Technological And Connectivity Conditions of Undergraduate Students of Economics, Accounting and Administrative Sciences at A Peruvian Public University

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Abstract

The purpose of the research was to identify the ICT and connectivity conditions of university students and how they use them in their undergraduate studies at a Peruvian public university. Data was collected from 208 students of the Professional Schools of Business Administration, Tourism Administration, Accounting and Economics enrolled in the Academic Semester 2024-1, with the support of a Google Forms survey. The results show that students mainly use laptops (90%) and cell phones (95%). They use wifi networks for their studies, 35% of them do not a c c e s s a network at the University or home. The preferred mobile operators are Claro (38.3%) and Bitel (35%). The preferred online service is Canva (48.3%). The most used social network is Facebook (88.3%), followed by Tik Tok (66.7%), Instagram (60%), YouTube (43.3%) and Twitter (25%). Technological conditions are limited to promote academic learning.

Keywords: *ICT, Higher Education, Internet, Mobile Devices, Online Applications*

INTRODUCTION

The implementation of information and communication technologies (ICT) has been progressively introduced in society during the last 30 years, this change in our society has led to the need to promote learning beyond the mere acquisition of information. Today it is necessary to promote competency-based learning that is focused on fostering students' ability to transform information into knowledge that is meaningful to them. Therefore, it is important to promote student-centered teaching practices instead of the common content-centered practices (Cabellos et al., 2024).

One of the fundamental challenges facing education systems worldwide is the successful integration of technology. The Covid-19 pandemic has highlighted the importance of the role o f digital technology in learning. However, being surrounded by technology does not guarantee that educational institutions use it productively and efficiently, so it is important to continuously examine the factors that enable the successful implementation of technology in pedagogical activities, as well as the quality of technology use in classrooms (Ninković et al., 2023).

The application of ICT in education leads to profound changes in both traditional educational philosophy and practical approaches to teaching and learning. To meet the new demands for talent training in the information

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age, many countries and regions have issued plans and policies to highlight the importance of digitization of education for national and regional development (Wang and Wang, 2023).

Interactivity in multimedia learning allows control over lessons. Learners can change parameters, perceive their results or respond to a selection of options. As stated in the cognitive theory of multimedia learning it is essential to integrate imagery and definitional methods to enhance learners' existing knowledge and extend it with new facts (Ling and Krishnasamy, 2023).

Studies show that learning communities have shaped the role of digital technologies, such as social networks, for proactive and collaborative users, making their learning experience more holistic and integrated. Learning c o m m u n i t i e s in educational settings aim to address the needs of learners by addressing specific issues or problems, learning to work and communicate with people of diverse views and backgrounds, and sharing what they have learned with each other. Social networks turn a group of learners into a dynamic learning community and provide a digital platform for learners and course facilitators to engage in conversations and build relationships (Chen et al., 2023).

The importance of higher education institutions lies not only in the fact of training future professionals with emphasis on the skills inherent to each field of action, but also in the complementarity required by the new technological and communicational trends (ICT), so those in charge of the teaching role in these institutions must provide adequate spaces for their own development and continuous training, with innovative strategies that facilitate the creation, storage and transfer of knowledge to students (Poveda-Pineda and Cifuentes-Medina, 2020). For this task, ICTs emerge as a central element of the cognitive processes in higher education institutions that allow the modernization of each of the links involved in the process, these interactions are summarized in Figure 1.

The use of ICT for academic activities could be characterized in terms of four factors: (1) interest in ICT, an individual's intrinsic motivation to participate in ICT-related tasks or activities;

(2) perceived ICT competence, an individual's notion of his or her own ICT-related knowledge and skills;

(3) perceived ICT autonomy, an individual's perceived control and independence in using ICT; and (4) social network use, the extent to which an individual communicates and interacts with others using ICT (Ma and Qin, 2021).
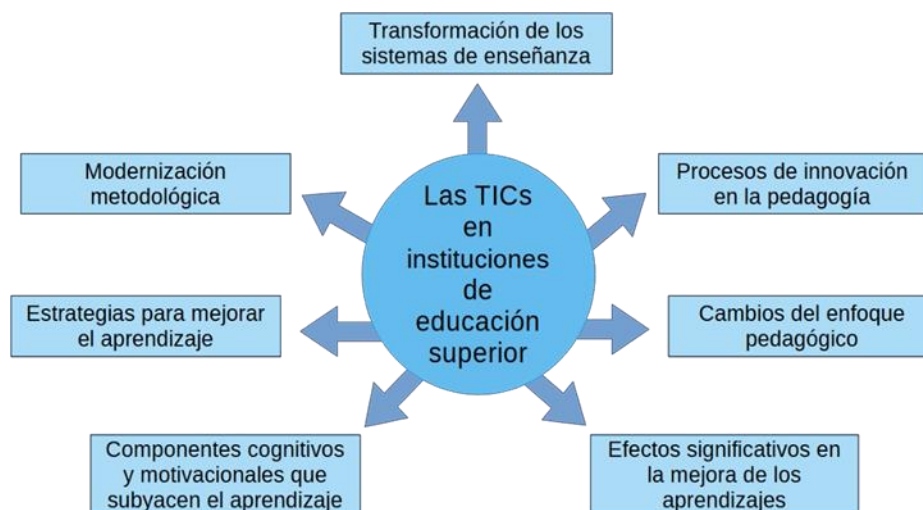
Figure 1 - ICT in the processes of higher education institutions. Adapted from Poveda-Pineda and Cifuentes-Medina (2020).

Helping students acquire ICT skills supports their learning processes and outcomes in school, or it also distracts them and hinders their learning. Students with greater ICT literacy may be able to use the component skills to learn more or use their familiarity with ICT-mediated activities to learn more. The component skills of ICT

literacy include accessing, managing, evaluating, and communicating information. By accessing more information through ICT, students can use ICT as building blocks to learn more. In addition, students who effectively manage/organize ICT information can learn more efficiently (Lei et al., 2021).

Several studies estimate the causal effect of ICT on student performance by exploiting the diversity of national or local programs aimed at increasing ICT infrastructure in schools and find little or no effect. Taken together, these findings seem to suggest that the use of ICT is no more effective than traditional teaching methods. One possible explanation is that the introduction of computers may have displaced alternative school resource investments and related educational activities that, if sustained, would have prevented a decline in student achievement (Comi et al., 2017).

However, a study conducted on the results of the PISA 2018 assessment showed that the national level of ICT was a significant positive predictor for individual skills between 4th and 8th grade students, i.e., for the countries evaluated, a positive causal relationship was found between ICT and academic performance (Skryabin et al., 2015). Labor markets evidence that the possession of technological competencies for professional performance is a social demand that must be met in the initial training process of graduates and therefore, technologies should be used as a resource that allows a better adaptation of students to different situations. The students who use ICTs the most are those belonging to the health sciences (Vega- Hernández et al., 2018).

A number of initiatives in recent years have proposed definitions and outlined frameworks for 21st century skills. The Organisation for Economic Co-operation and Development (OECD) defined 21st century skills as those skills and competencies that young people will need to have to be effective workers and citizens in the knowledge society. This definition of skills reflects the need to train skills in collaboration, communication and digital literacy, citizenship, problem solving, critical thinking, creativity and productivity, making ICT support important for every society (Siddiq et al., 2017).

The present research evaluates the relationship between ICT equipment, the ability to use it and the academic performance of undergraduate students of the Faculty of Economics and Administrative Sciences of the National University Toribio Rodríguez de Mendoza of Amazonas, for this purpose, an online data collection tool was developed, validated by experts and applied to students voluntarily.

data to learn about behaviors and skills with statistical parameters for non-clustered data. The students' opinion about ICT is important because it influences their use, which has an impact on their academic and professional success. Although a positive appraisal of ICT elements does not always imply their use in their learning process.

The paper is organized as follows. Section 3 explains the methodology, data and variables used in the article. Section 4 describes the results. Section 5 concludes and discusses the findings and their implications for educational policy.

MATERIAL AND METHODS

This article was prepared using the empirical-analytical approach (citation needed), the type of research is quantitative with descriptive scope, because the interest was to determine the characteristics of a study event within a particular context (citation needed); the data are cross- sectional, because they were obtained in a given period of time and for a specific research, the research is non-experimental since none of the variables under study have been manipulated or controlled (Hernández et al., 2014).

The research question that motivated the present study is the following: What information and knowledge technology equipment does a university student have and how does he/she use it in his/her undergraduate studies in the Faculty of Economics, Accounting and Administrative Sciences of a Peruvian public university?

Data were collected from 208 students of all the Academic Cycles of the Professional Schools of the Faculty of Economic and Administrative Sciences of the Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas enrolled in the First Semester of the Academic Year 2024. For data collection, a survey was developed with the support of Google Forms, which was answered individually and voluntarily by the students interested in participating in the study. The data collection tool was validated by three experts. The consolidation of participants is shown in Table 1.

The survey was composed of three sections, the first section collected socioeconomic data, the second section collected data related to ownership of ICT devices, and the third section collected data related to social networks and basic internet tools frequently used in undergraduate level classes. The questions were designed with multiple-choice answers.

Table 1 - Study participants

Professional School	Participants
Business Administration	55
Tourism Management	50
Accounting	51
Economy	52
Total	208

The study was conducted in the city of Chachapoyas, district and province of Chachapoyas, department of Amazonas, in March and April 2024.

RESULTS

The results of the first section, socioeconomic data, are summarized in Table 2, which indicates that in the Faculty of Economics and Administrative Sciences about three quarters are between 17 and 21 years of age, the predominant sex is male, with 54% of the participants in the study and most come from the same department where the University is located, and to a lesser extent from Cajamarca and Lima, which would be the second and third departments with the highest demand for studies. Of the 208 students, 158 live in a rented room, perhaps because they come from different cities, even though they come from the same department.

Next, we inquired about the ownership of ICT equipment (Figure 2). It was found that students have laptops (90%) and cell phones (95%) mainly, so virtual classes can be developed without difficulties. On the other hand, only 43.3% have a desktop computer and 3.33% have a tablet that they use in their studies.

Based on these results, the characteristics of the ICT equipment were evaluated, which are summarized in Table 3. It can be seen that the most used brands are Hp and Lenovo, which together account for 93% of the preferences. The operating system

Table 2 - Socioeconomic data on study participants

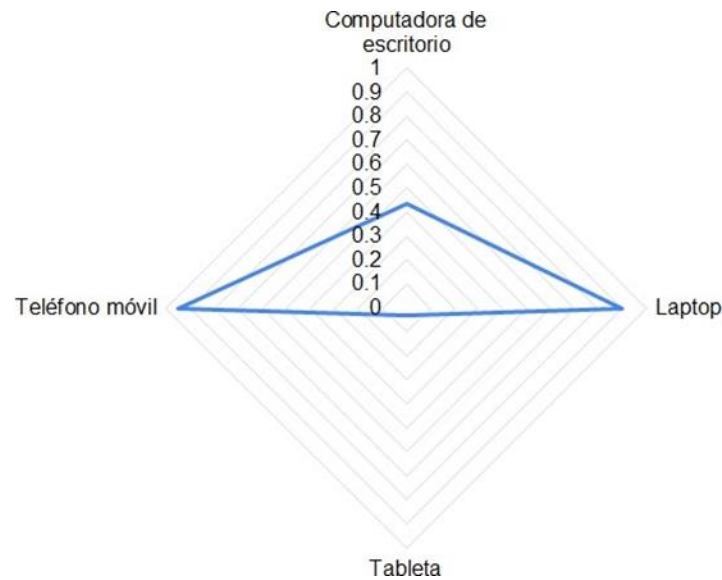| Variables	Categories	Frequency	Percentage
Age	*17 a 21*	*153*	*0.74*
	22 a 26	*47*	*0.23*
	27 a 31	*5*	*0.02*
	32 a 36	*3*	*0.01*
Sex	*Male*	*112*	*0.54*
	Female	*96*	*0.46*
Provenance (region)	*Amazon*	*162*	*0.78*
	Cajamarca	*35*	*0.17*
	Lima	*8*	*0.04*
	St. Maarten	*3*	*0.01*
Room	*Rented*	*158*	*0.76*
	Parents / Relatives	*46*	*0.22*
	Friends / Couple	*4*	*0.02*

Figure 2 - Ownership of ICT equipment by students The most widely used computer is Windows 10, even though the higher version, Windows 11, has been on the market for more than two years. The processor with the highest preference is Intel i5, perhaps due to the more accessible price compared to more recent processors.

With regard to cell phones, Table 3 also shows that Samsung and Xiaomi account for 68% of users, consolidating their position as the most used. The internal memory of the most frequently used cell phones is 55 to 128 GB, which would be those belonging to the mid-range, allowing the storage of text files (pdf, docx, txt, etc.) and media (.mp3, .mp4, etc.), without any difficulty, but in relatively limited quantities.

Table 3 - Characteristics of the ICT equipment used by students

Variables	Brand	%	Operating System	%	Processor	%
	Hp	*47.1*	*Windows 365*	*5.7*	*Intel i3*	*34.3*
Computer	*Lenovo*	*45.7*	*Windows 11*	*25.7*	*Intel i5*	*40.0*
Desktop		*7.1*	*Windows 10*	*58.6*	*Intel i7*	*11.4*
	Another					
			Another	*10.0*	*Another*	*14.3*

Variables	Brand	%	Internal memory	%
	Samsung	*43.9*	*From 0 to 54 GB*	*31.6*
	Xiaomi	*24.6*	*From 55 to 128 GB*	*52.6*
	iPhone	*8.8*	*From 129 to 256*	*14.0*
Cell phone	*Huawei*	*5.3*	*More than 256 GB*	*1.8*
	Honor	*5.3*		
	Motorola	*5.3*		
	Another	*7.0*		

Next, we investigated the Internet connectivity accessed by the students. The first part consisted of access through wifi networks (Table 4), finding that 18.33% of respondents access the service using a university mobile network or a home network, 25% of them access only through the university network, 21.67% access only through a home network and 35% do not access through any of these available wifi networks, a high percentage, considering the importance of the internet in today's education.

Table 4 - Wifi internet accessibility

		Wifi network access at home	
		Yes (%)	No (%)
Wifi network access at the University	Yes (%)	18.33	25.00
	No (%)	21.67	35.00

Of the students who access a wifi network at home (Table 5), they have quite diverse connection speeds ranging from 1 to 100 Mbps, covering 97.67% of respondents. This connection speed could favor or disfavor the transmission of content, especially multimedia. Of the participants who have home wifi service, 4.16% indicate that they get it for free, 66.67% indicate that a relative or friend pays for it and 29.17% respond that the cost is included in the monthly payment they make to the room they rent.

Table 5 - Characteristics of the home wifi network

Feature	Values	Frequency (%)
Wifi network speed at home	*From 1 to 10 Mbps*	*25.58*
	From 11 to 30 Mbps	*27.91*
	From 31 to 50 Mbps	*25.58*
	From 51 to 100 Mbps	*18.60*
	More than 100 Mbps	*2.33*
Payment of the wifi network service	*The network is free of charge*	*4.16*
	Paid by a relative / friend	*66.67*
	It is included in the room rate that	*29.17*

The second part of connectivity (Table 6) focused on mobile connectivity, used mainly through mobile devices (cell phones). Among students, the most popular mobile telephony operators are Claro, with 38.3% of preferences, and Bitel, with 35.0% of preferences, with just under three- quarters of users.

**Table 6 - Internet accessibility via mobile data**

Operator	Prepaid No Data	Data	Sub Total	Postpaid No Data	Data	Sub Total	Total
Of course	*8.3*	*5.0*	*13.3*	*-*	*25.0*	*25.0*	*38.3*
Bitel	*8.3*	*10.0*	*18.3*	*-*	*16.7*	*16.7*	*35.0*
Entel	*1.7*	*3.3*	*5.0*	*-*	*8.3*	*8.3*	*13.3*
Movistar	*3.3*	*0.0*	*3.3*	*-*	*10.0*	*10.0*	*13.3*
Total	*21.7*	*18.3*	*40.0*	*-*	*60.0*	*60.0*	*100.0*

Inquiring about the type of contract that students have with the operators, it was found that 40% are prepaid and 60% are postpaid, a trend that has been growing steadily in recent years. Prepaid customers with data access represent 18.3% of the total sample, while all postpaid customers have data on their mobile devices, reaching 60% of the total sample. This leads to the conclusion that 78.3% of respondents access the Internet through their cell phone.

The last topic under investigation was about the use of educational applications related to ICT, here we found marked trend results (Figure 3). The messaging service is used by all students and the only preferred application is Whatsapp. 88.3% of the students use Facebook, which would be the preferred social network. The second social network in preference is Tik tok, with 66.7% of users, the third Instagram, with 60.0% of users and the

fourth Youtube, with 43.3% of active users. Twitter is falling into disuse and only 25% of those surveyed use it.

On the class support side, Canva has 48.3% of users, an interesting figure, considering that it is free to use in this institution and there are no policies that promote its use. The opposite happens with bloggers, who reach only 5% of users, a rather low level.
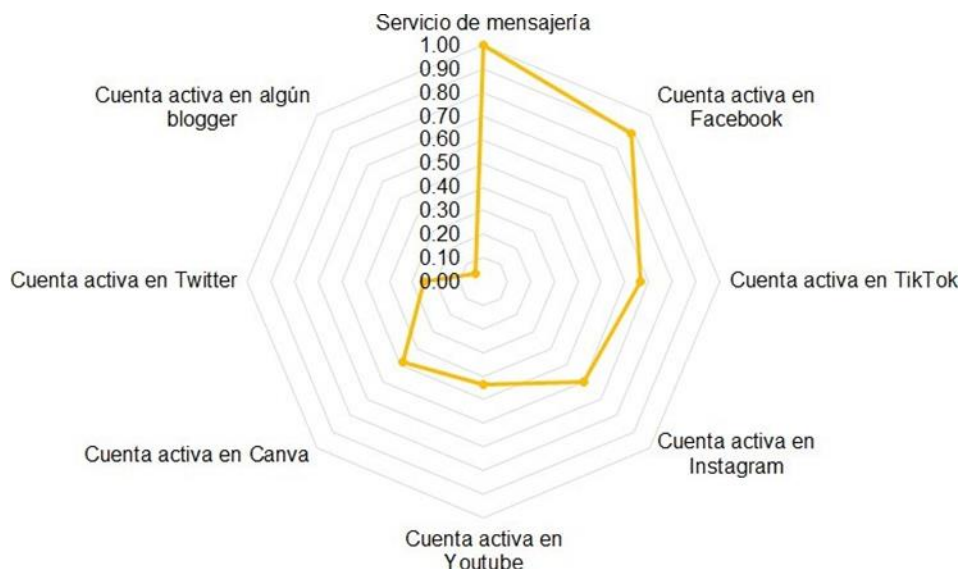
Figure 3 - Use of social networks and basic internet tools by students.

DISCUSSION

The purpose of this research is to identify the information technology equipment and knowledge that university students have and how they use it in their undergraduate studies at the Faculty of Economics, Accounting and Administrative Sciences of a Peruvian public university, which should be sufficient to acquire the necessary knowledge and complete their university studies without difficulties.

The results of the socioeconomic data of the study participants show that 74% of the students of the Faculty are between 17 and 21 years old, relatively young and coinciding with other similar studies (Acosta-Enriquez et al., 2024).

For this faculty there is a slight advantage of males over females, not significant and consistent with the results shown by Marin et al. (2024).

It is important to note that 78% of the students of this faculty come from the Amazon region, making it an important alternative for local youth. However, it is observed that a similar percentage (76%) live in rented rooms, i.e. they come from other districts of the region.

The results of ICT equipment ownership show the global trend of using mobile computing equipment (laptops preferred over stationary personal computers). It is worth mentioning that laptops offer a more complete browsing experience than mobile devices, as they have larger screens and more processing power, including keyboards and mice, which facilitates typing and Internet browsing (Chandranaik et al., 2024). Of the respondents, 90% have a laptop, 43.3% own a personal computer and all of them have a laptop, and only 10% own neither a laptop nor a personal computer. The most preferred computers are Hp and Lenovo, which together comprise 93% of the computers used by students.

The preferred operating system is Windows 10, followed somewhat behind by Windows 11. Processors are the standard in the market, with preferences between Intel i3 and Intel i5 with about 74% of respondents.

Regarding mobile connectivity devices, cell phones are the least used device to access the Internet, but their use is growing rapidly as they are very portable, and allow them to be used to access the Internet from anywhere. The study found that only 3.33% of the students have and use a Tablet, while 95% of them have a cell phone that they use in their studies. With this, it is evident that tablets are losing preference by students, similar to the findings provided by Kaplan-Rakowski et al. (2023). The most used cell phones are Samsung, with a preference of 44%. Most of the devices, 91.2% use as operating system some version of Android and the internal memory corresponds to mid-range phones, ranging up to 128 GB of storage, results similar to those provided by Moltalvo-Man et al. (2022).

Students access wifi networks to access classes and download information related to their studies. Thirty-five percent of them cannot connect to a network at the University or at home, so they must use public booths to connect to the Internet. Only 18.33% of the students have Internet access both at the study center and at home. The connection speed ranges between 1 and 50 Mbps, with 79% of the students in this range. Only 2.33% of respondents have more than 100 Mbps, the most appropriate speed for effective use of Internet programs and applications (Antón-Sancho et al., 2024). Only 29.17% of the students pay for the service, while for the rest it is free or paid for by someone else.

The preferred operator for students is Claro, with 38.3%, followed by Bitel with 35%, which are also similar for the population of Amazonas (Organismo Supervisor de Inversión Privada en Telecomunicaciones, 2019). Regarding the modality of contracting mobile data service, 60% maintain postpaid contracts and 40% prepaid, of the latter percentage, 54.25% do not have data on their cell phone, so their connectivity is limited.

The information collected on the use of ICT-related applications applicable to education shows that the universal service is messaging, with all respondents using Whatsapp. This means of communication is the preferred one between students and teachers, allowing massive and instantaneous exchange of files and academic information. In academic online services, half of the students use Canva (48.3%) and only 5% have a Blogger.

Analyzing the social networks, the most used is Facebook (88.3%), which students access at any time of the day. The second most used network is Tik Tok with 66.7%, even though it is not the most popular.

when students do not create content, being only consumers. The other social networks, in number of users, are Instagram (60%), YouTube (43.3%) and Twitter (25%). Evidencing a disuse of YouTube and Twitter in recent years (Mbaiossoum et al., 2024).

It is important to keep in mind that the data presented in this section are only a general description of the socioeconomic characteristics of the study participants. To obtain a more complete understanding of these data, it would be necessary to analyze them in conjunction with other data from the study, such as the results of the mental health measures.

The results obtained allow us to conclude that the technological conditions are not the most adequate for the students of the Faculty of Economics and Administrative Sciences under study. Therefore, if this situation is repeated in other universities in the country, the State should provide technological equipment and promote the use of online applications for both teachers and students, as content creators and users, to improve student learning.

CONCLUSIONS

The results show that the students under investigation use laptops mainly to connect to the Internet and carry out their academic activities. They also use their cell phones to access the Internet and communicate with their classmates and teachers.

However, a significant percentage of students do not have Internet access at home, which can hinder their learning. In addition, the Internet connection speed in students' homes is relatively low, which can make it difficult to access multimedia content and other online tools.

Finally, it was found that students use a variety of social networking applications and basic Internet tools to communicate, collaborate, and learn. However, the use of these tools is not always effective, and some students may be distracted or have limitations in learning online.

As a result, students are not in adequate conditions to conduct online classes or use computer tools effectively.

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