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## Understanding factors related to Chilean students' digital skills: A mixed methods analysis



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### ABSTRACT

For new generations to fully integrate and participate in an increasingly technology-rich society they must become digitally literate. Education systems have a role to play in this, especially given the growing evidence of a digital divide. Through this study, we look to identify and characterize factors related to the digital skills of 10<sup>th</sup> grade Chilean students, as measured by a national standardized test. A mixed methodology was used to explore these factors and provide a more detailed analysis. Statistical analysis was performed using a Hierarchical Linear Model to determine which factors explain student performance on the test. In addition to this, a qualitative analysis was also carried out using an exploratory case study. The purpose of this case study was to take a more in-depth look at the characteristics of high and low-performing students on the digital skills test. This was done by analyzing their activities, perceptions and motivations when using technology. The quantitative results revealed that the most important factors in developing digital skills are having access to a computer at home, linguistic capital, socioeconomic status, and years of experience using a computer. The qualitative study also revealed that students who scored highly on the test were generally able to focus and concentrate on their school assignments when using the Internet. These students also adopted cognitive and organizational strategies in order to be more effective. Our findings should be further investigated in order to support the design of school activities that aim to develop students' digital skills.

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## 1. Introduction

Information and communication technologies (ICT) have changed the way in which contemporary societies are organized. Modern societies have shifted from an economy based on commodities and manual labor to an economy based on knowledge and highly qualified human capital. Societies have also shifted from a culture based on time and space to a culture based on the virtualization of social interactions and the development of interactive, horizontal networks of communication (Castells, 1996). Furthermore, ICT have been given a central role in home and family life, both in terms of socio-demographics as well as dynamics, lifestyles and cultural expectations and attitudes (Livingstone & Helsper, 2007). The new role of ICT has given rise to new ways of communicating, socializing and learning, both inside and outside school (Erstad, 2012; Furlong & Davies, 2012).

Within this context, the ability to use ICT and work with information may be considered 'the indispensable grammar of modern life' (Wills, 1999, p.10), as well as an important 'capability for learning' (Hague & Payton, 2010, p. 11). Both of these views place strategic importance on digital literacy for new generations. The former view is important for preparing students to fully participate in society, while the latter is important for developing their capacity for lifelong learning. On the one hand, digital literacy allows students to successfully find and select relevant information and facilitates access to subject knowledge in different formats (e.g. text, video and image). On the other hand, digital literacy may also have an impact on what students know about school subjects and the skills required to independently develop subject knowledge (Hague & Payton, 2010).

The definition of digital literacy is still under discussion. However, most researchers agree that it includes the skills required for solving information and communication problems in a digital setting (i.e. searching, evaluating, summarizing, analyzing and presenting information) (Ananiadou & Claro, 2009; Ferrari, 2013; Fraillon, Schulz, & Ainley, 2013; Van Dijk & Van Deursen, 2014). There is also some consensus that digital literacy includes sharing and collaborating with others by using digital tools (Ananiadou & Claro, 2009; Anderson, 2008; Fraillon & Ainley, 2011). Nevertheless, little is known about how children, teenagers and adults become skilled in solving information and communication problems in a digital setting. There is a tendency to assume that digital skills develop spontaneously. There is also little attention paid to these skills within school systems (Prensky, 2001). However, research has shown that it is unlikely new generations will develop these skills without adult guidance (Brand-Gruwel, Wopereis, & Vermetten, 2005; Brand-Gruwel, Wopereis, & Walraven, 2009b; Duijkers, Gulikers-Dinjens, & Boshuizen, 2001; Hirsh, 1999; Walraven, Brand-gruwel, & Boshuizen, 2008). Teachers have also increasingly reported that young students are not as competent or skilled as they might seem. In fact, research on information problem solving has shown that while students may have the ability to find information using digital technology, they struggle to define information problems, specify proper search queries and evaluate the information that they find (Brand-Gruwel, Wopereis, & Walraven, 2009a; Van Deursen & Van Diepen, 2013; Walraven et al., 2008). The aforementioned studies have shown that it is not possible to suggest that young people possess the characteristics of a 'digital native'. It therefore seems reasonable to assume that there will be differences in the way young people access, use and benefit from these technologies. In this sense, the OECD and other researchers have warned against the emergence of what they call a "second digital divide" (OECD, 2010). This divide is defined as the difference between students who have the necessary skills and abilities to effectively use ICT and those who do not. Furthermore, several studies have demonstrated that once access to technology is equal, the differences in how effectively it is used depend on other factors. In particular, these factors have been shown to relate to social, cultural and economic variables (Hargittai, 2008, 2010; Van Deursen & Van Dijk, 2013).

There are also home-level and individual factors that explain differences in students' digital skills. Van Deursen and Van Dijk (2011) found that age and level of education were the main determinants of both operational internet skills (e.g. using browsers) and formal internet skills (e.g. knowing how to navigate the Internet). They also showed that years of experience using the Internet was only relevant for operational internet skills. With regards to content-related internet skills (i.e. knowing how to find the information they are looking for and using this information strategically), the authors found that level of education was the most important factor. They also found that age and experience were not significant for these types of skills. Similarly, Van Deursen and Van Diepen (2013) carried out a study of content-related internet skills among high school students. They showed that performance at school was the most important factor, while years of experience using the Internet and weekly hours of use were not significant. Hatlevik, Ottestad, and Throndsen (2014) found that higher levels of mastery orientation and self-efficacy (i.e. motivation) were predictors of students' digital skills. This was also the case for the students' family background (i.e. language integration and the number of books at home). In addition to this, Litt (2013) confirmed the importance of level of education and socioeconomic status as strong predictors for the development of these skills. This evidence suggests that those in more privileged positions take fuller advantage of the opportunities provided by the Internet.

Only a few countries other than Chile (e.g. Australia and France) have developed national performance tests to assess students' digital skills. The results of the International Computer and Information Literacy Study (ICILS) were published recently, with 21 countries taking part (Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014). This was done under the auspices of the IEA (International Association for the Evaluation of Educational Achievement). These national-level assessments have been consistent in showing the importance of individual and home-level characteristics in explaining student performance in a digital context. In particular, these characteristics include the students' economic, social and cultural capital, as well as the ICT resources they have available at home. However, quantitative analysis of national-level assessments can only provide general evidence of these factors. In order to design strategies to develop digital skills in schools, more in-depth information is needed regarding the characteristics of ICT use (e.g. how students go about doing their schoolwork). In fact,

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