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AN EMPIRICAL STUDY ON COMPUTER AND PAPER BASED RESOURCES: ARE THEY COMPETITIVE OR COMPLIMENTARY MEANS?

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ABSTRACT

The evolution and integration of Information and Communication Technologies in all sectors of society has resulted in a transformation of people's behaviour towards the conventional pen and paper tools. The adoption of technology has enhanced work and learning performance by adding swiftness in task completion, organisation of working materials and capacity of storage. Despite its popularity and value, technology, is still surpassed, in some domains, by pen and paper. This research aims to explore the advantages and disadvantages of using both computer and paper for reading and writing. The development of an online questionnaire that was administered to university students intended to examine their preferences and behaviours in terms of computer and paper based resources. Through the content analysis of the questionnaires it was possible to establish patterns of use, personal preferences and to establish a connection between computer and paper use that mirrors both competitiveness and complementarity.

KEYWORDS

Paper; screen; empirical study; advantages; disadvantages; student behaviour

1. INTRODUCTION

Whether the screen is being used in business, education or leisure, the perception that users have of its advantages will determine their use. The relation between screen and paper remains a pertinent subject that is transversal to multiple sectors of society. Research has been focusing on the screen and paper dichotomy since the emergence of the Personal Computer (PC)

(Holzingera et al., 2011). The evolution of technology has allowed computers to become increasingly portable and versatile, making them a fundamental presence in both private and professional arenas.

Despite the fact that the computer facilitates higher levels or writing effectiveness, most people are still not willing to abandon paper resources (Fortunati & Vincent, 2012). Hence, while the widespread use and acceptance of information technology is undisputable, the perseverance of paper resources is equally undeniable. As dynamic and resourceful as computer are, the prediction of a paperless office is far from reality (Holzingera et al., 2011).

Some studies have found that screens result in a slower reading speed. With regard to reading accuracy, paper based resources, also seem to be more advantageous. When assessing comprehension, several studies concluded that people were able to have a better understanding of the content when resorting to paper materials. The majority of the early literature on paper and screen comparison highlighted the superior performance of the paper in terms of accuracy, speed and comprehension. However, as the research in this area evolved, it become clear that the traditional indicators, for example reading accuracy or speed were not as successful at exploring the dichotomy of paper and screen as the use of specific task comparison might be (Chang & Ayyub, 2001).

The transformation of reading and writing habits changes people's behaviours at many levels. Namely, there are important differences in terms of the physical posture that paper and screen require and that affects their usage. Also, the widespread popularity of the internet placed multimodal communication at the centre of people´s everyday life.

This paper begins with an overview of the literature on the use of paper and screen, followed by a brief presentation of the methodology. In order to assess the views that student had on the use of paper and screen, a questionnaire was developed using a sample of students that was constituted by individuals that were enrolled in bachelor or master degrees in the field of Information Systems and Computing. The results section depicts the viewpoints of the students in terms of their use of and preferences for paper and screen resources. It also identifies the most common physical postures associated with the use of both tools and it defines patterns of use of multimodal communication.

2. PAPER VS SCREEN/PAPER AND SCREEN

The general idea in the literature is that digital resources do not substitute paper and pen, instead they assist certain tasks. The preferences of students seem to be dependent on what task is being performed (Farinosi, Lim, & Roll, 2015).

Throughout the constant progress of information technology, paper based resources have remained valuable and persistent instruments of information collection and cooperation. Paper resources have thrived in certain environments due to their manoeuvring flexibility. Paper can be easily carried and distributed among people and it dispenses relevant changes in position. Its subtleness and light weight consigns paper to a main role in the completion of certain activities, for instance, distribution in offices, comparing information that is located in different parts of a page (Luff et al., 2007).

The benefits of using a computer are often associated with its storage capacity, its easy access, the possibility of sharing documents and its features of content search. In contrast, the limitations of computers include discomfort in certain tasks, such as reading and reduced

information retention (Holzingera et al., 2011). Moreover, mobile screens, such as tablets have become fundamental parts of people's daily routines, due the fact that they are user friendly and portable. In terms of learning and reading related activities, tablets have become a widely used alternative (Chen, Cheng, Chang, Zheng, & Huang, 2014).

The exposure to technology might have an effect on the perceptions of students in terms of reading and writing digitally. The longer they have been dealing with digital devices the more familiarised they are with the digital world and the more they use those resources (Taipale, 2014). Also, they might depend on the country that is being research, since there are different national initiatives for the promotion of communication technology (Farinosi et al., 2015). The frequent complaints about screens refer to several aspects of software and hardware, but more recently some researchers have been investigating the possibility of other factors being at the origin of the lack of concentration and decreased information retention. Some studies have concluded that, when reading from screens, people use different cognitive strategies than they use when reading on paper. The difference of people's performance on paper and on screen might be more related with cognitive habits acquired over time, than with the technology itself (Ackerman & Lauterman, 2012). The literature suggests that when using a computer to read extensive portions of text, the user feels more challenged than he/she would feel if using paper. In this case the justifications that are commonly presented relate to cognition and ergonomics and they are often cited to explain this difference (Johnson, Nádas, & Bell, 2010).

2.1 Writing

Kaputa and Palus (2013) conducted a study that examined the preferences of users in terms of reading and writing using paper or digital resources and concluded that the great majority of the respondents preferred to write in computers, notebooks or tablets. Nonetheless, there are specific situations where people do privilege the use of pen and paper over computerised media for writing.

With paper, people use pens to write, to underline, to serve as pointers and to make marks. People require not only the fingers of their writing hand, but, frequently they need their other hand to hold the paper down and stabilize it. People use paper resources with digital instruments for comparing sources and finding information. One of the obstacles of this alliance is the physical difficulty of using them together. It becomes difficult to physically position both resources in a functional manner (Luff et al., 2007).

Writing on paper has a greater immediacy, since it requires no software (Fortunati & Vincent, 2012). Paper and pen continue to be used for drawing and short notes. Writing on paper is often seen as a way of adding a personal imprint and it is regarded as a self-reflective activity. It is also more flexible, namely by allowing drawing and writing sideways and it is more advantageous in terms of building mind maps (Taipale, 2014). On the other hand, some students have reported feeling discomfort in their hands when writing on paper. Handwritten documents can be difficult to read and when editing content on paper, its aspect can become cluttered (Fortunati & Vincent, 2012). Handwritten texts are also more difficult to share with other people. Moreover, writing on paper takes longer and it can leave the fingers with ink. (Taipale, 2014).

Computer based writing is assisted by a multiplicity of tools that allow for a more complete revision of text. In a computer students can review any grammar or spelling mistakes, they can use the thesaurus and make use of diverse formatting options (Cheung, 2012). Not only it allows for a variety of editing tools, it is also faster to write on a computer than it is to write on paper (Fortunati & Vincent, 2012). Typing on a computer is more productive in comparison with writing by hand on paper. Furthermore, on a computer there is the possibility to amend the text very easily. The possibility to swiftly edit content is highly valued among students. On a less positive note, the computer can represent a distraction (Taipale, 2014), it lacks expressiveness and a personal stamp and it can also cause strain on the tendons (Fortunati & Vincent, 2012).

The role of pen and paper on creativity has been the object of previous research and it has created contradictory results. On the one hand, they seem to be more compatible with creative activities (Farinosi et al., 2015). On the other hand, Gharibpanah and Zamani (2011) developed a study where the figural creativity of students was compared when they did a test using paper and pen and when the test was done by resorting to a tablet and stylus. The authors concluded that the testing method had no impact on the students' creativity scores (Gharibpanah & Zamani, 2011). The quality of the writing is an aspect that generates conflicting results in the literature, with some authors arguing that essays written on a computer have higher quality and others claiming that the difference between the two composition methods is irrelevant (Cheung, 2012). Lovett, Lewandowski, Berger, and Gathje (2010) assessed the writing quality of students essays that were typed in a computer vs. the essays that they wrote using pen and paper and found no significant discrepancy. The only difference was noticed at the level of the essays' length, with longer essays being produced by students typing in a computer. In a study about students performance in a paper based vs. a computerised English as Second Language (ESL) writing assessment, Kohler (2015) concluded that the students had limited digital skills to perform the essay in a computer based environment and advocated the maintenance of the paper based assessments, at least until computer proficiency becomes more widespread.

2.2 Reading

Paper is still an ideal medium for reading, as it offers agility in terms of space and it is portable and light weighted. The possibility to take notes on the original text while reading, is one of the advantages of using printed materials. Additionally, the inconvenience of screen reflection or glare are absent when dealing with paper and ergonomically and visually speaking, paper remains a valuable resource (Holzingera et al., 2011).

There are numerous research confirmations of the inferiority of the screen in reading performance. Mangena, Walgermoa, and Brønnick (2013) conducted a study in a Norwegian school that demonstrated that the students with higher scores in terms of reading comprehension read the texts that were printed as opposed to reading the ones presented to them on the screen. However other studies revealed the absence of significant differences in user performance between the usages of these two resources. Rockinson-Szapkiw, Courduff, Carter, and Bennett (2013) developed a study, with students from a university in the United States, that aimed to measure the differences in terms of their learning when using a conventional textbook and a electronic textbook. Their final conclusions confirmed a lack of significant disparities in terms of the student’s scores. Furthermore, a study about the work

performance of medical professionals in an Austrian hospital exposed the dearth of relevant disparities between the use of paper and the use of screen. The accuracy and speed of reading was calculated using both resources and the scores were very similar. What was clear at the end of the study, was the unmistakable predilection that the professionals had shown for reading on paper, rather than on screen (Holzingera et al., 2011).

There are situations where reading on screen does affect the comprehension of the reader. This means that reading from screens can have a detrimental impact on test taking, on annotation and from the teachers perspective, on test marking (Mangena et al., 2013). Chen et al. (2014) tested the reading comprehension of students when reading from a screen and from a computer and concluded that most students performed better on paper than on screen. Their study also examined the impact that the students familiarity with tablets would have on their reading comprehension. Their findings show that students had a better level of comprehension if they were more familiar. The users opinions about the performance of computer based learning environments, influence the way they engage with on screen materials. The increase of their practice with such resources has the potential to diminish the cleavage between on screen and on paper information retention (Lauterman & Ackerman, 2014). Genc (2011) conducted a study to analyse the different strategies that students employ when reading from a screen and reading from paper. The authors found that despite the fact that for both screen and paper some strategies remained the same, such as the use to reference material, when reading from a screen the participants adopted other methods. Namely, when reading documents with hypertext, the students resorted to slower and more careful reading and paid closer attention to aspects that they did not understand.

Researching the differences between paper and screen has many different and useful applications. In the education sector there are studies examining different aspects of test taking and students' competences, in order to understand how the proliferation of screen based tasks would impact the students and their learning path. It is important to modernize education and promote the adoption of communication technology, but it is equally crucial to understand the effect that they might have on the students learning outcomes. The introduction of digital and computerized devices inside the education sector cannot be done at the expenses of the students' learning outcomes.

Since the superiority of paper is still clear in terms of reading activities, it is important to understand how reading from screens could be improved. The layout of the text on the screen can reduce the need to read from printed materials. The presentation of the text is dependent on line length, interlinear space, the size of the window and columns organization. Each if this elements contributes for a different layout of the text and the text format can also be manipulated to improve the performance of reading on screen (Dyson, 2004). Legibility and usability are core values of electronic readers (Siegenthaler, Wurtz, & Groner, 2010). Display technology has recently experienced several breakthroughs in the pursuit of increased visual comfort (Holzingera et al., 2011). The technology that is being used in e-Books readers is evolving to an extent where the experience of reading an e-Book is becoming very similar to paper books. Nonetheless, the traditional paper books are resilient in their role of favourites. E-readers are not yet considered as their substitutes (Siegenthaler et al., 2010). Studies have shown that even among students who had already used an e-book, there was a clear preference for using printed materials for learning purposes (Woody, Daniel, & Baker, 2010) Furthermore, despite the progressive popularity of e-books, in educational settings, e-textbooks do not seem to be well accepted by students. Research has shown that when reading on paper and reading on screen, students' spend a longer period of time reading on screen than they do reading the same text on paper (Daniel & Woody, 2013).

3. METHODS

This research conducted an online survey to identify the main perspectives of students with regard to the use of computer screen and paper based resources. The questionnaire was distributed online to 100 students, who were at the time, enrolled in bachelor or master degrees in the field of Information Systems and Computing. The respondents were selected via a sample of convenience, which focuses on the most accessible population (Kelley, Clark, Brown, & Sitzia, 2003) and it is a valuable sampling method in cases where the research is centred on a specific and already formed group, such as a classroom (Creswell, 2008). The questionnaire was composed of four open questions on: the differences between paper and screen usage and their personal preferences when using each of these resources; the differences when reading on screen and on paper and the preferences of employing each one of them; the gestures and physical positions associated with each of these resources; and finally a question on the respondents' use of multimodal communication on the internet. Establish a relationship between the multimodality and their opinions of paper and screen. Only the screen allows several formats

The online survey resorted to the use of open questions to allow the participants to provide their own views of their relationship with both paper and computer resources, without any type of limitation. It was important not to provide guidelines or suggestions of answers in order to obtain a more authentic depiction of what the students thought when confronted with the use of these two resources.

4. RESULTS

The questionnaire obtained a total of 100 responses and only 2 were invalidated due to duplication. The 98 valid responses were analysed through and coded in the Nvivo 8 program. Through an initial qualitative content analysis, it was possible to identify several patterns of use of screen and paper. The main conclusions were divided in 6 main categories: pen vs. computer, personal preferences about pen and computer usage; reading on screen vs. reading on paper; personal preferences about reading on paper and reading on screen; physical gestures and positions adopted when using computers and paper based resources; and patterns of multimodal communication usage. The most relevant findings were also subjected to the coding schemes in a quantitative content analysis. The use of both quantitative and qualitative content analysis is a valuable strategy to improve the quality of this method of data analysis (Franzosi, 2008).

4.1 Writing with a Pen vs. Typing in a Computer

The data obtained from the questionnaires revealed six main differences between typing in a computer and writing with a pen: speed, dissemination, edition, access, aesthetics and comfort.

Speed was a characteristic that 50% of the respondents mentioned in relation to typing. Figure 1 illustrates the distribution of their answers.

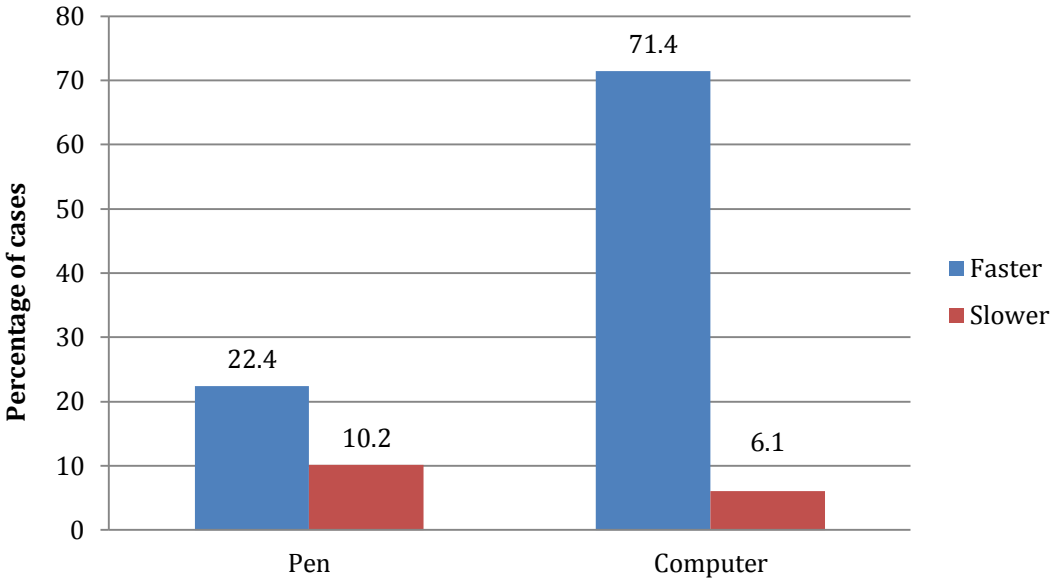

Figure 1. Writing swiftness using a pen vs. using a computer

The amount of respondents that mentioned speed in their answers led to the creation of a coding scheme that included all the synonyms and antonyms of the word speed, such as velocity, slow and swiftly. The coding used a word frequency query and resulted in 114 occurrences of these terms. Within the participants that highlighted speed, the vast majority (71.4%) stated that the computer allows a swifter introduction of text. "It [the computer] makes writing much faster." (Student N20). Only 3 people claimed that writing on the computer was more time consuming.

Despite the predominance of the computer in terms of writing swiftness, there were still 22.4% of the students that said that they would write faster if they used a pen.

Personally, I prefer the pen, because I can write faster. (Student N09)

The computer also took the lead in terms of the dissemination of the text that results from typing in a computer or writing with a pen. A paper based text cannot be easily shared with others.

Regarding the computer I … can change it [the document] at any time and send it to whoever I want and whenever I want (Student N78)

The capacity of editing a document is superior in the computer. According to the participants, it facilitates the automatic detection and amendment of spelling mistakes. In paper based documents people are more likely to misspell words

I do not worry too much about the mistakes because I know that the PC will fix them later (Student N46)

The students argued the predominance of the pen in terms of access. It is easier to have access to a pen, than it is to a computer.

The pen we can use in a more flexible and convenient manner (Student N12)

The answers of the participants reflected their belief in the incapacity of producing a visually appealing document when using a pen and a paper. When it comes to the aesthetics of the pen and computer dichotomy, the computer has a better performance. The computer allows for a clearer presentation of text.

The computer allows you to change the text whenever necessary, to make amends, leading to a better presentation and a reading that is always clear (Student N22)

With concern to comfort, the students highlighted that fact that it becomes painful to write with a pen after sometime.

On paper if we spend too much time writing our hand starts to hurt. (Student N28)

Although typing in the computer was a clear favourite in all the categories mentioned above, except access, the pen was described by some as a more useful resource in certain situations. By using a pen, the memorization of data becomes easier, as does the draft of schemes and ideas. It is believed to be the best tools for small notes and brief reminders. Also, the pen was deemed as being a more personal instrument. Some people even considered that writing with a pen was faster than on a computer. On the other hand, with a pen it is difficult to correct any potential mistakes without making the document visually confusing and unappealing. Also, a person's calligraphy may be difficult to understand. The pen's reduced capacity to produce sharable content and the fact that it is more tiring were also some the reasons that the participants mentioned to justify their preference for typing in a computer.

The computer provides a greater control over the appearance of the document (font, colour), facilitating a better presentation. The editing of the text is easy and it offers a wide variety of options. It has a large and safe storage capacity and it allows for content to be shared with others. Furthermore it presents faster results, the possibility to use a multiplicity of formats and it has search features to find relevant content. The downsides of using a computer include the fact that it can represent a major distraction.

4.2 Personal Preferences about Pen and Computer Usage

The different advantages and disadvantages of using a pen and a computer became clear when the participants were asked to identify the aspects that they liked and disliked about their usage. Table 1 summarises the benefits and the weaknesses associated to the use of the pen and the use of the computer that the majority of the respondents cited.

Table 1. Students personal preferences about using a computer and a pen

	Pen and paper	**Computer**
Disadvantages	Painful for the hand	Eyestrain
	Unclear handwriting	Is subject to damage
	Strikethrough text	Needs a power source
Advantages	Good for short notes	Text presentation
	Spontaneity	Speed of writing
	No need for a power source	Ability to save and reuse material

The use of the pen was most frequently praised for the spontaneity it allows, the advantages it presents for taking short notes, the simplicity of use, the personal stamp it permits and the fact that it does not need a power source to be functioning. When stating the aspects that they disliked in the use of the pen, the students highlighted the discomfort it causes in the hand if used for a long time, the fact that handwriting is sometimes difficult to understand, the impossibility of amending the text without leaving a mark and the weight of the notebooks.

When it comes to taking notes, writing down ideas, I prefer to use a pen and a paper (Student N30)

I could never give up pen and paper (Student N82)

I don't like to use the pen very much, because it takes longer and it can be uncomfortable (Student N26)

The most popular elements of using a computer had to do with the speed of writing, the possibility of correcting a text without leaving any marks and fact that the text can be saved and made available in the computer. Also, one of the great benefits of using a computer, according to the participants, is text edition and the numerous possibilities it offers the user to choose the manner in which the text is presented. On the least favourite items, the use of the computer, was associated with eyestrain, the fact that it is subject to damage, its heavy weight and the requirement of a power source to be functional. The speed of writing in the computer was attributed to the memorisations of patterns in the keyboard, which was presented as an inconvenient.

What I like the most about the PC is its ability to save and reuse a document in the future (Student N97)

I don't like it when there is an electrical power failure nor when the battery of the computer goes down (Student N50)

I like to use the computer for research (Student N32)

4.3 Reading on Screen vs. Reading on Paper

The scenario depicted by the students when the activity is reading provides a different perspective on the use of computers and printed materials. Reading activities originated less dividing responses. There were three main aspects that the students mentioned in terms of reading: time, length and comfort. As with writing, one of the categories was predominant over the others, so it was analysed in detailed through a coding scheme including the word comfort, discomfort and any similar words. The coding used a word frequency query and resulted in 65 occurrences of these terms.

In this case, 45 out of the 98 respondents used referred to comfort or discomfort in their answers. Figure 2 displays the distribution of the participants' responses.

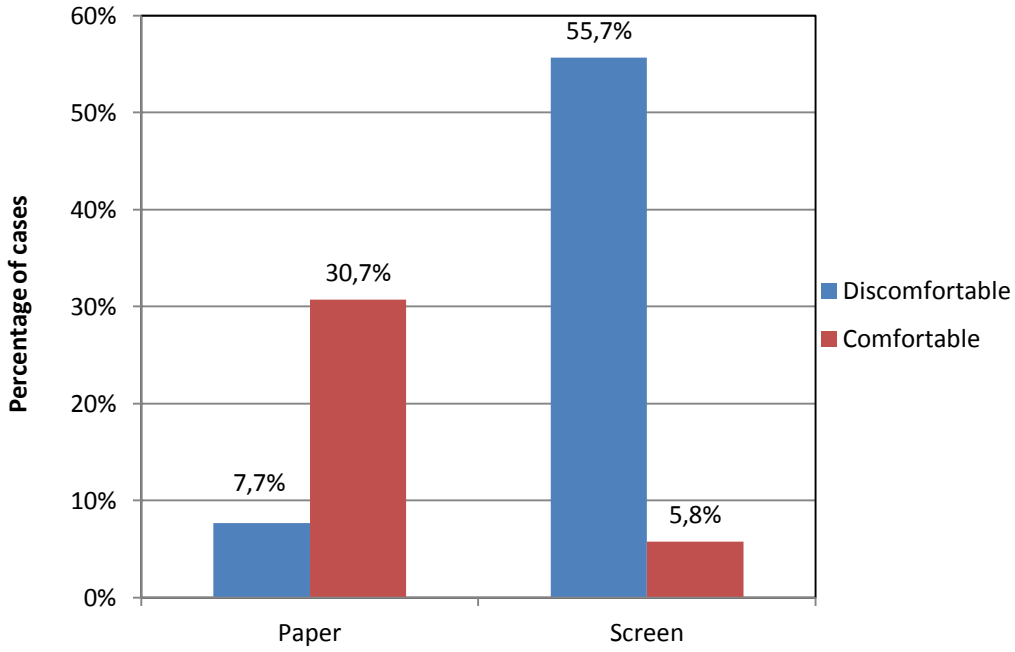

Figure 2. Comfort of reading on screen and on paper

When discussing the time spent reading, most participants preferred to use paper based resources. They can read for longer periods of time if they use a book or a printed document.

Another difference is the maximum reading time (Student N12)

The length of the text also influences the medium the students choose. If a document of very long it is preferable to use a book rather than a screen.

Great texts including books prefer to read on paper. The concentration when reading on paper is in my personal view superior. (Student N20)

In the comfort category, paper based materials were also predominant. It is more comfortable to read from a book.

To read on paper is less tiring, it allows personal notes, the content is more easily assimilated (Student N15)
Greater ease of reading anywhere in particular on the outside which does not happen with the computer (Student N10)
When I'm sitting in front of the screen for a long time I get tears in my eyes (Student N70)

It is important to mention that some of the respondents could not identify any differences between the use of paper and the use of screen for reading activities. These students' opinion is that there are no differences.

4.4 Personal Preferences about Reading on Paper and Reading on Screen

When reading, students, require specific conditions that are guaranteed by paper based materials, but also by screens. In terms of reading activities the benefits and the obstacles of using a screen or a book vary greatly. Table 2 provides a brief overview of the aspects that the students prefer when reading on a screen and on a paper.

Table 2. Students' personal preferences about reading on paper and on screen

	Reading on Paper	**Reading on Screen**
Disadvantages	Difficult to share with others	Aggressive towards the eyes
	Storage is problematic	Can be a distraction
	Weight of books	Not very portable
Advantages	To feel and smell the paper	Better to skim through text
	Increased concentration	Clean presentation of content
	Flexible	Can be adapted to the readers needs

Reading from a screen allows the reader to adapt the text to his/her needs and to search for content more easily within the text. Also, it is faster to read from a screen, namely when the objective is to read diagonally. The fact that it saves space, it allows a better organisation and it is cheaper represents additional benefits for the reader. The most significant obstacle, mentioned by the students, in terms of reading on screen is the discomfort of the position.

Definitely I do not like to read books (Student N60)
Paper can more easily become damaged and it cannot be easily shared (Student N20)
Books are heavier, its uncomfortable to transport them. Information in a digital format is not (Student N95)

More economic [the screen] in terms of printing and storage space (Student N20)
Reading on a screen becomes more comfortable because we can change the size of the letters according to our needs (Student N46)

Reading from paper based materials offers a more sensorial experience. It is easier to read from paper and it increases the reader's concentration. While reading from paper it is easier to take notes. Books are softer, they are more portable and also motivating. On the downside, books and other printed materials require more storage space and they are more perishable.

I like to feel the paper, to be able to keep it anywhere (Student N02)
When we read on paper we pay more attention to the words (Student N18)
I like paper, the comfort of its touch, but its conservation and the space to keep it is problematic (Student N33)

4.5 Physical Gestures and Positions Adopted when using Computers and Paper Based Resources

One of the objectives of this research was to determine how the students behaved when handling printed materials and when they operated a computer and what were their more recurrent gestures and positions. Most of the participants describe the use of the computer as being formal, and emphasised the flexibility and informality of paper.

In the computer I tend to adopt a more professional posture (Student N10)

Moreover, the majority believed that a computer requires a specific posture and that a book, for example, can be read in numerous positions and locations.

More comfortable reading position when using paper (Student N90)
When writing on a sheet of paper there is a tendency to bend our spine (Student N07)
When I'm reading on paper I can be standing, sitting down, laying down, walking, etc. (Student N51)
Reading on paper can be done anywhere (Student N85)
The abusive use of the computer can originate health problems at a joints level (Student N23)
By writing and reading on the computer I maintain a more upright position, my look is divided between the screen and the keyboard and I can use both hands (Student N80)

Although, some of the students did not identify any differences in terms of posture and gestures, there was a great variety of gestures and positions associated with the use of computer and with the use of printed materials.

In term of the computer, the students reported having a more formal posture. Sitting is the most common position and there is a concern in maintaining their backs straight, since the use of the computer is often the cause of back pain. The use of an office chair helps to maintain a correct posture. The computer is more convenient. The screen does not require the user to look down and it should be kept at an eye level to be in the correct height and to help the user to be straighter. Using a computer involves moving the hands and the fingers, as well as the wrists.

The use of paper based resources allows for a multiplicity of positions. There is more freedom in the positions that can be adopted. The posture is more relaxed and less rigid than when operating a computer. Paper allows more freedom also in terms of space. The students mentioned indoor rooms as well as outdoor spaces for handling printed materials. The typical posture seems to include having the upper body bent over and the head at a lower level to look down to the paper. Generally speaking the respondents stated that the posture that they adopted with paper resources is incorrect, but it increases the proximity between the reader and the material.

4.6 Patterns of Multimodal Communication Usage

The identification of patterns of multimodal communication is an important element in the assessment of internet and computer usage.

The great majority of the respondents highlighted their use of files of different formats both in the computer and in the internet. Images, video, music and text were recurrently mentioned.

In my personal experience in relation to the Internet, the most common form of communication is undoubtedly in writing, followed by images, audio and lastly video (Student N92)

The use of the internet and of the computer greatly facilitates my work and the interaction with my friends and family, with one click only I can share photos, videos and everything I want with people who are miles away (Student N01)

I no longer have a stereo, I listen to music on the computer, my photos are all digital (Student N06)

The multimodal communication that the students stated to engage in seems to have different characteristics depending on whether it is used for private reasons or for professional purposes. When the students are in professional settings, they use text formats more often. For a more personal and social use music and images are primarily used. The use of the internet is described as being widespread with little variations between the professional and the private arena.

I use the computer / internet daily. Professionally I use it daily and at a personal level it is also a tool widely used (Student N25)

Professionally I use the computer and the internet pretty much all day. I will do research, respond to business inquiries, ... the use of word and excel is recurrent (Student N90)

It is a tool that is part of my everyday life, either to work, to read, to study, for hobbies , communication, interaction with people. Nowadays it is central to my way of being in life (Student N07).

5. DISCUSSION

The respondents identified six essential divergences between typing in a computer and writing on paper: speed, dissemination, edition, access, aesthetics and comfort. In all of these categories, typing in the computer was more advantageous, with the exception of access. Similarly to previous research (Kaputa & Palus, 2013) the students praised and preferred the computer for writing activities. The respondents highlighted its advantages in terms of content editing and sharing and they underlined the fact that they wrote more swiftly on a computer. Nonetheless, as stated by Fortunati and Vincent (2012) the superior effectiveness of the computer does not cause people to abdicate of paper and pen tools. A significant part of the students argued the use of paper for writing, namely for short notes and due to its flexibility, which is coherent with previous findings (Taipale, 2014).

With regard to reading activities, the students' answers were divided into three core topics: time, length and comfort. In all of them, the use of paper was predominant. This relates not only with excessive eyestrain caused by the computer, but also with the type of posture that the participants adopt while using each of these tools. When enquired about the more physical aspect of using a computer or a paper based resource, the students underlined the difference between the formality of the computer and the flexibility and informality of the paper. The computer requires a specific posture, while a book, for example, can be read in numerous positions and locations. The reading preferences of the students are consonant with previous research on the subject. Paper remains versatile in terms of the spaces where it can be read and transported to (Holzingera et al., 2011) and it is more ergonomically friendly (Luff et al., 2007). Also, as it was mentioned by previous studies, in general people do chose paper over screen for reading (Mangena et al., 2013). This tendency to use paper more often for reading may be explained by the habits that people developed over time and their perception that the computer hinders the assimilation of information (Ackerman & Lauterman, 2012). Besides the usual technology based reasons (glare, screen resolution) there are cognitive and ergonomic reasons for the predilection for paper (Johnson et al., 2010).

In their final response, a great majority of the respondents highlighted their use of files of different formats both in the computer and in the internet. Images, video, music and text were recurrently mentioned with some of these formats being more associated with professional settings (for example text) and other more linked to a personal and social use (music, images). Multimodal communication is an aspect where the computer takes an overwhelming precedence. The paper is limited in the type of communication it allows, whereas the computer endows the user with endless possibilities that benefit their professional and private life.

Projects that aim to liaise paper and computer resources present an important strategy to ensure the survival of paper based materials in the sense that it endows them with a new usage. Also, these types of projects, invest on a relationship of complementarity rather than opposition, between paper and screen (Luff et al., 2007), which allows people to benefit from the advantages of both resources.

6. CONCLUSION

While the computer is seen as a fast and effective tool, the paper provides increased concentration levels and a more sensorial experience.

Despite the widespread use of ICTs there is still a significant number of students who prefer to use a paper based resource for writing and specially for reading. The understanding of how people interact with existing communication tools has an impact in several areas of society. The introduction and development of ICTs in education, business or health is dependent on their wide acceptance. Further research is necessary to explore the relationship between individuals and the tools available to them to learn, to work and to be social. The importance of analysing students views of working with a screen or with paper are extremely important for areas such as e-Learning, where the successful engagement of students with screens is core to the achievement of the learning goals.

The research developed in this paper aims to be part of an in-depth examination of students preferences for paper and screen usage, inside the learning context. While this study aimed to provide a general overview of their preferences, future research will need to approach a more specific strategy where the different tools (paper, pen, screens, computers) are compared as to their usefulness not only in terms of different activities, but in terms of the various settings where they are employed.

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