Integration of ICTS and Digital Skills in Times of the Pandemic Covid-19

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Abstract

In these times of global tragedy due to the pandemic that caused COVID-19, distance learning relies on the resources of the digital field, as well as on the management of ICT and the development of digital skills. Therefore, this research has been aimed at corroborating the existing links between the integration of ICT and digital skills pandemic times. A study with a quantitative, non-experimental, cross-sectional, correlational approach was developed. The sample consisted of 168 students from a public university in Lima, Peru. Two tools were adapted: 1) integration of ICT, 18 items and 2) digital skills, 30 items, with reliability coefficients by Cronbach's Alpha of 0.976 and 0.889, respectively. The questionnaires were developed and taken through Google forms. The results showed that the level of integration of ICT was high (89.9%) as well as digital skills (86.9%). Spearman's Rho correlation analysis concluded that there was a positive and high relationship between integration of ICT and digital skills (0.761, $p < 0.05$). Finally, discussions were raised about the development of aspects related to ICT during the current pandemic.

Keywords: integration of ICT, digital skills, technological skills, virtual learning, pandemic

1. Introduction

The 2020 academic cycle, in its various levels, as well as the educational systems in the world, suffered an untimely irruption with respect to the face-to-face modality; therefore, students and teachers were forced to relearn new ways of accessing, transmitting knowledge and interacting in cyberspace. Even the most stultified voices and positions with respect to new technologies had to submit to the new-networked work environments (De Vincenzi, 2020).

The adoption and integration of ICTs is of utmost importance to access knowledge and keep up with modern developments. There is availability of global resources such as digital libraries where professors, students, and professionals can access and share research and course materials anytime and anywhere 24 hours a day, seven days a week (Suárez, Almerich, Orellana y Díaz, 2018). New educational approaches are possible in the process of teaching and learning through the adoption and integration of ICTs, which provide higher order skills such as solving complex real world problems, improving the perception and understanding of the learning process (Knezek and Christensen, 2016).

The adoption and integration of ICTs into the teaching and learning environment offers more opportunities for teachers and students to work better in a globalized digital age (Lawrence and Tar, 2018).

It is worth noting the work developed by Van-Laar, Van-Deursen, Van-Dijk and De-Haan (2018), who focused on examining the relationship between 21st century skills and digital skills, in addition to providing a digital skills framework for the present century, with conceptual dimensions and operational components aimed at knowledge worker. The researchers developed a systematic review of the literature, finally, selecting 1592 different articles, out of which 75 articles met the predefined inclusion criteria. The results obtained show that the skills of the 21st century

are broader than digital skills. Furthermore, unlike digital skills, 21st century skills are not necessarily supported by ICT.

On the other hand, in a research carried out in Spain, Díaz, Cebrián and Fuster (2016) investigated the relationships between pedagogy, ethics and ICT in students. In this regard, they noted that the integration of ICTs occurs when the student acquires full understanding, as well as cognitive strategies of how to obtain more knowledge by using them. They concluded that the process of ICT integration was moderate with respect to learning strategies, based on new technological knowledge. Li, Su, Zhang, and Mao (2018), who stated that ICT is related to the use of technology in the education sector as a whole, and not just to a specific function, developed studies on factors that influence the adoption and integration of ICT in teaching and learning.

The thematic reality about lack of access to specialized knowledge and support for the use and integration of ICTs is a problem that prevails in many classrooms of developing countries (Ocaña, Valenzuela and Morillo, 2020). Morata (2020) mentioned that the emergence of the global pandemic COVID-19 has generated the greatest use or increase of new technologies. These technological tools are used today in a very vertiginous way due to the pressing need to transmit information; therefore, there has been an increase in the use of virtual platforms and social networks to transmit information. On the other hand, not all students have the necessary equipment or hardware (PC, laptop, or cell phone), software, or even access to the Internet (Katz, 2018).

The digital age encompasses all areas of human life (Ga`ová, Mi`ík and 'Tofková, 2018). As stated by Ocaña, Valenzuela and Garro (2019), modern trends demand digital literacy from employers, including the digital single market, industry 4.0, automation and digitalization. The employment potential of digital technologies depends on whether people can perceive their benefits, know how to handle them and actually use them in practice (Area, 2018 and Mavrou and Loizou, 2017). One of the prerequisites for an individual in the "information society" or "knowledge society" is the acquisition, renewal and deepening of digital skills (Colchester, Hagras, Alghazzawi and Aldabbagh, 2017).

The justification of the present research was to reveal the existing gap in this field, at a time when the epidemic COVID 19 is developing worldwide, and to show how this influences on university students, the levels of digital skills they are at, and what the real integration of new virtual tools is. Therefore, this research will show if there was any relation between both variables during the pandemic. It will also focus on the digital tools that generate great possibilities for developing new techniques of information search, skills and technological abilities within the academic framework of the University, for both students and teachers, who will be able to ask themselves how much knowledge they have of these new tools.

2. Theoretical Aspects

2.1 ICT Integration

As mentioned by Lawrence and Tar (2018), Information and Communication Technologies (ICT) are increasingly important in our daily lives and in our educational system. On the other hand, it should be noted that there is currently a growing demand from educational institutions to use ICT to teach the skills and knowledge that students need for the digital age (Knezek and Christensen, 2016).

ICTs have a profound impact on society and affect all aspects of human endeavor. The adoption and integration of ICTs in education continues to gain momentum in educational literature (Kauffman and Kauffman, 2017). According to Valencia, Serna, Ochoa, Caicedo, Montes, and Chávez (2016), some aspects of ICT integration include search engines, information search robots, platforms, interactive tools, and social networks, among others. On the other hand, Aguiar, Velázquez and Aguiar (2019) referred to aspects related to ICT integration, such as competence, proactive incorporation and motivation, also pointing out, that these are essential aspects, which allow advanced students to acquire an educational quality in the new way of learning through ICTs. Similarly, Melo (2018) defined the integration of ICT as knowing how to communicate and integrate new trends in technological advances, how to get students to achieve new knowledge using ICT at classroom level, based on skills; it is based on a holistic, constructivist, integrative, rational and systemic posture.

The process of integration of information and communication technologies (ICT), where teachers play a decisive role, is complex (Suárez et al., 2018). On the other hand, Yu, Lin, and Liao (2017) indicated that a large number of studies have shown that the integration of ICTs in teaching by teachers is also influenced by organizational factors and attitudes towards technology. The integration of ICT in education plays an important role in facilitating and

improving student learning. As Almerich, Orellana, Suárez, and Díaz (2016) have noted, integrating ICTs into teaching practices is complex and challenging.

The teacher's favorable or unfavorable attitude toward the use of ICTs influences their use; if the teacher shows a negative attitude toward them even though he or she is provided with excellent facilities; he or she will not use them in his or her session (Eger, Klement, Pisoňová and Petrová, 2018). According to Lawrence and Tar (2018), the adoption and integration of ICTs is largely governed by the characteristics of teachers such as age, gender, educational experience, knowledge of ICTs, and attitude toward them. Therefore, Eger al. (2018) noted that the teacher who has skills or knowledge is in a better position to judge the usefulness of adopting and integrating ICTs into teaching and learning activities.

Pittman and Gaines (2015) added that the availability of technological resources in the classroom has a positive impact since the teacher is motivated to use them. However, teachers adopt and integrate ICTs into teaching and learning activities if they have the ability or knowledge to judge the effectiveness of the technology, and not by its mere existence in the classroom (Picón, de Caballero and Paredes, 2020; Ocaña, Valenzuela and Morillo, 2020; Mavrou and Loizou, 2017 and From, 2017).

According to Aslan and Zhu (2016), technological factors represent the perceived characteristics of ICT. The adoption and integration of ICTs is largely governed by the way teachers perceive ICTs and their ability to use them for teaching and learning activities (Prendes, Gutiérrez and Martínez, 2018 and Suárez, Almerich, Orellana and Díaz, 2018). If teachers perceive that the use of ICTs offers a relative advantage over other technologies, for example, it improves the quality of teaching and learning, it is likely that they will be adopted and integrated into teaching (Suárez, Flores and Peláez, 2019; Lalangui and Valarezo, 2017 and Alemu, 2015). According to Eynon and Geniets (2016), the integration of ICTs in teaching and learning is very complex; such complexities inhibit teachers from adopting and integrating them.

Access is one of the basic prerequisites for the effective use of ICTs by teachers in schools and is very important for the effective integration of ICTs into the teaching-learning process (Moreno, Cavazotte and Alves, 2017 and Careaga and Avendaño, 2016). Flórez, Aguilar, Hernández, Salazar share this approach and Pérez (2017), who stated that access to technological resources is one of the effective ways to use ICTs in education. In this regard, Fernandez, Fernandez and Cebreiro (2018) pointed out that accessibility to ICT resources is the main obstacle to the implementation of ICTs in schools; therefore, access to ICT infrastructure and resources in schools is a necessary condition for the integration of ICTs in education (Al-Shwabkah, Hamad, Taha and Al-Fadel, 2016). ICT adoption and integration depends mainly on the availability and accessibility of ICT resources such as hardware and software. If teachers cannot access ICT resources, they will not use them (Moreno et al., 2017) and, by default, students will have little or no reference to ICT possibilities.

3. Digital Skills

Digital skills, according to Lévano, Sánchez, Guillén, Tello, Herrera and Collantes (2019), are the perspective of the new educational training, with a clear objective of educating and preparing students, allowing them to appropriate themselves of new ICT knowledge, tools that serve to include them within the educational system. The incorporation of new technological structures facilitates the incorporation of new approaches to teaching and evaluating students with ICT, for observing the progress they have made; that is, these competencies develop planning and organizational skills in education, which aids the construction of new knowledge, using technologies as tools in new scenarios (Jiménez and Gijón, 2016).

The digital skills of the 21st century drive the competitiveness and innovation capacity of organizations (Lévano et al., 2019). Although these skills are considered crucial, the digital aspect integrated with the skills of the 21st century is still not sufficiently defined (Van-Laar et al., 2018).

The definition of digital skills may vary according to the objective, audience, and context (Kauffman and Kauffman, 2017). Digital competence refers to the diverse range of knowledge, skills and attitudes required in a digital environment (Gašová et al., 2018). On the other hand, Area and Guarro (2012) asserted that digital skills revolve around the ability to search for information, the ability to express oneself in different programming languages and the capacity for social interaction, integrating new technologies.

4. Methodology

The design of the present investigation was outlined as non-experimental, of a transversal type, being at the same time a study of correlational nature. The type of study was the basic descriptive one since it was sought to measure the relationship that could exist among the variables.

The population included 300 students of both genders, from the Engineering Area of the Technological University of South Lima (Untels); the sample was estimated in 168 students. Two tools were adapted for the collection of information: the first one called Melo's ICT integration (2018), made up of 18 items, and the second one called Area's and Guarro's digital competences (2012), made up of 30 items. The validation of these instruments was carried out by the judgment of experts in the area in question; the reliability analysis, for both instruments is shown in Table 1.

Table 1. Reliability analysis of the questionnaires used

Tool	*Cronbach's Alpha Tool*	Number of Elements
ICT integration	0.976	18
Digital skills	0.889	30

The questionnaires were applied with the use of the Google platform technological resource called 'Google forms', since the participant students have access to an institutional mail attached to that platform, so the application was virtual. The data collected was obtained directly from the platform, which generated a spreadsheet to access the data, and was then evaluated through the software SPSS version 24 to obtain both the descriptive and the inferential results.

5. Results

In table 2, the levels of ICT integration in times of the pandemic were shown; the advanced level was predominant with 89.9%, i.e., the interviewees took into account the incorporation of the tools, responsibilities and the use of ICT. On the other hand, 7.7% showed an intermediate level in how they incorporated the tools and only 2.4% showed a basic level regarding the already mentioned feature.

Table 2. Levels of ICT integration in times of the pandemic COVID-19

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Basic	4	2,4	2,4	2,4
	Intermediate	13	7,7	7,7	10,1
	Advanced	151	89,9	89,9	100,0
	Total	168	100,0	100,0	

In figure 1, there is displayed the description of the dimensions referred to the integration of ICT in times of the pandemic COVID-19. In this regard, for the proactive incorporation dimension, the advanced level stood out with a high 90.5% of acceptance by those surveyed, while 7.7% presented an intermediate level, and only 1.8% were at the basic level. With respect to the motivation dimension, 85.1% of those surveyed reached the advanced level, while 11.3% were at the intermediate level and only 3.6% were at the basic level. Finally, the competence dimension showed that 89.3% identified themselves with an advanced level; followed by 4.1% of the intermediate level and only 3.6% identified themselves with the basic level.

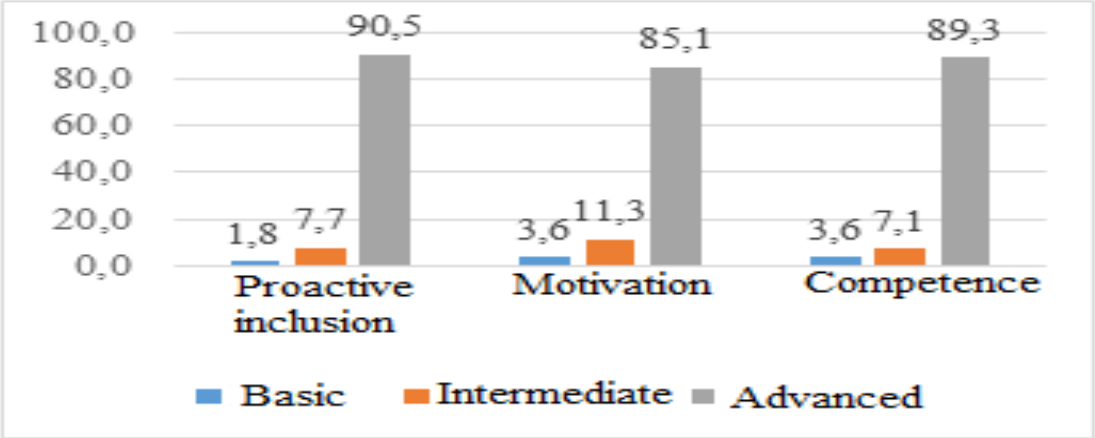

Figure1. Levels of dimensions of ICT integration in times of the pandemic COVID-19

Regarding the results obtained for digital skills displayed in table 3, it could be interpreted that 86.9% of the students surveyed identified themselves with the advanced level; followed by 9.5% at the intermediate level, and only 3.6% identified themselves with the basic level.

Table 3. Levels of Digital Competencies in times of the Pandemic

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Basic	6	3,6	3,6	3,6
	Intermediate	16	9,5	9,5	13,1
	Advanced	146	86,9	86,9	100,0
	Total	168	100,0	100,0	

With regard to the results obtained for the dimensions of the digital skills variable, according to Figure 2, the instrumental dimension was favorable in 94% of those surveyed, because they identified themselves with the advanced level; a similar situation was observed in the cognitive-intellectual dimension with 80.4% for the 'advanced' level; while for the socio-communication dimension, 83.9% was obtained for the referred level. As for the axiological dimension, the advanced level obtained 84.5% of acceptance among the participants. Finally, with respect to the emotional dimension, the value for the advanced level was 85.7%. It is worth mentioning that only for the cognitive-intellectual dimension, it was only possible to advance 5% to the "basic" level being lower than the value obtained in the other dimensions; the intermediate level did not exceed 15% for the total number of respondents in the dimensions mentioned.

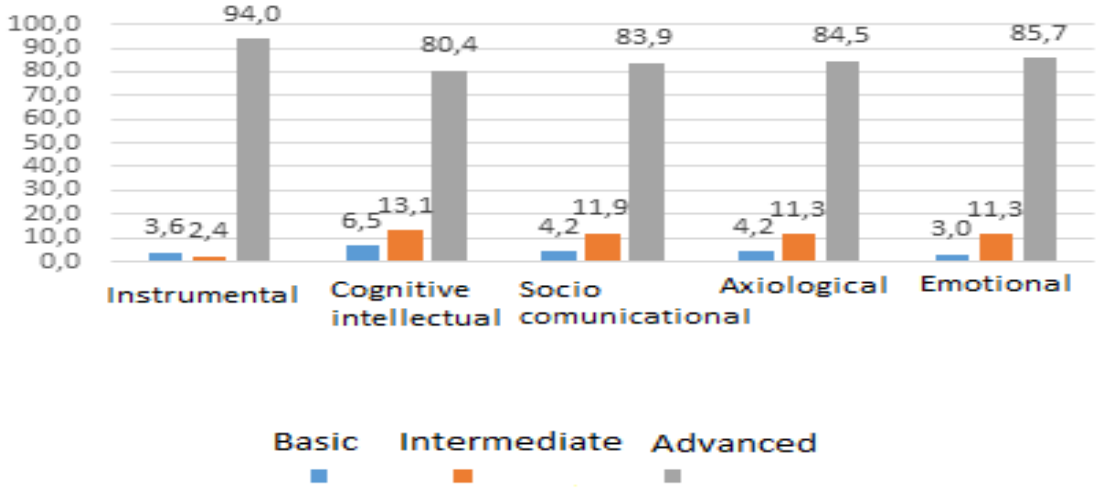

Figure 2. Levels of 'digital literacy' dimensions in pandemic time COVID-19

The results shown in Table 4 showed the positive and high relationship that was identified between the integration of ICT and digital skills (Spearman's rho = 0.761, p value < 0.05). It should be noted that there was a moderate and direct relationship between the proactive incorporation dimension and the digital skills (Spearman's rho = 0.593, p value < 0.05); followed by a direct and high relationship between the motivation dimension and the digital skills (Spearman's rho = 0.750, p value < 0.05); finally, it was determined that there was a high and moderate nexus between the competence dimension and the digital skills (Spearman's rho = 0.727, p value < 0.05).

Likewise, high and direct relationships were observed between the integration of ICT and the proactive incorporation dimension (Spearman's Rho = 0.872). It was the same for the relationship between the integration of ICT and motivation (Spearman's Rho = 0.922), and the relationship between the integration of ICT and competencies (Spearman's Rho = 9.27), being for all cases the p_value < 0.05, establishing that the relationship between the variables and the dimensions was significant.

Table 4. Degree of correlation and level of significance between the variables and dimension of the integration of ICT and digital skills in times of the COVID-19 pandemic

			Digital skills	ICT inegration	Proactiva incorporation	Motivation	Competence
Spearman´s Rho	Digital Skills	Correlation Coeficient	1,000	,761**	,593**	,750**	,727**
		Sig. (bilateral)	.	,000	,000	,000	,000
	ICT Integration	Correlation Coeficient	,761**	1,000	,872**	,922**	,927**
		Sig. (bilateral)	,000	.	,000	,000	,000
	Proactive Incorporation	Correlation Coeficient	,593**	,872**	1,000	,708**	,726**
		Sig. (bilateral)	,000	,000	.	,000	,000
		Correlation Coeficient	168	168	168	168	168
	Motivation	Sig. (bilateral)	,750**	,922**	,708**	1,000	,805**
		Correlation Coeficient	,000	,000	,000	.	,000
	Competence	Correlation Coeficient	,727**	,927**	,726**	,805**	1,000
		Sig. (bilateral)	,000	,000	,000	,000	.
		N	168	168	168	168	168

**. Correlación significativa, nivel 0,01 (bilateral).

6. Discussion

Regarding the dimensions of the ICT integration variable: proactive incorporation, motivation and competence, it was observed that 90.5% of the students surveyed considered themselves proactive because of the advanced level they reported to have. This means that, in this pandemic, students have integrated the use of new technological tools into their learning. In this regard, the results shown are contrary to those presented by Machuca and Véliz (2019), who mentioned that there is no significant relationship between the integration of digital skills to improve learning. This approach is perhaps due to its implementation prior to the state of the COVID-19 pandemic.

Regarding the motivation dimension, 85.1% were at the advanced level and for the intermediate level only 11.3%; while 3.6% showed no motivation, which translated into a lack of continuity in the use of technological tools. Finally, for the dimension of competence, 89.3% identified themselves with the advanced level; in other words, they have achieved the competences as part of their learning.

Casillas, Cabezas, Sánchez and Texeira (2018) referred to the importance of integrating digital skills into student learning, in order to develop their abilities to perform better in the face of new technologies. The results obtained were far from what was reported by Mateus and Suárez (2017), who, regarding knowledge on the use of new technologies, showed that only 45% of their respondents achieved the advanced level, while 39.2% achieved the intermediate level, and 11.7% were at a basic level. Suárez et al. (2019), who pointed out, also see this aspect of performance improvement in the field of new technologies that distance education through the web facilitates interactive relationships and the generation of communication processes.

Regarding the results of the integration and incorporation of digital skills, a statistical average of 85.7% was obtained, which translated into an advanced level, achieving better communication and learning, thus generating digital skills. This result is equal to that obtained in the research by Martinez, Lopez, Ortega and Rodriguez (2015); scholars mentioned that the incorporation of digital skills has developed better communication and learning.

The descriptive evaluation of the digital skills generated the perception of an advanced level (86.9%) by those surveyed, which indicated that there was an improvement in the integration process of the digital tools. In this regard, Diaz et al. (2016) indicated that slightly more than 55% of those evaluated in their research reached the advanced level.

The positive and significant correlation found between the integration of ICT and digital skills (Spearman's Rho = 0.761) highlights the social links of the participants and the multiple formation of the acquired digital skills (Díaz et al., 2016). In addition, this study was consistent with Lawrence and Tar (2018), who suggested additional studies on the adoption and integration of ICTs in other educational settings; the authors noted that the idea presented here should be added or modified.

7. Conclusions

A significant relationship was found between the integration of ICT and digital skills in times of the pandemic COVID-19, as they allow students to learn and master technological tools making them compatible with virtual education. In this regard, the analysis by Van-Laar et al. (2018) showed that compatibility contributes to the adoption and integration of ICT in teaching and learning, the emphasis lies on the alignment between the characteristics of technology and the characteristics of the task. Therefore, Lin, Huang, and Chen (2014) indicated that technological innovations would be adopted as long as they fit the current situation and the costs are lower.

Consideration should be given to what was mentioned by Ocaña et al. (2020), who argued that the lack of access to technological tools is an obstacle to the integration of ICTs into teaching and learning; infrastructure should be provided in the communities most affected by the digital divide (Chetty, Aneja, Mishra, Gcora and Josie, 2018). For their part, Bakhshi, Downing, Osborne and Schneider (2017) stated that digital skills are used in non-routine tasks, problem solving and creating digital outputs; however, in the near future, both interpersonal and technological skills will be in high demand at work. On the other hand, digital skills, which are linked to occupations that are less likely to grow, tend to be related to the use of software for administrative purposes (Chetty et al., 2018).

Similarly, the analysis of the results obtained was aligned with what Suárez et al. (2019) proposed, as both teachers and students should be aware of having adequate digital skills, even more so in this pandemic era, which demands digital literacy. These competencies also allow overcoming possible difficulties such as the accessibility presented by new technologies and maintaining an adequate status to keep learning in digital environments.

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