

## Ανοικτή Εκπαίδευση: το περιοδικό για την Ανοικτή και εξ Αποστάσεως Εκπαίδευση και την Εκπαιδευτική Τεχνολογία

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Βιβλιογραφική αναφορά:

## Ο Ψηφιακός Γραμματισμός μαθητών που συμμετέχουν σε πρόγραμμα ενός φορητού Η/Υ ανά μαθητή στην Ελλάδα

### Digital literacy of students participating in a one-to-one laptop initiative in Greece

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#### Abstract

This research was conducted at a private school in Athens Greece, that implements a one-to-one laptop initiative. There were two research questions: a) does the digital literacy of students participating in the program of one laptop per student change and b) is there a differentiation in the digital literacy of boys and girls. The students completed a questionnaire in two phases (pre / post) that included 75 Likert-scale questions, divided in 5 sections. According to the data, it can be concluded that the digital literacy of the students does indeed improve, while the second research question cannot be answered as there is no clear superiority of either of the sexes.

#### Περίληψη

Η έρευνα διεξήχθη σε ένα ιδιωτικό σχολείο στην Αθήνα που υλοποιεί ένα πρόγραμμα ενός φορητού Η/Υ ανά μαθητή. Τέθηκαν δύο ερευνητικά ερωτήματα: α) εάν διαφοροποιείται ο ψηφιακός γραμματισμός των μαθητών που συμμετέχουν στο πρόγραμμα ενός φορητού υπολογιστή και β) εάν διαφοροποιείται ο ψηφιακός γραμματισμός των αγοριών και των κοριτσιών. Οι μαθητές συμπλήρωσαν ένα ερωτηματολόγιο σε δύο φάσεις (pre / post) που περιλάμβανε 75 ερωτήσεις τύπου Likert, χωρισμένο σε 5 ενότητες. Σύμφωνα με τα δεδομένα, μπορεί να εξαχθεί το συμπέρασμα ότι ο ψηφιακός γραμματισμός των μαθητών έχει όντως βελτιωθεί, ενώ το δεύτερο ερευνητικό ερώτημα της έρευνας δεν μπορεί να απαντηθεί, καθώς δεν υπάρχει σαφής υπεροχή του ενός από τα δύο φύλα.

#### Keywords

*One-to-one laptop initiative, digital literacy, gender studies*

#### 1. Introduction

One-to-one laptop initiatives exist for more than 20 years, growing and expanding around the world (Cuban, 2006) and have been researched since their early years. One-to-one environments differ from what the ones in a traditional school, because all students and teachers are provided with continuous access to the internet, a wide range of software, electronic documents and other digital resources for teaching and learning. Students don't have to move to the school laboratory. Instead, every teacher and student has their own personal laptop which can be moved from class to class (Zucker & McGhee, 2005). At the same time, teachers are struggling with traditional pedagogy and face increased pressure to prepare their students for the technologically rich 21st century (Niles, 2006). They also face challenges related to the use of technology, for example, students may not know how to access or manage data (Stallard & Cocker, 2001).

## **2. Digital literacy**

### **2.1 Clarification of the term**

The term **digital literacy** (Sofos, 2010) relates to all media that can be used in digital form, that demand diverse abilities and skills from the users' part, like "non-linear reading", the dual activation of the user as "reader - writer" of messages, e.g. in Web 2.0 (Kron & Sofos, 2003). Gilster defines digital literacy as the ability to understand and use information presented via computers in various formats from a wide range of sources (Gilster, 1997, p.1 ). Rafferty and Steyaert (2007, in Sofos, 2010:71) say that digital literacy can be seen as a combination of the following skills: a) Functional skills, which refer to the use of technology, knowing how to use the keyboard or the mouse and more complex operations such as sending e-mail with an attachment, use of a word processor, spreadsheet and database applications, search the web or downloading and installing software. Such skills can be considered equivalent to reading skills in print media. b) Structural skills, that relate to the ability to use the (new) structures that contain information. In traditional print media, they are similar to the skills of the use of contents in a book, or the knowledge of finding a book in a library. These skills include the use of hyperlinks and evaluating the information found. c) Strategic skills, that refer to more strategic uses of information and include the possibility of active information search , the ability of critical analysis of available information and the constant search for information about work or personal life of the individual.

In general, digital literacy refers to search, management, organization, analysis, evaluation procedures and the understanding of digital contents, technological applications and the procedures of the creation, development and writing of this content. And while theoretical approaches focus on analytical skills, knowledge, skills and attitudes and are orientated to the empowerment, autonomy and self-determination of individuals, educational institutions and committees undertake educational planning or act advisory: they are geared to functional abilities in conjunction with the school, labor and modern society requirements (Sofos, 2010).

### **2.2 Measuring digital literacy**

There are several ways to measure the functional skills and digital literacy, for example, by measuring the acquisition of certified skills (e.g. in educational institutions), or by measuring real skills. At the individual level, the functional capabilities and digital literacy could generally be measured using three different approaches (Empirica, 2007): a) Evaluation of user skills through observation or

actual test conditions. b) Measurement of ex post real actions that took place and are related to ICT. c) Measuring the level of skills as perceived by users. Not all above practices can be applied when the survey sample is large. Thus, the most used practice is the completion of a questionnaire by the students, which includes statements like “I can rename a file” or “I can upload content to websites”. Each statement is accompanied by four or five closed options, one of which is selected by the students, depending on their agreement with each statement. Usually the options range from “strongly disagree” or “I cannot do this” to “strongly agree” or “I can show someone how to do this”. The majority of the literature on the measurement of digital literacy is based on the perception of people about their skills in handling the computer, instead of the real potential of people as can be measured by observation or questionnaires that measure actual knowledge on the functions and computer terminology (Hargittai, 2005; Hargittai, 2009). Moreover, although as a concept it is wider, digital literacy often equates to a minimum set of skills, which could make the user able to adequately handle various software tools or perform basic actions in retrieving information (Buckingham, 2007). Based on the above, to measure digital literacy, this study has focused on the measurement of specific skills through questionnaires completed by the students.

### **3. Methodology**

#### **3.1. Research questions**

There were two research questions: 1) Is there a difference in the digital literacy of students who have a personal laptop for use at school and at home and 2) Is there a difference in the level of digital competence between boys and girls? The research was oriented at the dimension of functional skills, as reported by Rafferty and Steyaert (2007, section 2.1). The questions were answered by examining indicators which led to conclusions about the level of digital competence of students as far as the use of media such as computer and internet are concerned.

#### **3.2. Data collection instrument**

The students answered a self-assessment questionnaire with Likert type questions. The following dimensions were examined, with students being asked to answer how “good” they can carry out a certain action: a) Basic terms related to computers and the use of the operating system, such as working with files and folders or understanding concepts. b) Basic use of Internet services such as e-mail, browsers and search engines. c) Use of basic word processing functions, such as formatting the pages of a document. d) Use of basic functions of presentation software, such as formatting of the slides of a presentation. e) Use of basic spreadsheet functions, such as formatting the cells of a sheet. Thus, the questionnaire consists of five sections: 1) Use of the operating system (Windows). 2) Use of internet services (Internet). 3) Use of the word processor (Word). 4) Use of the presentation software (PowerPoint). 5) Use of the spreadsheet (Excel). Each section begins by asking if the student who completes the questionnaire has made use of relevant software. If the students responded that they have not used it, they could skip the corresponding section and proceed to the next. 15 statements follow, to which students complete one of five available options: 1: I do not know what that is. 2: I do not know how to do this. 3: I can do this, but with help. 4: I can do this. 5: I can show others how to do this, I'm an expert! The last section of the questionnaire consists of basic information about the students. Their gender, their class and their code name. The code name consists of the first letter of their first

name, the first letter of the surname and date (day and month) they were born. The code name is used to match the questionnaires on the first and second phase, so that statistical tests could be conducted. The questionnaire was the same for all classes involved and was constructed for the purposes of this research. For its construction, questionnaires from the literature were taken into account (Schaumburg, 2003) which were adapted and updated.

### **3.3. Pilot study**

The questionnaire was tested in order to check its quality and structure. A pilot study was performed twice: In May 2010, where it was distributed to three different elementary schools (Fifth and Sixth class) with 20 to 22 students in each class. At the presence of the researcher, the students completed the questionnaire and made observations on the statements in the questionnaire that they felt that they wanted clarifications or different wording. After each visit and before going to the next school, the researcher revised the questionnaire according to the observations of the children. The second phase of the pilot study was performed in September 2010 and took place at the same Elementary schools, in order to further reform the questionnaire, if needed.

### **3.4. Study sample**

The study sample consisted of all students participated in the laptop initiative program, in which all students and teachers have their own personal laptop computer as part of their school reality the school year 2010-2011. They are all the students who attended the last three classes of the Elementary School and the first two classes of the Junior High School, 610 students in total. All students participated in the program for the first time, except the students in fifth Elementary and the second Junior High, who participated for the second consecutive year. The students completed the same questionnaire twice: in October 2010 (Phase 1) and in May 2011 (Phase 2). In the first phase of the research 442 questionnaires were collected, while in the second phase of the questionnaires were 445. Due to the fact that the sample of students should be the same for the two phases, in order to perform comparisons and conduct statistical tests, the questionnaires of the two phases were matched. The basis of the match was the code name of students. Thus, 404 questionnaires for each phase (808 total) were included in the analysis.

### **3.5. Research site**

The research was conducted at a private school in Athens. During the 2009-2010 school year, all students in that school of the Fourth Elementary and the First Junior High participated in a one-to-one laptop initiative program. The following year, which was the year this study was conducted, the program expanded in all grades from Fourth Elementary to Second Junior High. The laptop was paid and owned by the students and included all the necessary software: digital books, digital notebooks, educational software, word processors and other useful tools. The school was also equipped with a wireless network, so students could access the internet from any place in the school and all classes included an interactive whiteboard. All teachers of the school participated in seminar cycles, designed by the school. The school has a technical department, as suggested by the literature (e.g. Zucker & Hug, 2008).

### **3.6. Validity and reliability**

For the certification of the validity and reliability of the sections that consist the questionnaire, Cronbach's Alpha was calculated for the five sections. All values were found to be greater than 0,7, so it can be considered that all the data are consistent and the questionnaire is reliable (Muijs, 2011).

### 3.7. Data analysis

For each of the two phases of the research, for the declaration of use of the software, the percentage of the students who responded “yes” was calculated. To determine whether the difference in the percentages of students from the first to the second phase is statistically significant, the chi-squared test was applied (comparison of two nominal variables: phase and the declaration of use). Regarding the 75 statements in the questionnaire, for both phases the mean and the standard deviation was calculated. In order to determine whether the difference of means of the two phases is statistically significant, the Wilcoxon test was performed (comparison of two ordinal variables: the two averages of the two phases). To perform the Wilcoxon test, the sample should be the same for both phases. Thus, the students that reported use in the first phase was used as the sample. Additionally, the Mann-Whitney test was performed (comparison of ordinal and a nominal variable: mean and gender) to determine if difference of the means of boys and girls is statistically significant. The test was applied to separately for the two phases of the research. To save space, the results are not displayed by grade; they are grouped (Elementary and Junior High school). Also for space reasons, the means and the standard deviations are displayed for each section of the questionnaire.

## 4. Results

The percentages of students who made declaration of use are shown in Table 1. This section mentions the differences in the percentages that are statistically significant. Use of the operating system: For the Fourth Elementary grade, an increase from 95.05% to 100% ( $x^2=5,127$ ,  $df=1$ ,  $p=0,024$ ). Use of Internet: For the Fourth Elementary grade, an increase from 82.18% to 100% ( $x^2=19,761$ ,  $df=1$ ,  $p=0,00$ ) and for the Fifth Elementary grade, from 88.24% to 100% ( $x^2=7,873$ ,  $df=1$ ,  $p=0,005$ ). Use of word processor: For the Fourth Elementary grade, the percentages are 88.24% and 98.82% for the two phases respectively ( $x^2=7,873$ ,  $df=1$ ,  $p=0,005$ ) and for the Sixth Elementary grade, the percentage in first phase is 93.98% and increases to 100% ( $x^2=5,155$ ,  $df=1$ ,  $p=0,023$ ). Use of the presentation software: For the Fourth Elementary grade, the percentage increases from 77.23% to 100% ( $x^2=22,886$ ,  $df=1$ ,  $p=0,00$ ) and for the Sixth Elementary grade it increases from 93,98% to 100% ( $x^2=5,155$ ,  $df=1$ ,  $p=0,023$ ). Use of the spreadsheet: For the Sixth Elementary grade, the percentages for the two phases are 39.76% and 96.39% respectively ( $x^2=61,228$ ,  $df=1$ ,  $p=0,00$ ).

Table 1. Percentage of students who reported they have used the...

	Phase 1			Phase 2		
	Boys	Girls	Total	Boys	Girls	Total
<b>1. ...operating system</b>						
Elementary	96,60%	98,57%	<b>97,77%</b>	100%	100%	<b>100%</b>
Junior High	100%	100%	<b>100%</b>	100%	100%	<b>100%</b>

**2. ...internet**

Elementary	90,70%	87,86%	<b>89,22%</b>	100%	100%	<b>100%</b>
Junior High	100%	100%	<b>100%</b>	100%	100%	<b>100%</b>

**3. ...word processor**

Elementary	89,15%	92,86%	<b>91,08%</b>	96,90%	99,29%	<b>98,14%</b>
Junior High	100%	100%	<b>100%</b>	100%	100%	<b>100%</b>

**4. ...spreadsheet software**

Elementary	87,60%	90,00%	<b>88,85%</b>	100%	100%	<b>100%</b>
Junior High	100%	100%	<b>100%</b>	100%	100%	<b>100%</b>

**5. ...presentation software**

Elementary	31,01%	30,00%	<b>30,48%</b>	57,36%	53,37%	<b>55,39%</b>
Junior High	89,33%	88,33%	<b>88,89%</b>	90,67%	88,33%	<b>89,63%</b>

The means (Mn) and standard deviations (SD) for each section of the questionnaire are listed in Table 2. For all 75 statements of the questionnaire, there is an increase in the mean and all increases are statistically significant. For the 5 sections of the questionnaire, the means for both the Elementary and the Junior High in the second phase of the study are over 4.

**Table 2.** Means (Mn) and standard deviations (SD) for the 5 sections of the questionnaire

		<b>Phase 1</b>			<b>Phase 2</b>		
		Boys	Girls	<b>Total</b>	Boys	Girls	<b>Total</b>
<b>1. Use of operating system</b>							
Elementary	Mn	3,66	3,33	<b>3,49</b>	4,20	4,00	<b>4,10</b>
	SD	0,84	0,86	<b>0,86</b>	0,67	0,65	<b>0,67</b>
Junior High	Mn	4,10	3,95	<b>4,03</b>	4,61	4,38	<b>4,51</b>
	SD	0,66	0,62	<b>0,65</b>	0,47	0,54	<b>0,51</b>
<b>2. Use of internet</b>							
Elementary	Mn	3,77	3,59	<b>3,68</b>	4,26	4,18	<b>4,22</b>
	SD	0,95	0,94	<b>0,95</b>	0,77	0,67	<b>0,72</b>
Junior High	Mn	4,39	4,55	<b>4,46</b>	4,74	4,79	<b>4,76</b>
	SD	0,61	0,51	<b>0,57</b>	0,39	0,32	<b>0,36</b>
<b>3. Use of word processor</b>							
Elementary	Mn	3,69	3,48	<b>3,58</b>	4,27	4,13	<b>4,20</b>
	SD	0,88	1,07	<b>0,99</b>	0,79	0,73	<b>0,76</b>
Junior High	Mn	4,36	4,54	<b>4,44</b>	4,70	4,79	<b>4,74</b>

	SD	0,64	0,45	<b>0,57</b>	0,40	0,34	<b>0,38</b>
<b>4. Use of spreadsheet software</b>							
Elementary	M	3,98	3,94	<b>3,96</b>	4,52	4,38	<b>4,45</b>
	SD	0,78	0,89	<b>0,84</b>	0,56	0,62	<b>0,60</b>
Junior High	M	4,37	4,44	<b>4,40</b>	4,68	4,72	<b>4,70</b>
	SD	0,56	0,60	<b>0,58</b>	0,41	0,34	<b>0,39</b>
<b>5. Use of presentation software</b>							
Elementary	M	3,47	3,48	<b>3,48</b>	4,26	4,05	<b>4,15</b>
	SD	0,79	0,90	<b>0,84</b>	0,62	0,54	<b>0,58</b>
Junior High	M	4,10	4,13	<b>4,11</b>	4,49	4,51	<b>4,50</b>
	SD	0,80	0,69	<b>0,75</b>	0,66	0,50	<b>0,59</b>

## 5. Conclusions

According to the results, it is concluded that all students who participate in a program of one laptop per student, can handle the **operating system** and their skills in using the operating system increase significantly. The boys tend to be better users of the operating system. This conclusion is supported by the fact that in several statements difference in the mean of boys and girls is statistically significant in favor of boys.

All students participating in the laptop initiative come in contact with the **Internet** and its services, while their skills in using the Internet improve and the improvement is statistically significant. Boys of the Elementary school are better users of the internet, as their means are higher. For the Junior High school, a safe conclusion cannot be exported, because although the averages of the girls are higher than those of boys, there are some statements where the means of the boys are significantly higher than those of the girls.

Regarding the **word processing** software, students participating in a program of one laptop computer for every student come in contact with word processing software and the skills in using this software increase significantly. Boys of the Elementary school are better users, as they have higher means and there are statements where the mean of boys is significantly higher than that of girls. For the same reasons, girls of Junior High school are better users in word processing.

Students participating in a 1:1 laptop initiative know in their entirety how to the **presentation** software, they become better users of the software and the improvement is statistically significant. According to the means of the Likert statements, boys of Elementary and the girls of the Junior High are better users of the presentation software, but there are no statistically significant differences in the means of boys and girls to support this assertion.

The program of one laptop per student helps so that more students come in contact with the **spreadsheet** software and to improve the skills of students in using it, which is confirmed by the fact that all increases in means for the Elementary and the Junior High are statistically significant. Regarding the difference between boys and girls in the use of spreadsheet software, it seems that the boys of the Elementary and the girls of the Junior High use Excel more confidently, but a conclusion cannot be drawn based on the survey data.

## References

- Buckingham, D. (2007). Digital Media Literacies: rethinking media education in the age of the Internet. Communication issues. Tribute: Education and training in media.. 6, 13-29. Athens: Kastanioti.
- Cuban, L. (2001). Oversold and underused: Computers in the classroom. Cambridge, Massachusetts: Harvard University Press.
- Empirica (2007). Benchmarking in a Policy Perspective. Report No. 6: Digital Literacy and ICT Skills, Aprin 2007. [http://ec.europa.eu/information\\_society/eeurope/i2010/docs/benchmarking/wp6\\_digital\\_literacy\\_and\\_ict\\_skills.pdf](http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/wp6_digital_literacy_and_ict_skills.pdf)
- Gilster, P. (1997). Digital Literacy. [New York: Wiley Computer Publishing.](#)
- Hargittai, E. (2005). Survey Measures of Web-Oriented Digital Literacy. Social Science Computer Review, 23, 371-379.
- Hargittai, E. (2009). An Update on Survey Measures of Web-Oriented Digital Literacy. Social Science Computer Review, 27, 130-137.
- Kron, W. F. & Sofos A. (2003). Mediendidaktik. Neue Medien in Lehr- und Lernprozessen. München: Reinhardt.
- Muijs, D. (2011). Doing Quantitative Research in Education with SPSS. 2nd Edition. London: SAGE Publications.
- Niles, R. (2006). A study of the application of emerging technology: Teacher and student perceptions of the impact of one-to-one laptop computer access. Ph. D. Thesis, Wichita State University.
- Rafferty, J. & Steyaert, J. (2007). Social work in a digital society. In: Lymbery, M. & Postle, K. (Eds.), Social Work: a Companion to Learning (pp. 301-320), London, UK: Sage.
- Schaumburg, H. (2003). Konstruktivistischer Unterricht mit Laptops? Eine Fallstudie zum Einfluss mobiler Computer auf die Methodik des Unterrichts. Ph. D. Thesis, Freie Universität Berlin.
- Sofos, A., (2010). Digital Literacy as a Category of Media competence and Literacy - an Analytical Approach of Concepts and Presuppositions for Supporting Media Competence at School. In: Bauer, P., Hoffmann, H. & Mayrberger, K. (Eds.), Fokus Medienpädagogik - Aktuelle Forschung-und Handlungsfelder (pp. 62-82). München: kopaed.
- Stallard, C. K. & Cocker, J. S. (2001). The promise of technology in schools: The next 20 years. Lanham, MD: Scarecrow Press, Inc.
- Zucker, A. A. & Hug, S. T. (2008). Teaching and Learning Physics in a 1:1 Laptop School. Journal of Science Education and Technology, 17(6), 586-594.
- Zucker, A. A. & McGhee, R. (2005). A Study of One-to-One Computer Use in Mathematics and Science Instruction at the Secondary Level in Henrico County Public Schools. Arlington, VA: SRI International and Education Development Center