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Digital Skills in the Z Generation: Key Questions for a Curricular Introduction in Primary School

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Abstract
Media convergence and massive usage of Internet-connected devices, distinguishing features of our current society, cause changes in the way that new generations learn and access knowledge. In addition, emerging new digital skills are necessary for the Z generation to face the challenges of a digital society. This quantitative study, with a sample of 678 Primary School students, aims to provide empirical evidence about the level of digital skills of students belonging to this generation. The results show that the acquisition of digital competences is not inherent to use, but require specific instruction. Otherwise, there is a danger of creating a digital divide, not due to frequency of use or access to connected devices but to lack of instruction on how to use them. The absence of significant variance in the overall level of digital competence among Primary School students of different grades reflects, to some extent, that this level is largely acquired by informal activities with ICTs in an informal context, rather than by developing competences in a school context that affords gradual and progressive skills acquisition. The results show the need to address digital competence in schools, focusing on the systematic development and enhancement of its component areas to move beyond the informal level and reach the academic level, thus facilitating digital natives' access to future employment.

Keywords
Digital skills, digital literacy, curriculum, students, Generation Z, education, Internet, Primary School.

1. Introduction

The knowledge society generates immense and irreversible epistemological and structural changes in all facets of life. Education is not oblivious to all these transformations but is rather immersed in

finding answers to one of the challenges derived from this new information context: educating a generation born and raised in an era of technological explosion and currently encompassing the student body of our schools.

These are students who, as described by Feixa (2006: 13), "from the moment they begin to understand their environment, are surrounded by electronic devices that have configured their vision of life and the world." Many terms have been fashioned to refer to this group since Prensky (2001) mentioned digital natives, among which we find, as described by Fernandez & Fernandez (2016), the Z Generation, the V (Virtual) Generation, the C (Contents or Community) Generation, the Silent Generation, the Internet Generation or even the Google Generation, where the common link is technophilia and the incorporation of ICTs in their daily activities.

The expeditious transformation that ICTs impart to essential habits, learning styles and interaction modalities produces a vast array of possibilities as unknown as they are incalculable (Wolton, 2000; Tapscott, 2008), which education must not only confront, but also offer educational responses. This fact underscores the importance of knowing in depth the characteristics of the above mentioned Z Generation (Schroer, 2008), a term that identifies the cohort born between 1995 and 2012 –most of whom are currently incorporated in the education system– with the objective of pondering the use of ICTs by this generation, the degree to which they are integrated in daily life, and the level of digital skills that should be reflected on the teaching-learning processes developed in the classroom.

1.1. Characteristics of the Z Generation student body

From a socio-cognitive perspective, the Z Generation student body is characterized by distinctive features that differ from students of previous generations, amply described by Bennett & al. (2008), Gallardo (2012), and Fernández & Fernández (2016). Among these authors coincide in emphasizing a capacity of said generation for rapid response, a desire for immediacy and for continuous interaction. In the same vein, , the authors state that the student body of the Z Generation considers itself as expert and competent in ICT, attributing high expectations to technology, where learning tends to be independent or autodidactic.

Other notable characteristics are a preference for visual information and ease of performance in digital and visual environments accomplishing several tasks simultaneously, a phenomenon known as multitasking (Cassany & Atalaya, 2008; Reig & Viched 2013). These characteristics are evidenced in the context of a formal education that must adapt to a student body also known as the "copy and paste in school" generation (Mut & Morey, 2008), which is increasingly distinguished from previous generations in the distinct needs, demands, and behavior patterns brought into and clearly displayed in the classroom. In this regard, some authors such as Fernández and Fernández (2016) question the capacity of current teachers to meet adequate teaching-learning processes for Z Generation students; a concern seeking answers to the issues arising from inadequate skills in preparing future citizens for the demands of their adult lives.

1.2. Digital literacy within the context of Primary Education

The Spanish education system regards digital literacy as a third key proficiency for the student body to acquire by the end of the compulsory schooling phase. As reflected in Order ACD/65/2015 of 21 January, "digital skills are those that encompass creative, critical, and safe use of ICTs to reach the goals related to work, employability, knowledge, use of free time, inclusion, and participation in society. These skills assume, in addition to an ease in adjustment to changes introduced by new technologies in literacy, reading, and writing, the capacity to adapt to a new set of knowledge, abilities and attitudes that are necessary in this day and age to be competent in a digital environment" (Order ECD/65/2015, I).

Digital skills and new literacies for Primary School students are priority themes on government agendas (A Digital Agenda for Europe and a Digital Agenda for Spain). In this regard, as indicated by

González & al. (2012), this priority is substantiated by the directives of what is known as School 2.0 and summarized in a modified definition of literacy: digital literacy. The term refers to a multidimensional outlook comprising the cognition, attitude, and capacity of individuals to utilize digital tools and sources to recognize, access, negotiate, evaluate, analyze and synthesize digital resources to build knowledge, create multimedia contents, communicate with others, and exercise critical skills in virtual contexts, so that constructive social actions are established. (Martin, 2008; Thomson & al., 2014).

In a European context, the most representative study on digital skills was conducted by the Institute for Prospective Technological Studies. Started in 2011, the research yielded four reports that constitute the most comprehensive European study on digital skills and is the foundation on which all subsequent actions are based (Ala-Mutka, 2011; Janssen & Stoyanov, 2012, Ferrari, 2012; 2013). That investigation gave rise to the development of digital skills in five competence areas: information, communication, content creation, problem solving, and security (used for the construction of the instrument).

It is important to note that research regarding digital skills in an education context has mostly addressed higher levels of education, i.e., secondary education and particularly in a university context (Cabero & Llorente, 2008; Larraz, 2013; Gros & Forés, 2013; Sendín, Gaona & García, 2014), where the evaluation and development of digital skills has been the focus of the largest number of investigations.

A review of the research conducted in a primary education context in Spain finds investigative work related to the incorporation of Internet and ICTs (Sigalés & Mominó, 2004; Sigalés & al., 2008), contributions which primarily analyze the impact on innovation and improvement in education. There are also studies on the attitude of primary teachers towardsICTs (Almerich & al., 2005; Sáez, 2011). However, specific research on the digital skills or digital literacy of the Primary School student body in our education system has not been, in general, a focus of study, despite the existence of some comprehensive research on the matter (Aguaded & al., 2015; Pérez-Escoda, 2015).

Therefore, we consider it important to conduct a diagnostic evaluation of digital skills of the student body at this level, which corresponds to the Z Generation: Primary School students from 2nd to 6th year (aged 7 to 12). With that aim we propose the following investigation, focusing on the achievement of five objectives:

- Determine the extent of the use of technological devices as well as the Internet by the student body in informal environments.
- Ascertain the degree to which ICTs are integrated into the daily life of the Z Generation.
- Ascertainthe levels of digital skills by competency areas: information, communication, context creation, security, and problem solving.
- Analyze the results as a function of the sample characteristics for a better generalization of findings.
- Understand the possible implications of the findings in terms of teaching and training of the student body and, in view of the results obtained, study the curricular inclusion potential.

2. Material and method

2.1. Sample

The sample comprised pupils in primary education from the Spanish region of Castile and Leon. It was a convenience sampling, consisting of 678 students: 347 public school children and 331 children from private schools. Eight schools in Castile and Leon, from rural as well as urban environments, and from Leon, Salamanca, Segovia, Zamora, Valladolid, Burgos and Avila, collaborated with the study

The sample consisted of 52.4% boys and 47.6% girls, ranging in age from seven to twelve. There were 52 students from 2nd grade (7-8 yrs.), 125 students from 3rd grade (8-9 yrs.), 164 from 4th grade

(9-10), 178 students from 5th grade (10-11) and 159 students from 6th grade (11-12 yrs.). First-grade students (6-7 yrs.) did not participate in the study as they have not yet mastered their reading-writing skills, which would have created an impediment in the methodological application of questionnaires. Although the sample is limited in its ability to generalize, we consider that the results obtained can be considered representative and of interest to the education community, since there was a diagnostic evaluation process of digital skills of a primary education student body that aims to trigger, through its findings, thoughtful consideration of the status of such skills.

2.2. Information gathering instrument

The choice was to design a questionnaire of closed questions in order to simplify answering by the children and control the consistency level, thus avoiding confusion for the children as they answered the questions (Creswell, 2009). The questionnaire was composed of four differentiated blocks (Table 1) as a function of variable type and data collected.
The first block addresses contextual variables, demographic data and sample identification. The second block consists of five questions to evaluate ICT usage and time spent utilizing them. The third block evaluates the degree of integration of ICTs into daily life. Finally the fourth block, composed of 21 items, focuses on the dimensions of digital skills by competency areas.

Table 1. Study Variables by Blocks or Items

Block	Items		
I. Demographic information	• Age	• School	
	• Grade	• Father's occupation	
	• Number of siblings	• Mother's occupation	
	• Gender	• Location	
II. ICT use and frequency of use in informal environments	• How long have you used a computer		
	• Daily time spent using computer		
	• With whom did you learn to use the Internet		
	• Amount of daily time spent on the Internet		
	• When did you start using the Internet		
III. Degree of ICT integration in daily activities	• Play	Studying the frequency and device used (computer, laptop, tablet, mobile, none)	
	• Use Internet to search for information		
	• Search for videos or music		
	• Do homework		
	• Chat, talk with Friends		
	• Write emails		
IV. Dimensions of digital skills	Information area	• Surf the Net	
		• Select information	
		• Print and save information	
		• Copy and paste information from the Internet	
		• Watch YouTube videos	
	Communication area	• Send emails	
		• Use social network	
		• Participate in chats	
	Content creation area	• Write assignments with text	
		• Make presentations with images and text	
		• Record videos (with mobile, tablet)	
		• Record CDs	
		• Take and edit photos	
	Security area	• Start a program	

		• Download music from Internet
		• Download new apps
		• Disclose personal data
		• Download information from one device to another
	Problem solving area	• Update apps
		• Restart computer, tablet or mobile
		• Learn new apps from others

The internal consistency of the designed questionnaire was measured for validity and reliability. An initial exploratory analysis of the set of items allowed us to conclude that, given the nature of questionnaire blocks, it was better to perform psychometric analyses in a differential manner and with the purpose of obtaining a clear justification, particularly in the block that measured digital skills. Thus, in block three we found the Cronbach's α correlation coefficient of item-total values to be higher than 0.89, which indicates a high reliability in the block. The content was validated with a pilot application of 15 children from different grade levels with the aim of evaluating from 2nd grade to 6th grade of Primary School. This pilot was used to obtain the final version of the questionnaire, with semantic modifications applied according to comments made by the group.
The phases that guided the investigation took full account of the ethical issues that should steer any investigation involving children, ensuring their freedom to participate. The schools' management teams were contacted first, to explain the project and its goal. Once a favorable response to participation was obtained, information circulars were sent to families describing the proposed study and requesting their approval for involvement.
To promote a sense of security among the students, data collection was performed in the participating schools by their own teachers, who were instructed about how to proceed, thus avoiding the presence of strangers in the classrooms. The questionnaires were administered in writing due to the impossibility of online access for all students in participating schools that lacked the adequate infrastructure.

3. Analysis and results

3.1. ICT use and computer time used

The data gathered from the questionnaire reveal a high frequency in the use of technological devices by the Primary School student body, with computers being the most utilized (77.3%) followed by tablets (75.5%), mobiles (74.3%) and laptops (54%). These findings suggest the hegemony of the computer and its pervasive presence in the homes of the students.
Data analyses of findings by grade (see Figure 1) indicate the laptop as the least utilized device at all levels. When results are analyzed by grades, we see that Primary School 2nd graders use computers more often than those in higher grades, 82.7% of 2nd graders versus 77.3% of 6th graders. Another interesting finding is that 75% of 2nd graders use mobile devices.

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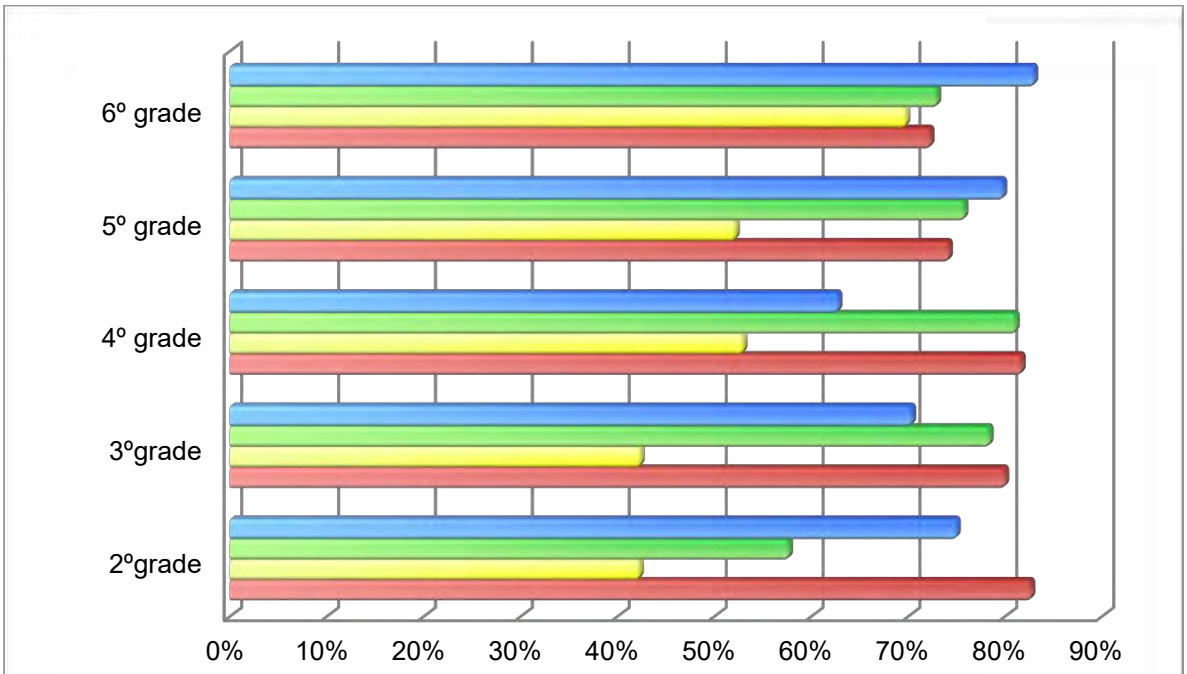

	2ºgrade	3ºgrade	4º grade	5º grade	6º grade
Use mobile	75,00%	70,40%	62,80%	79,80%	83,00%
Use tablet	57,70%	78,40%	81,10%	75,80%	73,00%
Use laptop	42,30%	42,40%	53,00%	52,20%	69,80%
Use computer	82,70%	80,00%	81,70%	74,20%	72,30%

Figure 1. Use of technological devices by Primary School student.

Results obtained in this content block show how the student body in Primary Schools is capable of using different technological devices with ease in their daily life. In fact, 82.7% of 2nd graders claim to use more than one device, and the numbers increase with the academic level, with 96.9% of 6th graders stating that they use more than one technological device in their daily life.

Regarding the item "with whom did you learn to use the computer and Internet," data show the highest percentages corresponded to family (68% of students) and autodidactic; friends or by themselves was indicated by 29.7% of students; while the response "with teachers" was the least selected, at 19.2%. An analysis of these findings in relation to the context variable "rural or urban environment" demonstrates that rural students are more likely to have learned from teachers (21.2%) compared to those from urban environments (16.9%). However, students from an urban environment say they have learned more with family (78.9%) than those from a rural environment (59%). Finally, the student body in rural environments tends to be more autodidactic (29.4%) than those in an urban environment (21.5%).

The analysis of the variable "time spent" addresses those students who say they use computers in their daily life by asking how often they use them. As can be observed in Figure 2, the majority of students in all grades use the computer once or twice per week. Students from 2nd and 4th grade report the highest use of computers (almost daily).

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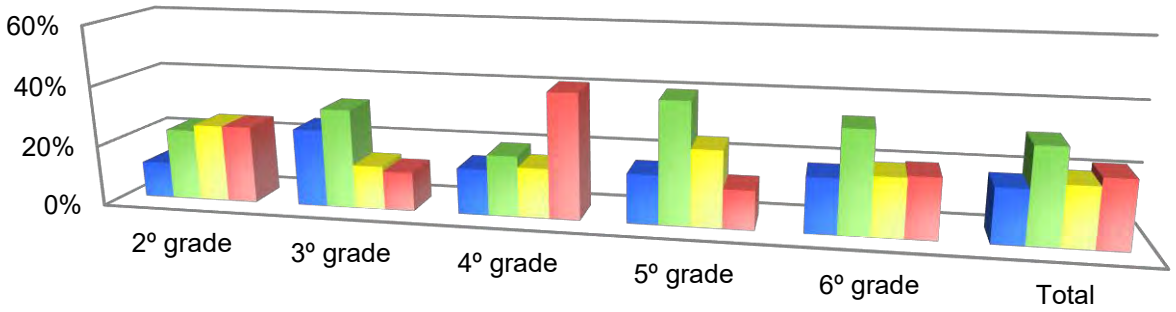

	2º grade	3º grade	4º grade	5º grade	6º grade	Total
Less than once a month	11,80%	25,60%	15,20%	16,30%	18,20%	17,90%
1 or 2 times a week	23,50%	32,80%	20,10%	40,40%	34,00%	31,30%
Several times a week	25,50%	14,40%	16,50%	25,30%	19,50%	19,80%
Almost every day	25,50%	12,80%	41,50%	12,90%	20,10%	22,50%

Figure 2. Length of time spent using computer in daily life.

Computer use and specifically Internet use by the Primary School student body leads us to analyze how long children have been accessing the Net. In this regard, the data throw up striking results, since over 34% of 2nd graders have been using the Net for over a year. Almost 30% of third graders have been accessing the Net for over 3 years and finally, 22% of 4th graders, 26% of 5th graders, and 16.4% of 6th graders have been surfing the Net for over 5 years. These findings demonstrate an increasing trend of younger children using the Internet. When looking at the gender variable to analyze this indicator, it is revealing that girls have started to use Internet and computers earlier, as shown by Figure 3 (https://goo.gl/K2wUC1), even though an independent sample t-test as a function of gender did not find statistically significant differences (n.s. 0,05) in the use of ICTs between gender and frequency of use (Table 2).

Table 2. Independent samples t-test as a function of gender in the use of ICTs and frequency of use in informal environments

Use of ICTs and frequency of use	$\overline{X}_{Boy}$	$\overline{X}_{Girl}$	t	p
Which devices do you usually use?	1,91	1,94	-1,407	0,16
How long have you been using computers?	2,15	2,27	-1,205	0,229
How often do you use the computer?	2,05	2,13	-0,794	0,428
How long have you been using the Internet?	2,36	2,22	1,511	0,131
How often do you use the Internet?	2,64	2,62	0,144	0,885

3.2. Degree of integration of ICTs in daily activities

In this section we analyze the degree of ICT integration in daily activities: play, search for information, search for videos, watch movies, do homework, chat, and write emails. As seen in Table 3, the data show that the most popular activity is play, with the highest mean (1.5), followed by searching for information (1.34) and searching for videos or music (1.3). However, when analyzing the frequency of use of different devices, data show each activity has a different device frequently used. By way of example, play and searching for videos/music, a tablet is most frequently used, with 64.9% and 49% respectively, while the computer is the most utilized device to search for information on Internet (48.7%), to do homework (50.4%) and to watch movies (33.3%). Finally, the mobile device has the highest frequency of use for chatting and talking with friends (58.2%) and writing emails.

Table 3. Analysis of mean, deviation, and frequency of using ICTs for daily activities							
Activity	**Mean**	**Std. Dev.**	**(%) Computer**	**(%) Laptop**	**2(%) Tablet**	**3 (%) Mobile**	**N**
1. Play	1,5	0,602	39,4	27,9	64,9	49,6	678
2. Search for information on Internet	1,34	0,659	48,7	33,8	41	28,5	678
3. Search for videos or music	1,33	0,643	34,1	26,8	49	45,1	678
4. Watch movies	0,88	0,726	33,3	25,7	27,5	8,4	678
5. Do homework	1,04	0,642	50,4	29,9	24,0	10,1	678
6. Chat or talk with friends	0,91	0,652	10,1	9,3	19,8	58,2	678
7. Write emails	0,68	0,739	21,6	18,2	16,2	21,2	678

The distribution of the amount of time students use ICTs for daily activities (Table 4) indicates that the tasks to which they dedicate most time (almost every day) are playing (32.7%), chatting or talking with friends using technological devices (31.3%) and searching for videos or music (31.3%).

Table 4. Time spent in activities using ICTs								
Activity	**Mean**	**Std. Dev**	**(%) No time spent**	**(%) Several times per month**	**(%) 1-2 times per week**	**(%) 3-4 times per week**	**(%) Almost every day**	**N**
1. Play	2,68	1,91	5,7	11,5	30,1	19,9	**32,7**	672
2. Search for information on Internet	2,27	1,941	10,2	19,1	**28**	24	18,4	674
3. Search for videos or music	2,39	1,515	9,6	18,1	27	17,5	**27,7**	675
4. Watch movies	1,27	1,142	**32,3**	26,4	28,3	7,9	5	674
5. Do homework	1,44	1,109	19,5	**40,4**	22,7	11,3	6,1	673
6. Chat or talk with friends	2,11	1,588	26,2	11,3	19,5	11,8	**31,3**	673
7. Write emails	1,08	1,308	**48,7**	19,1	15,3	8,9	8	672

3.3. Level of digital skills among Primary School students

The third proposed objective was to determine the level of digital skills by competency areas as reported by the students, in order to establish lines of action aimed at enhancing their training. Three digital skill levels were established for this purpose according to the answers students gave to each item. Using a Likert scale, the levels were determined as nil, low, little, some, sufficient, and much. Based on the answers, the levels were finalized as follows:

- Level nil: From lowest value to 19th percentile
- Level low: Percentiles 20 to 41
- Level medium: Percentiles 42 to 63
- Level advanced: Percentiles 64 to maximum value

Table 5 shows the number and percentage of students in each established competency level.

Table 5. Level of digital skills among Primary School students		
Level	**N**	**%**
Nil	153	22,5%
Low	282	41,6%
Medium	210	30,9%
Advanced	33	5%
Total	678	100%

From the distribution of the student body among the three levels of digital skills, it is evident that competency is heterogeneous; but it is remarkable that only 5% of the student body is classified in the advanced level versus 22.5% that show no digital skills at all (see more details by competency areas in Table 5.1 (https://goo.gl/ZweFIV). Digital skills levels can be affected by conditional variables such as grade level, gender, rural or urban environment of the student. Because of this, if we study the block by variables, the tendency is confirmed. Table 6 shows specifically how the lowest percentages are found in the advanced level for all grades.

Table 6. Contingency analysis between skill levels by grade

		Nil	Low	Medium	Advanced	Total
Second grade	Count	27	16	8	1	52
	% within the grade	**51,9%**	30,7%	15,3%	1,9%	100%
Third grade	Count	40	50	28	7	125
	% within the grade	32%	**40%**	22,4%	5,6%	100%
Fourth grade	Count	43	71	46	4	164
	% within the grade	26,20%	**43,20%**	28%	2,40%	100%
Fifth grade	Count	26	77	67	8	178
	% within the grade	14,60%	**43,20%**	37,60%	4,40%	100%
Sixth grade	Count	17	68	61	13	159
	% within the grade	10,60%	**42,70%**	38,30%	8,10%	100%

Furthermore, an analysis of the gender variable yields statistically significant differences, especially in the content creation competency level, where an independent sample t-test shows disparity between genders with significant bilateral values 0.030, 0.000 and 0.007 for the three variables in this area (as shown in Table 7: https://goo.gl/AnZ1uW).
Finally, in the ANOVA analysis of variance the differences in this block are studied according to grade levels. Evidently, the striking feature here is not the difference in skills levels among grades (which is completely expected) but the absence of statistically significant differences between the youngest and the oldest with the item “record videos” (within the content creation competency level, Table 8: https://goo.gl/lx6io5).

4. Discussion and conclusions

The coexistence of the student body corresponding to the Z Generation, currently at the primary education stage, and ICTs is clear. Access to technology at an early age is a characteristic of this generation, as noted in a theoretical framework (Prensky, 2001; Feixa, 2006; Schroer, 2008). This is also apparent from the present investigation, where we found that the student body at lower grade levels (2nd grade of primary) uses ICTs and demonstrates an amount of usage time higher than that of the student body in the highest primary grade. These data reinforce the arguments that with increasing precocity children are intensely engaged with screens (García, Callejo, & Walzer, 2004; Blanco & Römer, 2011), since - as research demonstrates - before they learn to read and write with ease they surf the Net and use all kinds of digital devices.
However, this study demonstrates that simple exposure to, use of and coexistence with media and technology do not imply development of digital skills. Data obtained in the evaluation of digital competency of the student body belonging to the Z Generation indicate low skill levels, in contrast with expectations of digital natives. These results point to a new type of digital divide among those born with technologies, not due to lack of use or access but to a lack of digital skills (Van-Deursen & Van-Dijk, 2010). We therefore agree with the premise indicated by several authors (Cabra-Torres & Marciales-Vivas, 2009; Cobo & Moravec, 2011) who refer to the fallacy of the digital native. From our perspective, this concept would assume that the child has access to and coexists with ICTs, not that the child knows how to use digital technologies. In this regard, Horizon Report Europe 2014 (Johnson

& al., 2014) points to the insufficient digital skills of European children and adolescents, which corresponds to the present findings of the sample we analyzed, where the lack of significant variance in the general level of digital skills among the students in primary education grades reflects, to some extent, that such a level is acquired by coexisting with ICTs and not because of adequate development in a school context that increases acquisition in a gradual and progressive manner.

While we understand that this study has limitations, it does nonetheless offer objective clues for future lines of investigation that reinforce the need to address digital skills in school, focusing on the development of their component areas, enhancing them to surpass the level of daily use and raise them to an academic level that will eventually facilitate the development of digital abilities for the world of employment (DO C451, 2014). If, as we have noted, current digital skill levels correspond largely to the stimulation of a socio-familiar context and the child's contact with ICTs, there is a danger that these skills, if not well developed or cared for in an educational context, will propitiate inequalities in the promotion of digital competency. Education has the challenge and responsibility of offering a response tailored to this reality, transitioning toward a School 2.0 that does not overestimate the digital skills of the student body and that allows students the possibility to not just sit in front of screens, but to do so in an effective manner, repositioning the need for critical and participative literacy in the handling, creation, and dissemination of information (Suñé & Martínez, 2011).

To achieve this it is necessary to sensitize teaching staff as to the actual digital competence level of the student body, focusing on the fact that digital literacy is not inherently achieved through the use of technology but rather needs adequate instruction (Cabero & Marín, 2014). The following are some guidelines that may steer the teaching-learning process of the student body of a Z Generation, which tends to place high expectations on technology and develops independent or autodidactic learning, and perhaps facilitate a real and effective inclusion of digital skills in the Primary School curriculum:

- Design assignments that assume the student body will apply skills and strategies to access information, to decode and construct new messages in an ethical and critical manner that favors the development of transmedia navigation and an ability to follow the flow of media information.
- Organize tasks and undertakings that entail the utilization of technology in a collaborative manner, incorporating networking activities.
- Organize activities that entail the development of critical judgment to evaluate the reliability and veracity of the information sources being accessed.
- Assume that the role of the instructor in the classroom should be more as an energizer and supervisor and not so much as a transmitter of information,
- Develop problem-solving through technological resources from a collective, participative and active perspective
- Introduce gamification as a teaching strategy, incrementing motivation, team work and development of ethical values.

These strategies, in our view, should help favor the development of a School 2.0 that responds with quality and efficacy to the need for digital and media literacy in a student body which is exposed to electronic devices and should acquire digital skills to utilize technologies in a critical and effective manner (Ferrés, García, & al., 2011).

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