabilities in the same device. Often, this includes adding phone functions to already capable PDAs or putting 'smart' capabilities, such as PDA functions, into a mobile phone.' For the purposes of this report we shall use the term smartphone to refer to a mobile phone that includes PDA functionality.

A tablet PC is a wireless, portable personal computer with a touch screen interface. The tablet form factor is typically smaller than a notebook computer but larger than a smartphone. These devices -- which are what that most people mean when they refer to a tablet -- have electronics integrated into the touch screen unit and lack a hardware keyboard. However, external keyboards are available for slate-style tablets. Some keyboards also function as docks for the devices.

Other styles of tablets:

- A convertible tablet (Figure 2-b) typically has a display that rotates 180 degrees and can be folded to close, screen up, over the integrated keyboard. Convertible models may allow user input through a variety of methods in addition to the hardware keyboard, including natural handwriting with a stylus or digital pen and typing through a screen-based software keyboard.

- A hybrid tablet, sometimes referred to as a convertible or hybrid notebook (Figure 2-c), is like a regular notebook but with a removable display that functions independently as a slate.

- A rugged tablet (Figure 2-d) is a slate-like model that is designed to withstand rough handling and extreme conditions. Rugged tablets are usually encased in a protective shell and have shock-protected hard drives.

| (a) | (b) | (c) | (d) |

Figure 2. Different styles of tablets. From the conventional tablets to the laptop-combined-tablets. As it can be appreciated, the mobility is not the same for every style of tablet. It depends on the size and the weight.

There are a set of very specific features that a table should have for learning purposes:

- A big display. Tablets are designed to help consumers enjoy entertainment, surf the Web and engage in other activities that require a larger screen. For learning purposes a big display in order to facilitate the student perception about the contents.

- Applications are an integral component in the tablet experience. Everyday new applications are developed to enjoy their consumers. These applications are low price and they are accessed by millions of people around the world. They extend the device's usability and help keep people interested in the product.

- Suitable design. The already mentioned mobility and how the tablet fit in our hands are key factors from an ergonomic perspective.

- Pricing. The tablet must be accessible by every student. Fortunately there are a lot of these products in the market. The price's competition between companies makes them affordable.

- Mobile connectivity. This is the central appeal of a tablet. After all, tablets are designed to be mobile products people can bring them to their homes or classrooms. Thus, wireless connectivity is the central point to any tablet.

Because of the service's infrastructures and the "online culture" already absorbed, a potential influence of mobile devices on our society is much higher than the traditional computerization was in the 90s. The growth in popularity of mobile Internet is taking place a few times faster than the first phase of the development of access to the Internet on PC computers. Just last year, more mobile devices have been sold than the stationary ones (Figure 3). Therefore we must bear in mind that the tablet space continues to grow. In fact, according to some analyst estimates, tablet makers likely shipped 63 million tablets in 2011.
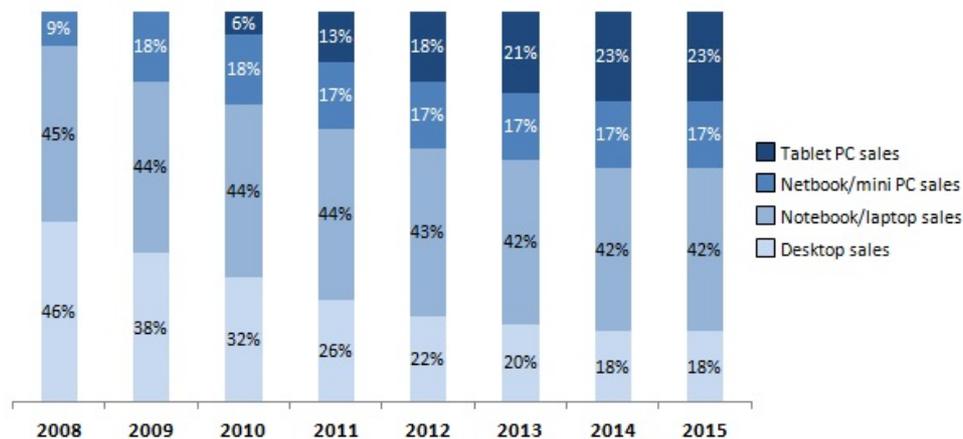

Figure 3. More recently, tablets and smartphones were released and revolutionized respectively the computer and mobile phone industries. Considering development of the tablets market and its strong growth rate, tablets devices might be a quarter of the personal computer market in two or three years from now. [1]

Obviously, any device without appropriate software is not very useful. Teachers who have access to mobile technology are scrambling to find the best education apps for their mobile devices. Educators use apps for everything from communicating with students to inspiring creativity to dissecting virtual frogs. For the next years we will appreciate the revolution of the education trough these device's applications.

1.2 The elderly population

Probably Europe is a good example of the global ageing. As a consequence of the welfare state, different social and cultural phenomena emerged and that situation imposed family and social organization changes, and therefore the need for an adequate answer. These phenomena refer to the work and family life reconciliation. The women incorporation into the labour market, the decrease in birth rate, the delay in youth integration into the workforce and the European people ageing influenced into the creation of a new family model. This situation required the formation of services and resources that cannot be completely undertake by the family as a primary social agent. At this time of economic and social globalization, it becomes increasingly necessary to fix the situation of disparity contexts and social disadvantages such as situations of dependency.

On the other hand, a lot of studies show that during the last decades the rate of population over 65 years has progressively increased. For example, the 2008 Report: Older People in Spain published

by the Ministry of Health and Social Policy shows more than 6% increase of the population over 65 years in 2007, compared to the population of the late 80's. Also this document identified the significant prolongation of life expectancy for people over 80 years which in the early twentieth century was around 0.6%, while the projection for 2040 is that this estimation rises to 9%.
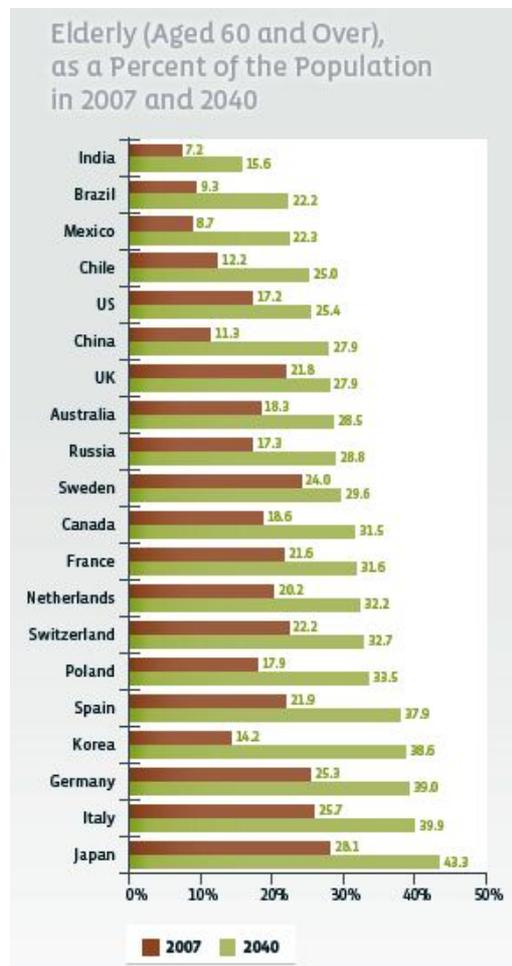

Figure 4: Population Predictions population projections 2007 (Basic Scenario). [21]

Thus, considering the data from the Collection of Senior Series Studies 11005 - "Social Participation of Older Persons", the Spanish population over 65 has exceeded 6.6 million in 2007, representing the 14.7% of the total population. By age, the interval between 65 and 74 years is the largest, reaching 3.8 million people. The number of people aged 75 and over is now slightly more than 2.8 million people. This situation provides the need of adapting both; social policy and services offered to the population of these age ranges.

With the integration of information technology, a new medium of communication, interaction and social organization is introduced. This new social model is defined by Castells, M. as *"a society whose social structure is built around information networks from micro-structured information technology on the Internet, understanding the Internet as the medium that is the organizational form of our societies."*[3].

This social model could generate a lot of new opportunities but also could generate a new sphere of inequality in the access to information technology and communication. This means that in the case of older people's access to this "new media", it creates a technology gap. This gap difficult access to a larger collective society increasingly dynamic and connected, fundamental variable to consider for promote the integration of our seniors in daily life today.

Furthermore, it is essential to have initiatives to promote healthy ageing, in order to promote health and integration of all people in society, defined by the World Health Organization as *"(…)the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age. It applies to both individuals and population groups. Active ageing allows people to realize*

their potential for physical, social, and mental well-being throughout the life course and to participate in society, while providing them with adequate protection, security and care when they need. Ageing takes place within the context of friends, work associates, neighbours and family members. This is why interdependence as well as intergenerational solidarity is important tenets of active ageing"[4].

1.3   The Internet connectivity within the elderly

The importance of the Internet and its relation with the tablets was remarked previously. Now the question should be do we have a potential market within the elderly population? The percentage of older Internet users has been increasing in recent years. According to statistics released in 2009 by the China Network Information Center (CNNIC), the percentage of Internet users aged over 60 in mainland China steadily rose from 0.3% in 1998 to 1.5% in 2008 [5]. By contrast, this percentage for people between 50 and 60 rose from 1.0% to 4.0%. Elsewhere, the European Union is also trying to reduce the gap in the use of the Internet between the elderly and the average of population. In the United States the average is quite relevant about the increase of Internet use among the elderly population (See Figure 5).
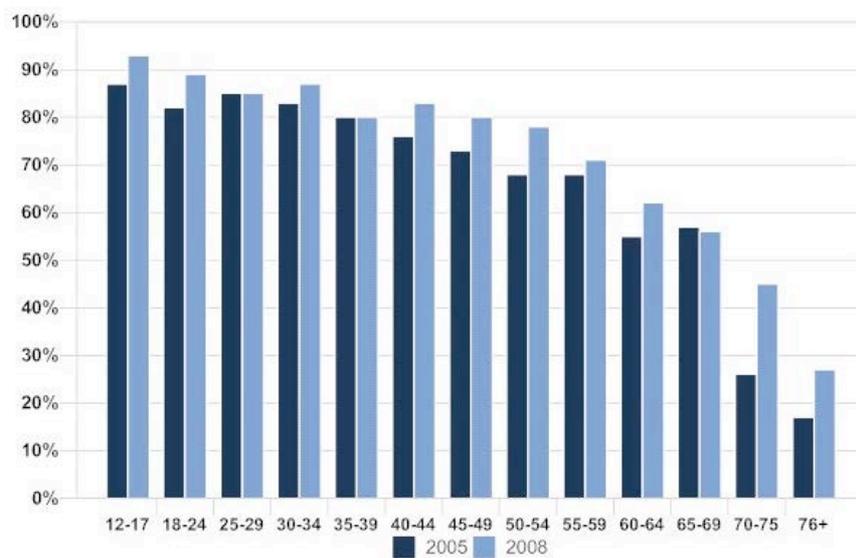

Figure 5: U.S. average about the increase of Internet among the population. [19]

However, young people, the pioneers of social networks, are still the mainstream. Services available and appropriate for older people are inadequate. In addition, in contrast to most young web users, the elderly face challenges when enjoying such services because their physical and mental states have changed. In fact, the designs of most social network websites are poorly suitable for the elderly. This fact often keeps the elderly away from existing services, no matter how popular and functional these services can be.

1.4   Ageing changes

There is a lot of literature about elderly, perhaps one of the most relevant is Heller. This author pointed about ageing: "As people grow older, their abilities change. This change includes a decline in cognitive, physical and sensory functions, each of which will decline at different rates relative to one another for each individual." [7] This makes it hard to define "the elderly" as one consistent group, and presents a challenge for designers of computer technology. Facing this challenge, however, can ultimately provide benefits for both elderly people and society. It must be also pointed that, as people reach old age, in general, their cognitive skills deteriorate, which affects their learning capability [13]. Elderly people do however compensate for this disadvantage by developing a number of strategies that are acquired trough experience [8].

Sensory and Motor Changes	Vision	This is an important factor that should be considered when elderly people are facing the use computers. There are some existing basic sets of design guidelines for interfaces (including websites) given by various authors [8, 9]. Colors, fonts, navigation, sound, content and layout and style can be very helpful if they are managed in an appropriate way. Web design guidelines such as [10] and [9] give recommendations on this matter.
	Hearing	It has been proved that decrease in hearing already starts around middle-age [11], gradually progressing from then on. This is an important fact, not for the use of computer by itself but for lack of attention that can occur during the lessons.
	Motor Skills	The way people move affects the way in which they use a computer [10]. The use of the mouse could be an extremely hard action for some applications like Google Maps [17] or even for some specific mouse's combined movements such as selecting a text. Dickinson described that this can be done "by removing, where possible, the need to carry out complex actions using the mouse, presenting larger targets and removing menus" [8].

One of those strategies is the use of a mental model that is related to another type of technology which they understand. For example, when using a computer application and the older user need to remember a sequence of actions, they act the same way as when they need to remember the buttons of a remote control, they write them down the steps on a note [8]. An interesting survey [12] debates the increasing need to support informal learning in order to deal with this cognitive disadvantage. They concluded that there are significant differences in the learning habits across different age groups, suggesting that design and development of the course need to consider the age profile of their management population when developing these lessons. On the other hand and based on their research, we assume that the use of tablets give them the chance to improve their learning process because of the intrinsic characteristics of the tablet's design; mobility, lack of external instruments (mouse, keyboard) and a wide screen. The idea is to overcome their physical limitations (e.g. motor difficulties or hardly visual perception) that can hinder the learning process.

2   EXPERIENCE

Following a similar approach to Meiler et al. [2], we have designed the course by gathering information and making a number of decisions about the way the course will be taught. Secondly, we engage in teacher-student interactions as we implement the course we have designed. Due to the elderly profile, the use of tablets supposes a lot of innovation through this experience. The adoption of innovations is considered to represent a process rather than an instantaneous event. Rogers offered a five stage model:

1. Knowledge. The individual becomes aware of the innovation's existence and gains understanding of its function.

2. Persuasion. The individual develops a favorable or unfavorable attitude toward the innovation based on the information acquired.

3. Decision. The individual engages in activities that lead to a decision to adopt or reject the innovation.

4. Implementation. The individual puts the innovation to use.

5. Confirmation. The individual seeks reinforcement of the innovation decision already made.
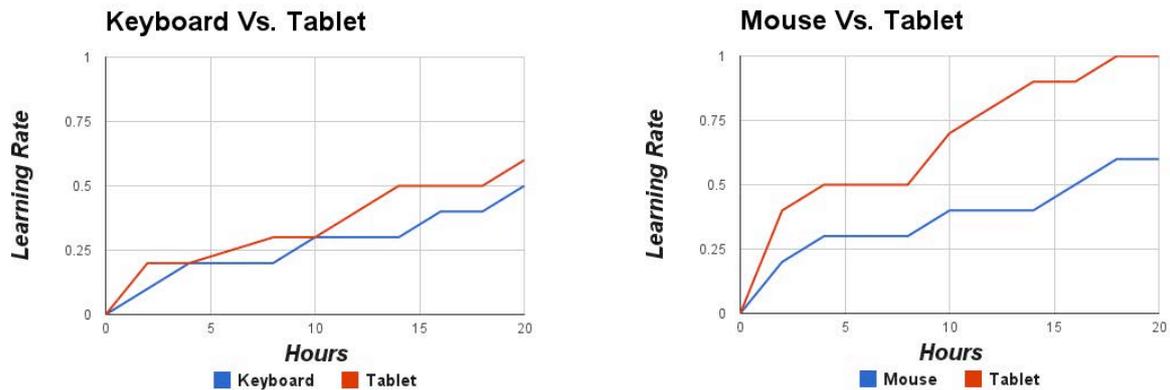
Figure 6. Learning Rates.

It must be pointed that our group of elderly had no experience using tablets and they barely how to use the peripheral devices. The tests were done based on the use of five different applications: a draw application, a word processor application, an Internet browser, a game and a social network [16].

As it can be appreciated, learning rates between using a conventional PC and tablets are shown in Figure 6. The first important fact is that the mouse and the keyboard are external elements that take time to get use to. For the keyboard the main difficulties are related to the search of the different keys. Well, for the PC the elderly had some difficulties due to the size of each key, the position of the keys (they are not familiarized) and the combination of keys. The tablet had a better result than the conventional keyboard just because each user can fit the key size to their vision needs. Also, the position of the basic keys (letters) are easier to handle because of the screen's size (it is smaller than the conventional keyboard). The elderly also confirm that it is very helpful to see how the keys are highlighted when they touched them. Their major difficulties are related to the hidden keys (to change from lowercase letter to uppercase letters). This is the main reason because the tablet's learning rate didn't achieve a much higher rate than the keyboard. In Figure 6 can also observable the learning rate when the elderly people are using the mouse. In this case the tablet outperforms the conventional mouse. Even for a young person is difficult to start using a mouse. The motor skills previously described must be considered for the elderly. Thus, the conventional mouse experience was quite hard in terms of time and effort. They hardly can use the mouse in an efficient way; for example, an uncomfortable situation is that they just drag the mouse until the end of the table and then they just got blocked. On the other hand, the touch screen allows that moving, selecting or dragging things in their tablets would not suppose to be a hard time anymore. They use their finger in an intuitive way and that is the main reason because they achieved very good learning rates. Perhaps those are the main advantages about the use of these new devices. Due to our student's profile, other learning rates such as internet surfing or computer/tablets administrator management are careless from a practical point of view.

3   CONCLUSIONS

Sometimes the elderly aren't able to learn technological things because they just don't understand how to interact with a machine. One of the most important features of this student profile is that they possess special physical characteristics. This makes it hard to define "the elderly" as one consistent group, and presents a challenge for designers of computer technology. Facing this challenge, however, can ultimately provide benefits for both elderly people and society. For example, older people have a number of significant motor difficulties. In our work has been seen that the use of tablets has had a very positive influence in this situation. We could appreciate that the learning time needed to manage mouse and keyboard has been drastically reduced through the use of touch technology.

Another important aspect to consider is the type of software that has been shown to improve the benefits of the use of these new devices. On the one hand it has encouraged the acquisition of basic skills in the use of the touch screen through games and word processors. On the other hand, older people have been able to navigate through the network using these devices. It has been observed a considerable difference in user response time versus device events compared to the same events if they occur on a conventional PC.

Finally, the device has been as a motivation element by itself. Until the beginning of the course this technology was distant for the elderly. The basic computer knowledge that the elderly already had combined with the use of these devices combined had created a very positive learning environment in the classroom. For example, among other duties, older people have accessed to their social networks accounts or checked their personal email through the tablets.

AKCNOWLEDGMENTS

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