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Behaviours and Characteristics of Digital Natives Throughout the Teaching-Learning Process: A Systematic Review of Scientific Literature from 2016 to 2021

Olga Vitvitskaya

Josefina Amanda Suyo-Vega

Monica Elisa Meneses-La-Riva

Víctor Hugo Fernández-Bedoya

Division of Research, Universidad César Vallejo,
Av. Larco 1770, Trujillo 13001, Peru

Abstract

Information and communication technologies have generated transformations in the behaviour of digital native university students, which affect the teaching-learning process in the scenario of the Covid-19 pandemic. The objective of this study was to systematize the scientific evidence on university teaching strategies related to the behaviour of digital natives and the characteristics of their learning. The method employed was a systematic review of scientific articles from the EbscoHost, Scopus, Proquest, Eric and Scielo databases through the Boolean operators AND and OR. Initially, 51 638 records were obtained, of which only 26 met the inclusion criteria (years of publication, language, subject matter, free availability). The results show in the articles that most digital natives actively use social networks on a daily basis, while others conduct research or produce digital content with varying degrees of difficulty, some adapt quickly to new innovations related to technology, and many easily multitask and perform self-regulated learning, while demanding a more flexible teaching where learning is fast and practical. However, the attention of digital natives is dissipated by other interests such as social networks (generating cyber laziness), a situation that can lead to antisocial behaviour and self-exclusion from physical reality (phubbing). In conclusion, digital natives require greater attention from their university teachers, who must innovate in the teaching-learning process using the virtual environment, raising the interest of digital natives, to generate an autonomous learning where they can strengthen their skills and competencies for the achievement of their professional development.

Keywords: digital natives, university education, behaviours, learning, teaching

1. Introduction

Recently, information and communication technology has become increasingly sophisticated, especially in the scenario of a new reality brought about by COVID-19 (Barrutia & Echebarria, 2021; Łopatka, 2021; Mouratidis & Papagiannakis, 2021; Vitón-Castillo & Lazo Herrera, 2021). There is in this

new context a generation of young people called "digital natives" (Prensky, 2009) or "generation Z", who were born between the years 1995 and 2010 and who have attended primary and secondary education in a digital context (Díaz-Sarmiento et al., 2017; Pérez-Escoda et al., 2016; Vesga-Parra & Hurtado-Herrera, 2013), who demand particular attention in their educational training (Mat Zain et al., 2021; Shorey et al., 2021; Szymkowiak et al., 2021).

In this regard, the United Nations Educational, Scientific and Cultural Organization (UNESCO) expressed at the beginning of the pandemic that the health situation should be seen as an opportunity to be seized, in relation to familiarization with the digital environment in technological solutions related to education and content for use in cell phones (UNESCO, 2020).

Digital natives basically demand two things: First, that teaching be adapted to the needs of fast, relevant and practical learning. Second, that teachers standardize a technological language aimed at this population group (Thompson, 2013; Zuluaga Trujillo & Gómez Montero, 2019).

Likewise, it has also been reported that some of the digital natives consider that in the academic aspect it is essential to use the cell phone to search for information and browse social networks, despite the various distractions that may entail (Lee et al., 2014; Motaung & Dube, 2020). On the other hand, the results of other studies indicate that the excessive use of technological equipment (such as cell phones) causes dependence (Tejedor & Pla Pablos, 2020).

Along the same lines, the phenomenon of phubbing is described as the act of snubbing someone you're talking with in person in favour of your phone (Beukeboom & Pollmann, 2021; Capilla Garrido et al., 2021; Grieve et al., 2021; Solecki, 2021). This act can be applied in educational contexts when a student ignores the lessons dictated in class to check his or her cell phone (Hernández-Gracia et al., 2021).

Referring to the use of free time, young people attach importance to digital leisure activities, highlighting participation in social networks, video games and surfing the Internet (Gentina & Chen, 2019; Jaciow & Wolny, 2021; Pichler et al., 2021; Sá et al., 2020). Regarding the perception of their responsibilities to others (París, 2020), there is evidence of differences in the value structure between different generations and digital natives are more selfish and pragmatic than digital immigrants (Álvarez-Cabrera et al., 2021; Álvarez-Sigüenza, 2019).

Likewise, there is concern about the expression of sexuality and intimacy by digital natives who present an online mode of relating to their peers in intimate aspects, leaving aside expressions of affection (Ibar, 2016). The most popular coping strategies among digital natives are those involving a change of attitude towards the situation or submission and willingness to make concessions (Raslie, 2021). Likewise, they consider avoiding contact with the frustrating environment without physically moving away from it (Álvarez-Sigüenza, 2019).

In terms of behaviour related to their academic activities, the ability to combine tasks is associated with cyber-laziness as part of self-regulated learning, while the effectiveness of media multitasking does not contribute to their training (Soto Decuir, 2018).

In virtual learning environments, university students increase the ability to share, transmit and exchange knowledge, achieving cooperative and autonomous work that favours the teaching-learning process in the virtual environment (Asllani & Paçarizi, 2021; Eiris et al., 2022; Mora et al., 2020; Mujib & Marhamah, 2020). Likewise, digital natives are not very prone to communicate or publish their productions or achievements, results that defy the statements of those who postulate that digital natives, as a group, are a generation prone to publish and share their projects, opinions, ideas or own productions (Cabrales & Díaz, 2017).

Being part of the generation of digital natives does not necessarily mean having the skills to create content and publish in virtual environments (Icaza-Álvarez et al., 2019; Jamil, 2021; Myovella et al., 2021; Rentería Macías, 2021). The myth is questioned, that there is a great disparity in literacy levels since although they remain hours connected and on the network, there are many tools that are unknown in their daily practice (Ruiz Aguirre et al., 2015).

The learning of digital natives made in the management of technology and its tools have aroused interest in research, since most of the learning is obtained through internet sources

(Kolikant, 2010; Wang et al., 2019). Digital natives prefer to receive information immediately, in addition they can work and perform tasks in parallel (Mujica-Sequera, 2020; Salmerón & Delgado, 2019).

In relation to the limited use of technologies, it is stated that digital natives search, store and share information, that they require teacher support, therefore, self-directed learning alone is not the most effective way to develop digital competence in the educational environment (Dauzón Ledesma & Izquierdo Sandoval, 2020; Romero Rodríguez & Rivera Rogel, 2019). And in the educational dynamics it is necessary to adapt curricula to the virtual environment in addition, to use a pedagogy that adapts to changing scenarios, solving existing problems (Espinosa Brito, 2017).

Teachers working with digital natives must apply the acquired competences and, being qualified, provide by example different ways of finding information with the required contents (Hämäläinen et al., 2021; Lauricella et al., 2020; Suyo-Vega et al., 2021). To this end, it is advisable to use search engines as a strategy for finding information both for use for research purposes and also for real case studies (Buitrago Acuña et al., 2021).

In this sense, the above findings led to the elaboration of the research question: What is the scientific evidence on the behaviours of digital natives in the teaching-learning process?

2. Materials and Methods

To answer the research question, a systematic review was conducted following the PRISMA methodology (Liberati et al., 2009; Moher et al., 2009). The databases EbscoHost, Scopus, Eric, Proqust and Scielo were chosen because they integrate journals that have the criteria recognized by the scientific community, as well as publications from different countries.

Scientific articles in Spanish, English, Portuguese and Russian found by specific search equations and their synonyms through the Boolean operators AND and OR were selected (see Table 1 and Table 2).

Table 1: Concepts and synonyms from the search on behaviour of digital natives in education.

Concept	Synonyms
University education	University education, university training, university teaching, higher education
Digital natives	New generation, generation Z

Table 2: Search equations

Language	Search equation
Spanish	(enseñanza superior OR enseñanza universitaria OR estrategia OR formación universitaria OR educación universitaria) AND (nueva generación OR nativos digitales OR generación Z)
English	(higher education OR university education OR strategy OR university training OR university education) AND (new generation OR digital natives OR generation Z)
Portuguese	(educação superior OU educação universitária OU estratégia OU educação universitária OU educação universitária OU educação universitária) E (nova geração OU nativos digitais OU geração Z)
Russian	(высшее образование ИЛИ университетское образование ИЛИ стратегия ИЛИ университетское образование ИЛИ университетское образование ИЛИ университетское образование) И (новое поколение ИЛИ цифровые аборигены ИЛИ поколение Z)

Of 51 638 publications found, 26 studies met the inclusion criteria, including publication years from 2016 to 2021. For the final selection of articles, subject matter and language fluency specialists validated the inclusion of articles for the current research, as seen in Table 3.

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Table 3: Data base and phases developed to obtain information

Database	Step 1: Identification	Step 2: Screening	Step 3: Eligibility	Step 4: Included
EbscoHost	41 661	28 296	144	8
Scopus	24	5	4	4
Eric	162	106	15	7
Proquest	9 758	3 167	921	4
Scielo	33	33	9	3
Total	51 638	31 607	1 093	26

The application of identification, selection, eligibility and inclusion criteria can be seen in the PRISMA flow chart, detailed in Figure 1.
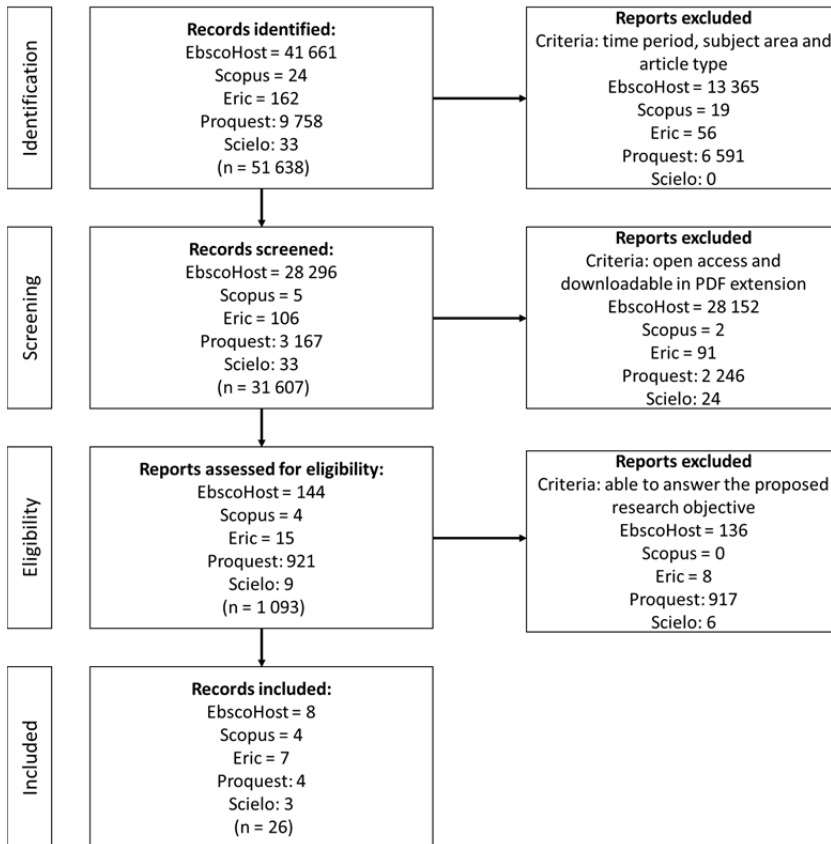

Figure 1: PRISMA flow chart.

3. Results

A total of 26 pieces of evidence were identified that responded to the research question formulated. For each one of them, the database in which it was found, the author and year of publication, the country from which the scientific evidence was collected, their keywords, as well as the categories or dimensions explored were detailed. These results were systematized in Table 4.

Table 4: List of authors and year, countries, keywords, and categories explored by article and database

DB	Number	Author (year)	Country	Keywords	Categories
Ebsco Host	1	(Fajardo et al., 2015)	Spain	Digital skills, digital natives	Learning
	2	(Asorey et al., 2018)	Brazil	Research education, digital natives	Teaching / Learning
	3	(Pérez Angulo, 2019)	Venezuela	Diagnostic strategy, digital natives	Teaching / Learning
	4	(Gutiérrez Ángel, 2020)	Spain	Video games, literary reading, digital natives	Teaching
	5	(Novoa Cabrera & Sánchez Torres, 2019)	Peru	Cell phone dependency, adolescents	Learning
	6	(Comunian Soares et al., 2020)	Brazil	Phubbing, mobile media, digital natives	Behaviour
	7	(Tatarinov & Music, 2020)	Russia	Teaching methodology, digital natives	Behaviour
	8	(Sivrikova & Kharlanova, 2020)	Russia	Digital natives, pandemic behavioural strategies	Teaching
Scopus	9	(Hunt-Gómez et al., 2020)	Spain	Textisms, spelling, teachers in training, generation Z	Teaching
	10	(Sixto-García & Duarte-Melo, 2020)	Spain	Educational innovation, mobile technology, digital natives	Teaching
	11	(Khechine & Lakhal, 2018)	Canada	Technology, university students	Teaching
	12	(Hernandez-de-Menendez et al., 2020)	Mexico	Generation Z	Teaching
Eric	13	(Matamala Riquelme, 2016)	Spain	ICT, learning	Apprenticeship
	14	(Grijalva-Verdugo & Moreno-Candil, 2017)	Mexico	Media competence	Apprenticeship
	15	(Chacón Cuberos et al., 2017)	Spain	Academic factors, video games	Learning
	16	(Schmeisser & Medina-Talavera, 2017)	Mexico	Inverted classroom, academic performance, teaching strategy.	Teaching
	17	(Valdemoros-San-Emeterio et al., 2017)	Spain	Digital society, youth, leisure	Behaviour
	18	(Sánchez-Rivas et al., 2019)	Spain	Inverted classroom, flipped class	Teaching
	19	(Pérez-Escoda et al., 2016)	Spain	Digital competence, generation Z.	Teaching
Proquest	20	(Simanjuntak et al., 2019)	Indonesia	Internet use, cyber laziness	Behaviour
	21	(Wickramanayake & Muhammad Jika, 2018)	Nigeria	Social networks, students	Learning
	22	(Yot-Domínguez & Marcelo, 2017)	Spain	Self-regulated learning, digital natives	Learning
	23	(Al-Hamad et al., 2020)	Jordan	Smart devices, challenges of the teaching-learning process	Teaching / Learning
Proquest	24	(Linne, 2014)	Argentina	Generations, digital natives, characteristics	Behaviour
	25	(Zuñiga Rodríguez & Cáceres Mesa, 2021)	Mexico	Sense of school, student perception	Behaviour / Learning / Teaching
	26	(Jara Gutiérrez & Prieto Soler, 2018)	Colombia	Digital natives, digital immigrants, higher education	Learning

A total of 26 articles were found, mostly from Spain (10), Mexico (4), Brazil (2), Russia (2), Argentina (1), Venezuela (1), Peru (1), Canada (1), Colombia (1), Indonesia (1), Jordan (1) and Nigeria (1). Likewise, the term digital native and digital competencies are prioritized, followed by teaching and learning as keywords. In the case of the categories explored by the authors, the terms learning, teaching, behaviour and skills predominate.

A deeper analysis of each study collected allowed us to identify aspects related to the methodology used, the behaviour observed, and the characteristics and skills of the digital natives described in each article (see Table 5).

Table 5: Methodology employed, behaviour observed, and characteristics and skills of digital natives described in each article.

Number	Methodology employed	Behaviour observed	Characteristics and skills of digital natives
1	The INCOBI-R questionnaire (Richter et al., 2010) was applied to evaluate digital skills in correlation with digital reading competence. The sample consisted of 50 students excluding those integrated and those receiving psycho-pedagogical help.	-	Students are involved in text editing, image editing, PPTs, games, video and audio editing.
2	An introductory course in physics was developed for university students from different careers. Blogs with Phyton codes, Twitter and Facebook groups were used for educational purposes.	Young people carry negative preconceptions, generally negative, about physics.	-
3	The DINADI strategy was developed for the diagnosis of digital natives in the university environment in a sample of 61 new students.	Young people need daily access to the Internet, consider themselves proficient with technology and text with their friends during classes.	Digital natives have grown up with access to information and communication technologies, are proficient with technology, prefer graphic information, and have multitasking capabilities.
4	Video games were tested as a teaching strategy for reading.	-	-
5	The mobile phone dependence test was adapted (Chóliz, 2012). The sample consisted of 82 18-year-old students.	They were identified as surfing on social networks and using their cell phones during classes.	Academic performance is not significantly affected by cell phone use.
6	The study approach was quantitative, using a 28-item questionnaire as an instrument, which was applied to 384 high school students.	The young people studied are involuntary phubbers and do not visualize their school and teachers as adapted to this new digital reality.	Digital natives are highly connected, seek differentiated learning alternatives.
7	The AER (rapid e-learning) method was investigated, to create flexible courses that are easily updated if the course is quickly outdated (this course contains mini-scripts and small portions of learning content).	Their strategies are of adaptation or submission and willingness to make concessions, strategy of self-isolation (concentration on internal states and experiences), may be accompanied by psychological suppression, displacement of stress factors, use of psychotropic drugs (alcohol, drugs) to change the internal state.	Internet generation responds well to multitasking and constantly changing activities.
8	A sample of 384 college students with an average age of 20.5 years was surveyed online. The instrument to measure Covid-19 related behaviors was adapted from the Adaptive behavioral strategies inventory (Melnikova, 2004).	-	"Digital natives" are more selfish and pragmatic than "digital migrants".
9	The quantitative approach was used, where the perception of the influence of textisms on spelling was analyzed in a sample of 264 trainee teachers belonging to Generation Z, literate in a digital writing environment.	They demand the content of rapid renewal.	Young people are more tolerant towards Textisms, participants consider that textisms should be included in the classroom as a teaching resource, simultaneously they think they are detrimental to spelling and should correct them.
10	Research with a quantitative approach. The sample was composed of 131 university students, where 90.83% belonged to the Z generation.	Anxiety, computer self-efficacy and autonomy were identified as personal characteristics.	Generation Z registers high rates of media consumption, but their digital competence is not as outstanding as could be expected.
11	A quantitative approach was used on a sample of 377 university students. The use of Elluminate webinars was studied.	Pressures for change are being created, and there is increasing competition from universities for global human talent.	Students demand that teachers reinforce students' perception that participating in a webinar is enjoyable and can make learning activities more interesting.
12	A review of literature related to a review of educational technology with examples of current applications performed by different educational institutions was developed.	Predominantly passive attitude to follow the news, to be informed of what is happening, seeing their friends' posts or phrases referring to their emotional state, or uploading photos, although it is rare for them to post about issues of global problems.	Digital natives are a hyper-cognitive generation, which will meet the demand for qualified graduates to do jobs that do not yet exist.
13	A qualitative methodology was used, oriented mainly by the bases of grounded theory. We worked with a sample of 24 students in the second year of secondary school from six public and private schools in Madrid (Spain), who were selected according to the frequency and purpose of their use of ICT.	They are concerned about global issues, social protests or other topics of interest, they value being informed.	Young people use ICTs for study and entertainment almost simultaneously, looking for necessary, emerging and free information.
14	A questionnaire was applied to the sample of 385 subjects divided into natives, immigrants and digital illiterates.	There is a rejection of political participation and mobilization. Digital natives tend not to get involved in criticizing and questioning politics.	the existence of the types of media competence and social empowerment, however, not in the emancipatory, liberating and critical tradition

Number	Methodology employed	Behaviour observed	Characteristics and skills of digital natives
15	The need for prevention programs to facilitate self-control in the pathological use of video games was studied in order to avoid future pathologies.	The excessive use of video games has a negative influence on the academic performance of university students.	university students tend to have better self-regulatory mechanisms when it comes to investing time in digital entertainment
16	The implementation of inverted classroom methodology in the subjects of Spanish, English and mathematics was developed.	To demonstrate the greatest learning students must have the greatest disposition of resources, time and motivation.	Digital natives have a different way of processing information, learning and problem solving than the generation that was educated with printed texts.
17	Research with a quantitative approach. The sample amounted to 1,764 students. The digital leisure variable was measured on the basis of an open-ended question in which they had to indicate the three most important leisure activities, and family functioning was assessed using the Spanish version of the FACES IV (Rivero et al., 2010).	They prioritize participation in social networks, visiting video websites and surfing the Internet.	Students who prioritize digital leisure, have worse possibilities to adapt to new situations, with practical consequences in leadership processes, negotiation, discipline, roles or rules they adopt.
18	The flipped class and the use of smartphones were studied. The research presented a quasi-experimental design and used the questionnaire as an instrument in a sample of 262 (130 subjects in the experimental group and 132 in the control group).	Concern among the study population about methodological innovations.	The ubiquity of learning has been one of the strong points in the evaluations made by the participants in the inverted classroom sessions.
19	Research with a quantitative approach with a sample of 678 elementary school students. The aim was to provide empirical evidence on the level of digital competence of students belonging to the Z generation.	-	They acquire digital skills not inherently but through the development of digital competence.
20	The participants for this research were university 423 students of a private university located in Indonesia. The participants were students coming from the Faculties of Medicine, Nursing, Pharmacology and Psychology.	Students participate in non-academic Internet access during classes, called cyber-slacking (relaxation, leisure).	Possess self-regulated learning, effectively practice multitasking.
21	Stratified sampling was used to select subjects that constituted a sample of 242 final year students in an institution in Nigeria. The approach used was quantitative, where inferential and simple descriptive statistics were developed.	Predominant use of cell phones to access social networks for education, entertainment and communication among them.	Effective use of social networking among students enhanced their different types of skills, including learning.
22	Research with quantitative approach. The researchers developed the Survey of Self-regulated Learning with Technology at the University (SRLTU) instrument and applied it to a sample of 711 university students from the various universities located in the region of Andalusia (Spain).	They tend not to use digital technology to self-regulate their learning process. Young people need to have a personal presence on the network, which contributes to collaborative learning.	The most used tools are Internet information search and instant communication.
23	A structured interview with a qualitative approach was used with a sample of 364 instructors.	Causes of rejection of the use of smart technologies in classes by teachers: distraction, misuse and lack of skills on the part of students.	Lack of awareness and training skills for teachers in the use of smart technologies.
24	Surveys, interviews and observations of digital native students of generation 1.0 and 2.0 were used.	Digital natives 2.0 (post -mail) manifest an "intimate-affective" relationship with mobile technological devices from which they almost never separate, and associate their identity and status, take self-portraits taken in their room and posted on the network; postings about their aesthetic-emotional experiences; Facebook statuses, etc. They do not establish divisions between the real and the virtual.	They develop the skills of instantaneousness, multitasking, hyper connectedness, and multitasking, hyper connection and permanent exchange of stimuli with their community through SRS and instant messaging. "Prosumption skills" (content producers and consumers).
25	Qualitative research in which there were 4 key subjects, who were students from different universities.	Complain of physical (poor posture, poor vision, back pains), and emotional (stress due to isolation) afflictions.	New knowledge in the handling of ICT, interest in research and use of more resources to enrich the more resources to enrich the learning process.
26	The research is a systematic review on immigrants and digital natives. Sixty scientific articles were analyzed.	They choose graphics over text, so they communicate and think, enjoy multitasking, consider themselves multitaskers, and devote more time to entertainment than to serious work.	Digital skills depend on the socioeconomic context of students, visuospatial skills and the ability to integrate the virtual with the virtual world.

4. Final Conclusions

The results of the systematic review included a total of 26 articles. Most of the evidence came from Spain and Brazil. The category developed by the authors with the greatest predominance is the behaviour of learning in teaching as the protagonist of the university student, who is the generator of

his autonomy and responsibility to develop skills and competences.

It was possible to understand that the student body responds actively in the various virtual platforms and teaching-learning strategies through graphic information (texts, images, presentations and audios).

The use of various technological tools can motivate university students to strengthen learning in accordance with existing learning theories.

The digital consumption of information in this age group is permanent, however, there are gaps in some skills in the use of digital resources for learning in some parts of the world.

Digital natives currently require a flexible and individualized learning process from a collaborative and autonomous approach to achieve their professional skills. To achieve this, it is required the strengthening of digital skills in the teacher on the various existing platforms. Likewise, digital natives perceive the need to strengthen teachers' virtual skills in the management and use of these resources for academic activities, such as the organization of conferences, symposia, webinars, workshops, academic meetings, among others through the Internet.

University students have greater self-regulation in the use of technological resources. All the information processing they receive is free and they conceive knowledge as something that exists for everyone, but learning is self-regulated by each individual.

Unlike adults, digital natives process information to solve problems they face, they are practical. However, a salient feature is egocentrism and adaptability to various forms and means of sending a text message, thus sharing a common language among their peers. They have the ability to text different people, groups or organizations to which they belong at the same time, becoming consumers of content according to their preferences and interests.

Some students prioritize digital leisure having limitations and difficulties to adapt to this new virtual context, lacking leadership, negotiation skills, responsibility, and compliance with roles, regulations and rules established in their institutions.

Ubiquity has been the strength in the class sessions, which have been taken in different parts of the world, strengthening knowledge and sharing experiences of different cultures, customs that are visible in the learning process. This experience is the opening to a globalized thinking where there are no barriers to communication and learning, except language barriers. English is the universal language in international electronic media.

One of the most relevant elements of digital competencies is the effectiveness of social networks that influence learning, becoming spaces of interest. The use of the Internet is identified as permanent and unlimited for instant and effective communications.

The use of technological resources strengthens the teaching-learning process in the search for information, thus strengthening the research, which, although it does not have a methodological process, if presented with a problem, resorts to various electronic means to provide a solution to the problem posed.

The higher education of digital natives can no longer be the same as before, therefore, in order to adapt the teaching process to the needs and demands of digital natives, firstly, it is necessary to be clear about the profile or characteristics of these students, and secondly, to develop new strategies for teaching digital immigrants.

5. Acknowledgement

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