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AN INTEGRATIVE REVIEW OF LITERATURE ON LEARNERS IN THE DIGITAL ERA

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Abstract

The purpose of this paper is to report on the state of knowledge in education related to the concept of the "digital native" and affiliated concepts, as well as on how the literature was identified, analyzed, synthesized, and reported. To address the research aim, an integrative literature review was performed. In all, 355 articles (both qualitative and quantitative) published between 1991 and 2013 were reviewed. On the basis of the findings, the literature review revealed 46 terms related to the notion of this "new generation" of students, some similar, others quite different, and many redundant. The three most common terms in circulation are: digital natives, net generation, and millennials. The author recommends moving beyond the superficial dichotomy of "natives" and "immigrants", focusing on the implications of being a learner in a digital era, and taking into account factors such as age, gender, education, culture, experience, institutional context, learning design, social inclusion and exclusion, subject discipline, and socio-economic background.

Keywords

digital learner, digital era, digital technologies, higher education, integrative literature review

Introduction

The increase in the use of information and communication technologies (ICT), especially the Internet, has had a significant impact on society and on many aspects of daily life (Acilar 2011; Jelfs & Richardson 2012). ICT entered our lives relatively recently and plays an increasingly important role in our work and personal lives. In most developed countries, students use digital technologies and the Internet in all facets of their daily life (school, work, and leisure) (Kolikant, 2010; see also Levin & Arafeh, 2002). However, the same cannot be said for many developing countries where access to digital technologies is much more limited (Acilar, 2011; *Hilbert, 2011;* Miah & Omar, 2012), e.g., inadequate access to ICT infrastructure such as computers and the Internet.

The world that young people grow up in prior to their arrival at university is now filled with new technology that is integral to the way they live, think, communicate, and work (Jones & Healing, 2010; Simoneaux & Stroud, 2010). Most of these students, who were born roughly between 1980 and 1994, represent the first generation to grow up with this new technology, and they are characterized by their familiarity and confidence with ICT. This generation has been given several nicknames to emphasize its affinity and tendency to use digital technology, such as "generation Y" (Howe & Strauss, 1991), "millennials" (Howe & Strauss, 1991), "net generation" (Tapscott, 1998), "digital learners" (Brown, 2000) "digital natives" (Prensky, 2001), "new millennial learners" (Pedró, 2006), "learners of the digital era" (Rapetti & Cantoni, 2010), and "digital nerds and digital normals" (Thirunarayanan, Lezcano, McKee & Roque, 2011).

Discussions about digital natives are usually based on the assumption that students born roughly between 1980 and 1994 are proficient users of digital communication technologies because they have grown up in an age when computers, mobile phones, and the Internet are part of mainstream culture and society. Discussions about digital natives, usually centered around an assumption about the existence of a homogeneous generation of prolific users of technology, have been accepted uncritically by many educators. Despite the considerable attention focused on digital natives (Prensky's term applies to developing countries), remarkably few studies have carefully investigated the characteristics of this group. Most of the studies that were used to support the digital native concept were either methodologically suspect or relied excessively on anecdotal data. Little empirical evidence was provided to support claims about the presumed digital natives and their implications for higher education (Bullen, Morgan & Qayyum, 2011). This changed in 2007 as researchers began to take a more critical look at this issue and a number of methodologically sound studies were published (Bennett, Maton & Kervin,

2008; Kennedy, Krause, Judd, Churchward & Gray, 2008; Nicholas, Rowlands & Huntington, 2008; Bullen & Morgan, 2011; Bullen, Morgan & Qayyum, 2011a; Kennedy, Dalgarno, Gray, Judd, Waycott, Bennett & Churchwood, A., 2007; Nicholas, Rowlands & Huntington, 2007; Morgan & Bullen, 2013; Rapetti & Cantoni, 2013; Romero, Guitert, Sangrà & Bullen, 2013). These authors assert that the new generation of learners who are entering the higher education system have grown up in a technologically enhanced environment that has fundamentally influenced their preferences and skills in a number of key areas related to education.

Aim and research question

The aim of this paper is to report on the state of knowledge in education related to the concept of the digital native and affiliated concepts, as well as on how the literature was identified, analyzed, synthesized, and reported. We also want to provide a critique of past research related to the term "digital natives", because this term seems inappropriate for describing the population of current learners. The study was guided by the following research questions: (a) How many terms are used to characterize learners in the digital era? (b) How is the new student generation in higher education described in contemporary research findings? and (c) What kind of experiences do they have?

Methodology

To address the research aim, an integrative literature review was performed. This method "reviews, critiques, and synthesizes representative literature on a topic in an integrated way such that new frameworks and perspectives on the topic are generated" (Torraco, 2005, p. 356). To Hamilton & Torraco (2013, p. 311), "this methodology is particularly appropriate when existing research is scattered across disparate areas and has not been systematically analyzed and integrated". There is a misconception with respect to literature reviews that integrative literature reviews are less rigorous or easier to write than other types of research articles (for example quantitative meta-analysis). On the contrary, the integrative literature review "is a sophisticated form of research that requires a great deal of research skill and insight" (Torraco, 2005, p. 356). This is consistent with the aim of the article to examine the literature as a means of providing researchers and educators with new ways of thinking about this topic (Hamilton & Torraco, 2013).

The review used inclusion and exclusion criteria to focus on the problem. The inclusion criteria were: (a) empirical and research-based publications;

(b) qualitative, quantitative, and mixed research studies; (c) specialized textbooks and peer-reviewed journal articles; (d) only full-text articles; (e) reports commissioned by international organizations; (f); literature reviews (including unpublished/gray literature: government reports, policy statements, conference proceedings, theses, dissertations, and research reports); (g) English language only; and (h) published between January 1991 and December 2013. It must be highlighted that that the author selected 1991 as the starting point, as the first term referring to students in the digital era was proposed by Howe and Strauss in 1991. The exclusion criteria were: (a) opinion and working papers; (b) practice reports; and (c) articles that did not focus on the aim of this study.

Online electronic databases such the ISI Web of Knowledge, ERIC, Social Sciences Citation Index®, ScienceDirect, SAGE Publications, Wiley Online Library, Taylor & Francis Online, Emerald Group Publishing, UNESDOC Database, and Google Scholar were systematically searched using combinations of the following keywords: digital natives, generation net, millennials, and generation Y. According to the literature (Jones & Czerniewicz, 2010; Rapetti & Cantoni, 2010b), these keywords are the four most common terms in circulation. When a new term or conceptually similar word appeared during the search, it was added to the list. To conduct the most comprehensive search, the reference lists of the found articles were examined for more articles that may not have been found by the electronic databases. Newly published articles were identified by alert notifications on the aforementioned databases using the keywords. An online thesaurus (found at some electronic databases) was a helpful tool, providing a selection of related, narrower, and broader terms for the topic. To facilitate the access to and recovery of information, all the documents were organized using reference management software such as Mendeley, which was a helpful organization tool for keeping track of which articles needed to be read and which were the most important. This software was chosen because Mendeley (2013) is a free reference manager and academic social network that helps the researcher organize the research, collaborate with others online, and discover the latest research.

The search strategy identified 2500 publications as potentially relevant sources of evidence. Consequently, a staged review – an initial review of abstracts, followed by an in-depth review (Torraco, 2005) – was employed to review the 2500 publications and identify relevant articles. Titles and abstracts of the papers were scrutinized independently by two reviewers. Publications were screened for purposeful, representative, and relevant validity criteria (Torraco, 2005; Rocco & Plakhotnik, 2009). Following this process, 355 of the articles met the inclusion criteria, corresponded to the aim of this review, and were analyzed.

To provide knowledge and understanding of the phenomenon under study, the documents were thematically analyzed, as outlined by Braun and Clarke (2006). Thematic analysis (see Figure 1) is a method for identifying, analyzing, and reporting patterns (themes) within data that minimally organizes and describes the data set in (rich) detail (Braun & Clarke, 2006; Cohen, Manion & Morrison, 2007; Guest, MacQueen & Namey, 2012; Vaismoradi, Turunen & Bondas, 2013). Content analysis and thematic analysis are two commonly used approaches in data analysis. They are used interchangeably, and there are many similarities between the approaches, including cutting across data and searching for patterns and themes; the main difference is that content analysis offers more opportunity for data quantification (Vaismoradi, Turunen & Bondas, 2013). Thematic analysis "moves beyond counting explicit words or phrases and focuses on identifying and describing both implicit and explicit ideas within the data, that is, themes" (Guest, MacQueen, & Namey, 2012, p. 10).

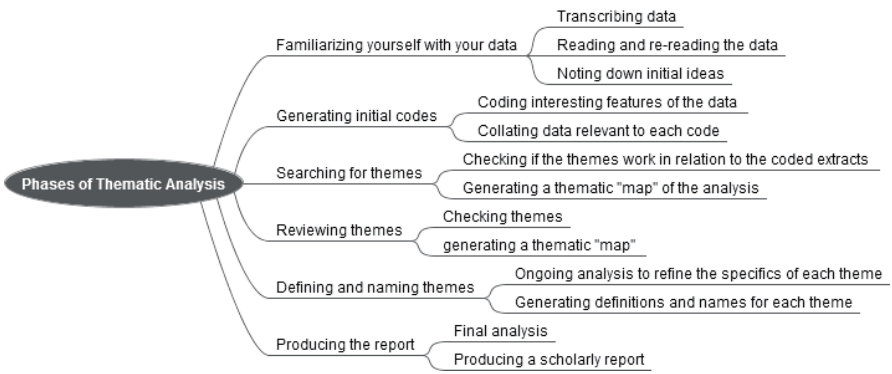

Figure 1
Phases of Thematic Analysis. Adapted from Braun & Clarke, 2006, p 87.

The themes emerged through several readings and a theoretical or deductive ("top down") process of condensing identified key concepts into major categories by determining the main contribution of the literature source to what is known about the new generations of students. The publications were categorized for discussion using three views suggested by Rapetti (2012) characterizing how authors and scholars perceive and define learners using ICTs: (a) enthusiasts, (b) reactionaries, and (c) critics (see Table 1 for a detailed description). Finally, the researcher reviewed each article in each category multiple times to identify information that could be compared, contrasted, discussed, critiqued, and synthesized.

Table 1
Three different views characterizing how authors and scholars perceive and define learners using ICTs

View	Description
Enthusiasts	They are firmly convinced that digital technologies are making the generation of younger learners very skilled (e.g., Howe & Strauss, 1991; Prensky, 2001).
Reactionaries	They accept the idea of a digitalized generation of learners, but focus on the potential dangerous effects, such as violence, dumbness, harassment, addiction, etc. (e.g., Bauerlein, 2008).
Critics	They question the idea of characterizing the set of skills of the young generation simply in terms of ICT usages, criticizing overgeneralizations, and requesting deeper studies and localized analyses (e.g., Bullen, Belfer, Morgan & Qayyum, 2009).

Note. Adapted from Rapetti, 2012, p. 144.

Reliability and validity are very important concepts to take into consideration when conducting qualitative research, since they help to maintain the objectivity of the research in which the researcher determines and checks the accuracy or credibility of the findings through strategies or procedures (Creswell, 2003, 2008). The researcher tried to design research which is auditable, i.e. transparent and replicable; if another researcher can clearly follow the decision trail used by the researcher in the study, then the results should be the same over time and over instruments (Koch, 2006; Cohen et al., 2007). An audit procedure (also known as an audit trail) was conducted to ascertain if the study meet the criterion of reliability. According to Akkerman, Admiraal, Brekelmans, and Oost (2008), this procedure is "the most developed and useful tool for maintaining and evaluating the quality of research that involves complex analyses" (p. 261). According to Koch (2006) the audit trail concept is based on the idea of the fiscal audit, which requires the auditor to authenticate the accounts of a business to exclude the possibility of error or fraud. All of the phases of this study were subject to scrutiny by an external auditor experienced in qualitative research methods (Creswell, 2003). Audit trails document the course of development of the completed analysis. Table 2 provides an account of all of the research decisions and activities throughout the study.

Table 2
Stages of the audit procedure

Stage	Description
Orientation to the audit procedure	Both the researcher (the auditee) and the evaluator of the quality of the study (the auditor) negotiate and agree upon the goals, roles, and rules of the audit.
Orientation to the study	The researcher arranges a meeting and explains the audit trail to the evaluator in order to familiarize the evaluator with the study. The evaluator examines all the materials provided in the audit trail in detail.
Determination of the auditability of the study	The evaluator determines the completeness, comprehensibility, and utility of the audit trail. Both the researcher and the evaluator discuss the auditability.
Negotiation of the contract	The researcher and the evaluator establish a timeline, determine goals, specify roles, arrange logistics, determine outcomes and formats, and identify renegotiation criteria.
Assessment	Based on the audit trail, the evaluator assesses the research process in terms of the specific quality criteria.
Renegotiation	The evaluator presents findings. The researcher assesses the accuracy of the evaluator claims and adherence to the agreement.
Final auditor report	The evaluator writes a substantiated assessment on the trustworthiness of the study.

Note. Adapted from Akkerman et al., 2008, p. 263.

According to Miles and Huberman (1994), validating themes in the early and late stages of data analysis is essential. The researcher asked several senior researchers and experts from Commonwealth of Learning (Canada), Rovira i Virgili University of Tarragona (Spain), and Ludwig Maximilian University of Munich (Germany) to conduct a thorough review of the study and report back in order to generate peer support and to find better connections between categories in progress (Creswell, 2003; Saldaña, 2009).

Findings: 46 terms to characterize learners in the digital era

The literature review revealed 46 terms (Figure 2) related to the notion of this new generation of students in the digital era with a high affinity and tendency to use digital technology, of which "digital natives" has been the most prominent in the past decade. Whatever the terminology, the assertion

that students who now enter higher education have been exposed to a wide range of digital technologies that did not previously exist is accurate (Brown & Czerniewicz, 2010). According to the literature, digital natives, net generation, and millennials are the most common terms in circulation; this will be explained in more detail. Appendix A provides an overview of the wide variety of concepts/terms derived from the literature review used to describe these students. Torraco (2005) emphasized that organizing articles chronologically allows for knowledge about the historical evolution of the phenomenon studied and we have followed this suggestion.

Figure 2
Terms used to characterize students in the digital era

Three most common terms

The term "net generation" (also called net gen) was originally coined by Tapscott (1998) and includes people born between 1977 and 1997 (Tapscott, 2009). According to Tapscott (2009), the defining characteristic of this generation is that they were the first to be "growing up digital" (p. 2) and "the first generation to be bathed in bits" (Tapscott, 2009, p. 17). The general claim made in the net generation discourse concerns young people developing a natural aptitude and high skill levels in relation to new technologies for formal and informal learning purposes (Jones, 2010; Jones & Czerniewicz, 2010; Rapetti & Cantoni, 2010b).

Howe and Strauss (2000) refer to "millennials" (students born after 1980 to 2000) as the first generation to grow up surrounded by digital media. Millennials are characterized as special, sheltered, confident, conventional, team-oriented, achieving, and pressured (Howe & Strauss, 2000). According to

Djamasbi, Siegel, and Tullis (2010), millennials are a "very large and economically powerful generation" (p. 307), and their generation "is one of the first generations to have technology and the Internet from a very early age – they are significantly more likely than older internet users to create blogs, download music, instant message, and play online games" (p. 309).

The term "digital native" was coined by Prensky (2001a, 2001b) and its definition has its origins in the work of Tapscott (1998) and Prensky (2001a, 2001b).Prensky uses the terms "digital native" and "digital immigrant" to distinguish between those who were not born into the digital world (Prensky, 2001a) and those who have grown up familiar with multiple technologies. Prensky's main point is that this new group of students entering universities is essentially different than previous generations because of their constant and frequent use of digital technologies; they are all "native speakers" of the digital language of computers, video games, and the Internet (Prensky, 2001a). To Prensky (2001a), today's college students are digital natives, while most of their teachers are digital immigrants. Digital immigrants—as opposed to digital natives—are people who were not born into and who do not live a digital life in any substantial way, but are finding their way in a digital world.

The "enthusiast" authors (from Table 3) have each proposed their own lists of the characteristics they believe define the new student generation in higher education. Definitions of the these terms have become interchangeable (Jones, Ramanau, Cross & Healing, 2010) and have influenced one another, the claims made by authors supporting notions of digital natives often overlap between the various lists and share commonalities (Smith, 2012; Thompson, 2013).

Table 3
Key claims about "digital natives"

Key claim	**Author**
Want to get along by being team-oriented and desire to cooperate and be perceived as being cooperative.	Downing, 2006; Howe & Strauss, 1991; 2000; Lancaster & Stillman, 2002; Martin & Tulgan, 2002, 2006; Oblinger, 2003; Oblinger & Hawkins, 2005; Oblinger & Oblinger, 2005; Prensky, 2010; Tapscott, 1998; 2009
Marked ability to multitask with a variety of digital technologies.	Frand, 2000; Lancaster & Stillman, 2002; Gaston, 2006; Oblinger, 2003; Oblinger & Hawkins, 2005; Prensky, 2001b; Rosen, 2010; Simoneaux & Stroud, 2010; Tapscott, 1998; 2009; Zemke, Raines & Filipczak, 2000

Key claim	Author
Need to acknowledge and to drive a digital revolution transforming society. Need to think in terms of transforming the educational experience.	Frand, 2000; Howe & Strauss, 1991; 2000; Oblinger, 2003; Oblinger & Hawkins, 2005; Oblinger & Oblinger, 2005; Prensky, 2001a; Tapscott, 1998; 2009
Seen as innately or inherently tech-savvy as opposed to older generations.	Oblinger, 2003; Oblinger & Hawkins, 2005; Oblinger & Oblinger, 2005; Prensky, 2010; Tapscott, 1998; 2009
Need for achievement and detailed instructions/guidelines for assignments.	DeBard, 2004; Howe & Strauss, 2000; Martin & Tulgan, 2002, 2006
Possess new learning styles or different ways of knowing and being.	Brown, 2000; Frand, 2000; Howe & Strauss, 1991; 2000; Oblinger, 2003; Oblinger & Hawkins, 2005; Oblinger & Oblinger, 2005; Prensky, 2001a
Need for constant connectivity; being in touch with friends and family at any time and from any place.	Frand, 2000; Oblinger & Oblinger, 2005; Prensky, 2001b, 2006; Rosen, 2010
Purported as native speakers of computers, video games, and the Internet.	Brown, 2002; Prensky, 2001a; Prensky, 2010
Preference for online/offline games and interactive simulations to serious work.	Downing, 2006; Frand, 2000; Oblinger, 2003; Prensky, 2001a; Tapscott, 1998; 2009
Marked preference for images over text-based content.	Prensky, 2001a, 2001b; Tapscott, 2009
Confident in the knowledge that they have in their use of technologies. Optimistic about their future.	Downing, 2006; Howe & Strauss, 2000; Martin & Tulgan, 2002, 2006; Taylor & Keeter, 2010

Beyond digital natives

In the literature, students are sometimes assumed "to feel empowered with respect to learning because of their familiarity with and access to ICT" (Kolikant, 2010, p. 1384). In fact, most of the academic research on this topic (Kennedy et al., 2008; Bennett et al., 2008; Brown & Czerniewicz, 2010, Li & Ranieri, 2010) shows that digital natives appear to possess a superficial understanding of the new technologies, using them for very limited and specific purposes and having only superficial information-seeking and analysis skills. In recent years, empirical research into net geneBulration students' use of, and preferences for, technologies in higher education revealed "that while most students regularly use established technologies such as email and Web searching, only a small subset of students use more advanced or newer tools and technologies" (Kennedy, Judd, Dalgarno & Waycott, 2010, p. 333).

A research project conducted by the University College London revealed that learners' ICT skills are less advanced than educators tend to think (Nicholas et al., 2008) and that the characterization of young people as digital natives hides many contradictions in their experiences (Luckin, Clark, Logan, Graber, Oliver & Mee, 2009; Littlejohn & Margaryan, 2010; Littlejohn, Beetham & McGill, 2012).

The international research project "Digital Learners in Higher Education", which investigates how post-secondary learners think about technology, suggests that there are no meaningful differences between net generation and non-net generation students in terms of their use of technology. The research shows that today's learners, regardless of age, are on a continuum of technological access, skill, use, and comfort (Bullen, Morgan, Belfer & Qayyum, 2008; Bullen & Morgan, 2011; Bullen, Morgan & Qayyum, 2011). A study among first-year students at an Australian university demonstrated enough diversity in ability, access, and use of technology by the students to suggest that a technologically homogenous group of students cannot be assumed (Corrin, Lockyer & Bennett, 2010). A meta-analysis of learners' experiences of e-learning by Sharpe (2010) confirmed that we should not make assumptions about learners' digital competencies and literacies when they enter higher education. A survey conducted in 2007 of 3533 students regarding ICT use in six higher education institutions in five South African provinces confirmed that new technologies are infrequently used despite the hype associated with Web 2.0 technologies (Brown & Czerniewicz, 2008). Another study conducted in 2009 of more than 290 first year students at two South African universities about their access to and use of technology revealed that the students did not appear to use such technologies and were not interested in using them in their studies, with the exception of tasks involving the mobile phone (Thinyane, 2010). This study concluded that there are dissimilarities between student experiences in developed and developing countries, such as South Africa, Mexico, and Brazil (Thinyane, 2010).

An empirical study (Kennedy et al. 2007; Kennedy et al. 2008) conducted in 2006 with more than 2,000 incoming first year Australian university students showed no fundamental difference between digital natives and immigrants and suggested that the digital native characteristics can be found only among a minority of students. Research conducted in Switzerland concludes that it is unrealistic to attribute behaviors and characteristics simplistically basing them on generational "virtues" (Rapetti & Cantoni, 2010a). A nationally representative survey in the UK by Helsper and Eynon (2010) concluded that their analysis does not support the view that there are unbridgeable differences between those who can be classified as digital natives or digital immigrants based on when they were born. A research project of South African higher education students showed that age is not a

determining factor in students' digital lives (Brown & Czerniewicz, 2010, p. 357). They found that being a digital native was not about age but about experience, access, and opportunity (Brown & Czerniewicz, 2010; Czerniewicz & Brown, 2010), and that the term could only be applied to a small and elite group of students (Czerniewicz & Brown, 2010).

Despite the widespread acceptance of the concept of the "digital native", the key claims of this definition are not based on empirical research. In fact, in the paper "Digital Natives, Digital Immigrants" in which Prensky (2001a, 2001b) proposes these terms, he does not cite any research to support his ideas. Many researchers refute the notion of the digital native and found no empirically sound basis for most of the claims that have been made about the net generation (Bennett & Maton, 2010; Bullen, Morgan & Qayyum, 2011; Bullen & Morgan, 2011, Thirunarayanan et al., 2011). Brown and Czerniewicz (2010) find the concept of the digital native especially problematic, both empirically and conceptually, and likely to be offensive as a term. In his defense, Prensky (2009, 2012) has suggested this distinction may no longer be relevant and now talks instead about digital wisdom for the profit of enhancing natural human intellectual capacities through digital technology. In addition, Prensky (2011) mentions that many people have been interpreting "very literally – rather than *metaphorically* – what a 'Digital Native' was" (p. 16). In sum, there is little evidence to support the digital native debate that authentically "maps not only the rapidly shifting technology developments, but also the emergent nature of the perceptions and viewpoints informing the learner, educator, and researcher assumptions and beliefs underlying such debates" (Smith, 2012, p. 14). Digital natives should not be used as a blanket term for an entire generation of learners (Maclean & Elwood, 2009); hence, "It is time to put the digital natives discourse to rest and focus on digital learners" (Bullen & Morgan, 2011, p. 66).

Conclusion

The integrative review research method, used as an initial stage, can be employed as an important instrument to provide a more comprehensive understanding of the learner in the digital era. Although the body of theoretical literature in education that explores concepts and characteristics around learners in the digital era is still growing, research around them is just beginning and may need more critical examination.

The literature review revealed extensive theoretical and terminological diversity related to the notion of the digital native. A variety of terms have been proposed as well as a multiplicity of definitions: some similar, others quite different, and many redundant. Exposure to technology is a critical

element in determining at least some of the characteristics attributed to these students. A shared element among the numerous and proliferating similar and/or related concepts to describe these students is that all of these concepts suggest somehow the idea of a digitalized/technologized generation (Rapetti & Cantoni, 2010b).

The term "digital natives" seems inappropriate or insufficient to describe the population of current learners because some features of the widespread expression "digital natives" and many associated assumptions have not yet been demonstrated (Rapetti & Marshall, 2010; Rapetti & Cantoni, 2010a). There is no absolute definition of digital natives: it will vary amongst individuals, societies, regions, and nations, and also over time. There are a number of variables other than age that may help us understand the nature of student use of digital technologies. Despite the general belief that digital natives show greater willingness and ability to use technology, the analysis of the literature demonstrates a clear mismatch between the confidence with which claims are made and the evidence for such claims (Bennett, Maton & Kervin, 2008). Generalizations based on "generational differences" are not useful for discussions concerning teaching and learning. Thus, as "we can now say with certainty that generation is not relevant" (Bullen & Morgan, 2011, p. 63), it is necessary to consider other variables besides age that can help us understand the nature of the use of digital technologies by students.

We recommend further research on the concept of the "digital learner" with the aim of developing a comprehensive understanding of how learners use digital technologies, focusing on the implications of being a learner in a digital era and trying to develop a comprehensive understanding of the issues, taking into account factors such as age, gender, education, culture, experience, institutional context, learning design, social inclusion and exclusion, subject discipline, and socio-economic background.

Finally, we recommend moving beyond the superficial dichotomy of "natives" and "immigrants" toward other authentic understandings of today's learners. How learners use digital technologies is a complex issue that goes much deeper than age. By pushing beyond this dichotomy, "we may create and utilize rich, alternative typologies and theoretical frameworks that better inform and reflect the complexity of higher education technology issues facing generations today" (Smith, 2012, p. 14).

Limitation of the study

The search was limited to English language sources and relevant publications containing useful information may exist in other languages.

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Appendix A

Table 4
Terms used to characterize students in the digital era

Term	Reference	View	Year
Generation Y	Howe & Strauss*	Enthusiast	1991
	Lancaster & Stillman	Enthusiast	2002
	Jorgensen	Critic	2003
	Oblinger & Oblinger	Enthusiast	2005
	Weiler	Critic	2005
	Djamasbi et al.	Enthusiast	2010
Millennials	Howe & Strauss*	Enthusiast	1991
	Howe & Strauss	Enthusiast	2000
	Lancaster & Stillman	Enthusiast	2002
	Martin & Tulgan	Enthusiast	2002
	Coomes & DeBard	Concerned	2004
	McMahon & Pospisil	Enthusiast	2005
	Oblinger & Oblinger	Enthusiast	2005
	Downing	Enthusiast	2006
	Simoneaux & Stroud	Enthusiast	2010
	Taylor & Keeter	Enthusiast	2010
	Bajt	Enthusiast	2011
	Koeller	Enthusiast	2012
Net-agers	Howe & Strauss	Enthusiast	1991
Next Great Generation	Howe & Strauss	Enthusiast	1991
Nintendo generation	Soloway*	Enthusiast	1991
	Green, Reid, & Bigum	Critic	1998
	Guzdial & Soloway	Enthusiast	2002
Grasshopper minds	Papert*	Enthusiast	1993
Clickerati	Harel*	Enthusiast	1997
Digital generation	Tapscott	Enthusiast	1998
Net Generation	Tapscott*	Enthusiast	1998
	Oblinger & Oblinger	Enthusiast	2005
	Kennedy et al.	Critic	2007
	Kennedy et al.	Critic	2009
	Tapscott	Enthusiast	2009
	Jones & Czerniewicz	Critic	2010
	Jones	Critic	2010
	Jones et al.	Critic	2010
	Gros, García & Escofet	Critic	2012
	Romero et al.	Critic	2013
Boomer babies	Howe & Strauss	Enthusiast	2000
Boomlets	Howe & Strauss	Enthusiast	2000

Term	Reference	View	Year
Digital Learners	Brown*	Enthusiast	2000
	Bullen et al.	Critic	2008
	Qayyum et al.	Critic	2008
	Bullen et al.	Critic	2009
	Bullen & Morgan	Critic	2011
	Bullen, Morgan & Qayyum	Critic	2011
	Romero et al.	Critic	2012
	Morgan & Bullen	Critic	2013
	Romero et al.	Critic	2013
	Thompson	Critic	2013
Gen.com	Howe & Strauss	Enthusiast	2000
Generation Next	Howe & Strauss	Enthusiast	2000
	Tapscott	Enthusiast	2009
Generation Tech	Howe & Strauss	Enthusiast	2000
Generation Why	Howe & Strauss	Enthusiast	2000
Generation XX	Howe & Strauss	Enthusiast	2000
Generation 2000	Howe & Strauss	Enthusiast	2000
Nexters	Zemke, Raines & Filipczak	Concerned	2000
Cyberkid	Holloway & Valentine*	Concerned	2001
	Valentine & Holloway	Concerned	2002
	Holloway & Valentine	Concerned	2003
	Holmes	Critic	2011
Digital natives and digital immigrants	Prensky*	Enthusiast	2001
	Prensky	Enthusiast	2004
	Carlson	Concerned	2005
	Gaston	Enthusiast	2006
	Prensky	Enthusiast	2006
	Bennett Maton & Kervin	Critic	2008
	Kennedy et al.	Critic	2008
	Palfrey & Gasser	Enthusiast	2008
	Maclean & Elwood	Critic	2009
	Bennett & Maton	Critic	2010
	Brown & Czerniewicz	Critic	2010
	Czerniewicz & Brown	Critic	2010
	Jones & Czerniewicz	Critic	2010
	Kennedy et al.	Critic	2010
	Kolikant	Critic	2010
	Li & Ranieri	Critic	2010
	Prensky	Enthusiast	2010
	Thinyane	Critic	2010
	Margaryan, Littlejohn & Vojt	Critic	2011
	Thomas	Critic	2011
Instant-Message generation	Lenhart, Rainie & Lewis	Enthusiast	2001
Generation mix (Gen Mixers)	Martin & Tulgan	Enthusiast	2002
	Martin & Tulgan	Enthusiast	2006

Term	Reference	View	Year
Internet-savvy students	Levin & Arafeh	Enthusiast	2002
MTV generation	Guzdial & Soloway	Enthusiast	2002
	Veen & Vrakking	Enthusiast	2006
	Veen	Enthusiast	2007
Gamer generation	Carstens & Beck	Enthusiast	2005
Generation M (media)	Roberts, Foehr & Rideout*	Enthusiast	2005
	Rideout, Foehr & Roberts	Enthusiast	2010
Generation Me	Twenge*	Concerned	2006
	Twenge	Concerned	2009
	Tapscott	Enthusiast	2009
New millennial learners	Pedró*	Critic	2006
	Pedro	Critic	2009
Clicking replaces thinking	Brabazon*	Concerned	2007
Generation C	Duncan-Howell & Lee*	Enthusiast	2007
Google generation	Nicholas, Rowlands & Huntington*	Critics	2007
	Rowlands et al.	Critics	2008
MySpace generation	Rosen	Concerned	2007
Born digital	Palfrey & Gasser*	Enthusiast	2008
Digital settlers	Weinberger*	Critics	2008
	Palfrey & Gasser	Enthusiast	2008
Dumbest generation	Bauerlein	Concerned	2008
Facebook generation	Kitsis*	Enthusiast	2008
Digital melting pot	Stoerger*	Critic	2009
Digital wisdom	Prensky*	Enthusiast	2009
	Skiba	Enthusiast	2010
	Prensky	Enthusiast	2011
Visitors and Residents	White*	Critic	2009
	White & Le Cornu	Critic	2011
	Connaway, White & Lanclos	Critic	2011
Digitizen	Brown & Czerniewicz*	Critic	2010
i-Generation	Rosen, Carrier & Cheever*	Concerned	2010
Learners of Digital Era	Rapetti & Cantoni*	Critic	2010
	Rapetti	Critic	2012
	Rapetti & Cantoni	Critic	2013
Digital nerds and digital normals	Thirunarayanan et al.*	Critic	2011
App Generation	Gardner & Davis	Concerned	2013

Note: Personal compilation, *who coined the term