

# Analysis of Information and Communication Technologies and Digital Competences in Professors and Undergraduate Students

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**Abstracts:** We can observe changes made during and post pandemic according to the use of digital tools to achieve education at all levels, this was at the beginning a hard reality for not being able to help all students from different nations who were not prepared in this way. This research had as general objective, to analyze and understand the use of ICT and the development of digital competences of professors and undergraduate students in times of pandemic of a particular university in Cusco, 2023. The study was of qualitative approach, with a basic type and descriptive design at a phenomenological level. The data collection technique applied was the in-depth interview, working with 6 professors and 6 students in total. In order to obtain the results, the inductive method was implemented for the information analysis of the two study categories; triangulation was carried out considering the students- professors -researcher. As results, it was obtained that the educational stakeholders have been forced to use digital tools to continue with their teaching or learning process; during the pandemic, the computer, laptop, tablet or cellphone were the devices applied by professors and students; using a series of software and platforms. To access to ICT, professors and students solved the problem of the internet through their own resources, the digital services they accessed were the ERP system and the virtual platform to continue with the classes.

**Keywords:** ICT, Digital Competences, Connectivity, Virtual Platform, ERP University.

## 1. INTRODUCTION

The Information Society or Knowledge Society that we have been living in, is immersed in a technological globalization that is part of our lives, increasing greatly the communication systems, where hyper communication dominates (Soto et al.,2022).. Since 2019 we are going through a global crisis due to the Covid-19 pandemic, representing great changes and challenges for the different fields of knowledge worldwide. The work of professors in universities is based on internet connection, knowledge and the use of web 2.0 technologies (Montesano de Talavera et al.,2023), while students are digital natives (Díaz et al.,2022), therefore computerized educational models should be used, from a sociocultural approach technologies are cultural tools promoted by the government of each country through its digital transformation policies (Soto et al.,2022) and (Morales et al.,2021), representing the technologies, the critical variables for the advancement of today's society (Alemanno et al.,2023).

At the international level, the United Nations Educational, Scientific and Cultural Organization (UNESCO,2018), mentions that the competence is a group of skills and knowledge that the student develops, being one of the greatest educational influences as mentioned by (Carneiro et al.,2019), it is related to the degree of digital competences that the professor achieves considering that we have overcome a pandemic (Castellanos Sánchez et al.,2017), improving the process of mastering technology to the creation of new knowledge (UNESCO 2018), the World Bank, affects the requirement of boosting digital competences considering students and professors, for this it proposes to conduct training considering technology in the curriculum Squire (2023) and (Manzano García, 2015), digital competences include the safe and necessary use of ICT for entertainment, work, communication, based on

the key skills such as the use of computer equipment, programs and social network (González López Ledesma, 2022), (Chiecher et al.,2018) and (Julca Guerrero et al.,2022), the issue of digital competences has been working for many years as part of the educational quality of today's society.

For all the above mentioned, the formulation of the problem was established: How are ICT used for the development of digital competences of professors and undergraduate students in times of pandemic in a private university of Cusco, 2023? in order to explain this, these specific problems were established: What is the use and access of ICT in the teaching and learning processes of students and undergraduate professors? What is the culture and technological leadership of the university? How are the digital competences of professors and undergraduate students developed in times of pandemic in a private university of Cusco?

According to the epistemological, theoretical, practical, and social justification, some works and information related were reviewed on the ICT categories and digital competences, allowing us to explain the theoretical evolution (Caballero Montero et al.,2023), from these two categories through the years in the academic field, contrasting the different contributions of other authors on them, allowing us to make a theoretical comparison of the contribution of various authors, international organizations on the ICT categories and digital competences (Álvarez-Cadavid et al., 2022), (Padilla et al.,2021), (García Vélez et al., 2021), (Tippe Marmolejo et al.,2021) , (Gual,2023) and (Manco et al.,2020), in this way it was possible to suggest improvements in the private university of Cusco for the achievement of digital competences of professors and undergraduate students and thus also improving academic processes.

In order to explain this situation, the following general objective was proposed: To analyze and understand the use of ICT (Martínez-García et al.,2023),\_and the development of digital competences of professors and undergraduate students in times of pandemic in a private university. The specific objectives were: To analyze and understand the use and access to ICT in the teaching and learning processes of undergraduate students. To analyze and understand the technological culture and leadership of the university. To analyze and understand the development of digital competences of professors and undergraduate students in times of pandemic in a private university.

In the theoretical development (Alenezi et al.,2023), (Mukul,2023). For the information and communication technologies ICT categories, within their theories, the researches propose one from them that is related to integration of education with paradigms related to the use of technologies (McDougall, 2006),considering as a key aspect the empowerment of a permanent development of teacher's competences and that the resources used in technology improved the quality of the academic processes, because when the appropriate conditions are not in place, the incursion of technologies represents difficulties for professors.

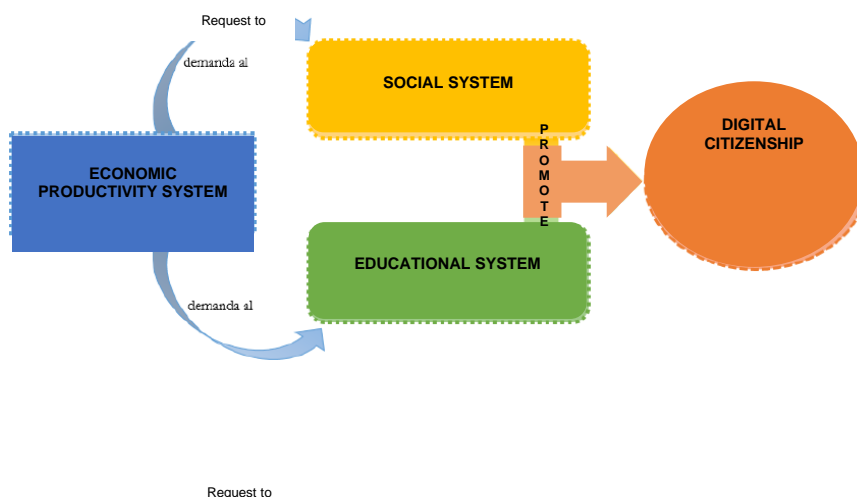
Continuing with all the theories related to ICT (Pirnau et al.,2020), (Farias-Gaytán et al.,2023), (Becerra et al.,2022), and (Arellano Espinoza et al.,2021), in the educational field, we can mention that the importance of the use of ICT by professors emphasizing on boosting the preparation of interactive digital competences (Castellanos et al.,2019) in higher education institutions, show the urgency of the needs while using ICT (Althibyani et al.,2023), besides the contents on theory that are taught due to they need an interaction and complementation with enough practice and collaborative learning, so the use of ICT is required (Makananise et al.,2023),several researchers found that not enough value is given to the functional particularities of ICT (Palacios-Núñez et al.,2022), in the educational processes carried out in these centers, representing a current problem not yet solved, therefore it can be evidenced that technological innovations have still not taken the place they need in the educational context, despite the fact that it is clear the transcendence in the changes of academic processes, based on the imminent requirements of the use of ICT (Domingo-Coscollola et al.,2020).

ICT policy models Cazales (2023), (Llanga Vargas et al.,2023), (Montoya Acosta et al.,2023), (Fung et al.,2023) and (Manzanilla-Granados et al.,2023), from a sociocultural vision, are cultural tools that the government of each country promotes through their digital transformation policies (Saavedra, 2020).

Internationally, there is a model of ICT policies that is worked by the different governments from all the countries, each one has established the ways of working according to the subject, in Peru (Rivera et al.,2020), the government announced the policies of digital transformation throughout the country, a process that has been progressing gradually.

**Image 1:**

*Current theoretical model in ICT policies*



Source: Impact of ICT in teaching in Spanish educational system: a review of research (Colás, et al., 2018, p. 297).

For this category, two subcategories were considered: use and access to ICT, culture and technological leadership of the university (Salcedo, 2018, cited by Gómez, et al., 2021), these subcategories helped to explain ICT in the context of undergraduate students' education. The subcategory uses and access to ICT was important because its incorporation in the field of education leads to propose the development of technologies in universities, promoting the use of it in classrooms (Salcedo, 2018), it was necessary to explain that there are several factors that determine the influence they have on the incorporation of technologies in the educational environment to determine the use in the academic process carried out by professors (Ocaña-Fernández et al.,2020),(Leyva,2015) and undergraduate students, due to the importance of technologies in education and training of future professionals, understanding the access that professors and students have to different electronic devices such as computers, laptops, tablet, smart cell phones and boards, among others; likewise the access to internet and virtual classroom (Salcedo, 2018).

The digital competence category, in relation to the theories on digital competences in accordance to the studies found (Tejada y Pozos, 2018) indicate that teacher training in the educational field has a strategic and important value in the information society. For the second digital competences category (Arango et al.,2020), (Area et al.,2008), state that its development is a requirement of the current labor context required to education professionals, so they have a good development of their digital skills in order to improve their performance (Gómez,2020), (Gómez et al., 2021), therefore ICT should be used in the various production activities.

Theories also include communicative competence (Delgado et al.,2018), related to the way in which students have contact with other students, professors or experts to exchange ideas, knowledge and experiences that contribute to the improvement of the academic process. On the other hand, they present that ICTs as virtual platforms enhance digital competences in academic processes whose theoretical basis details that these have

primordial place in educational centers, highlighting the use of educational platforms, being a means of advancement in academic processes contributing to the achievement of educational objectives.

For several authors such as (Vega, 2020), (Cabero et al., 2022) and (Garzón et al., 2021 cited by Cabero et al., 2022), (Ruiz et al.,2020).) and (García y Occelli, 2019), digital competence is the creative and safe use of ICT for the achievement of objectives linked to the workplace, employment, learning, entertainment and citizen participation in virtual education between professors and students (Carneiro et al., Cabero, Carvalho et al.,2019), digital competence is the set of knowledge, skills related to the critical and creative use of ICT for the successful achievement of academic processes.

The subcategory digital literacy, in the educational field and at the university level, involves skills for the use, management, evaluation and understanding of technologies for academic processes (Picón et al.,2020). The subcategory communication and collaborative work (Azinian,2009), concerns about the use of digital tools for the planning, organization and development of learning (Misión para la Sociedad de la Información,1997 cited by Bernales, 2017), as well as the ability to transmit and communicate learning and being able to communicate the learning obtained (Cabero, 2022). The subcategory, digital citizenship refers to the ethical, responsible and safe use of ICTs (Cabero, 2022).

## 2. METHODOLOGY

This research was based on the interpretive paradigm, because it focuses on understanding the significance of the actions of living creatures, prioritizing people and their environment (Hernández-Sampieri & Mendoza,2018), using the inductive method with a basic type; according to the epistemological basis of the research, it had a qualitative approach, because of the collection and analysis of information applied in order to reformulate or not the research questions during the interpretation, so it was a dynamic development in both cases, and a cyclical process. The study was of qualitative approach, with a basic type and descriptive design at a phenomenological level.

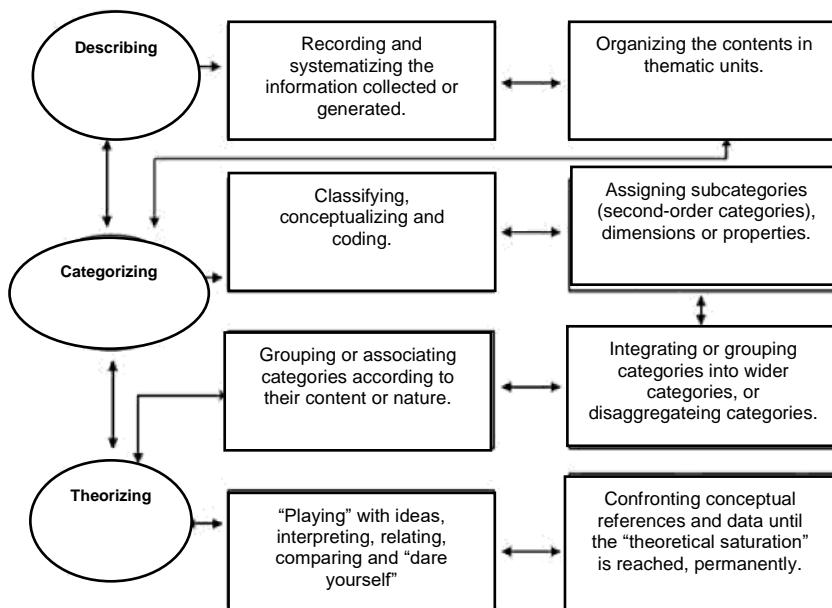
The qualitative approach (Bautista,2022), (Ballestín et al.,2019) and (Rodríguez et al.,1996) and (Miles & Huberman,1994), analyzes the natural way in which facts occur, it means that reality is not manipulated or stimulated, this type of research was sustained in an interpretive perspective focused on understanding the activities of living beings, especially people and their environment (Hernández-Sampieri & Mendoza,2018). Reality was obtained through the interpretation of those involved in the research in relation to their own realities (Galeano,2021) and (Hernández-Sampieri & Mendoza,2018)., in this way, different realities coincided, producing an exchange between all those involved in the research.

Regarding to the research, it has a descriptive design (Useche,2019), (Pérez et al.,2017), with a phenomenological level involving the line of symbolic interactionism which did not pretend to inquire about causes/explanations completely universal (Galeano, 2021) or phenomena occurring in society, but seeking to understand and interpret through inductive logic the interpretations of the participants obtained from the observations or data collection.

The stages for the construction of categories, proposed linear processes developing and connecting each other cyclically and permanently. These stages were to describe, categorize and theorize (Galeano, 2021) as shown in Figure 2:

**Figure 2:**

*Categorization and coding process*



Source: (Galeano,2021). Qualitative research: Inexhaustible questions.

In this research two categories were identified, the first ICT is defined as the grouping of technological tools that constitute the information society (Galeano, 2021), including computing, internet, multimedia resources, as well as digital communications systems (Gómez et al., 2021). ICTs help and enhance the data collection and management, storage and transfer (Gómez et al., 2021). For this category, two subcategories were considered: use and access to ICT, culture and technological leadership of the university (Salcedo, 2018, cited by Gómez, et al., 2021).

The second category, digital competence is considered as the evolution of skills in the management of technological, computing, multimedia and communication tools (Duarte et al., Diaz, 2021), (Escoda,2017) and (Vega, 2020). Three subcategories were considered for this category: digital literacy; communication and collaborative work; digital citizenship (Cabero et al., 2022).

**Table 1**

*ICT and digital competences categorization matrix*

Categories	Subcategories
ICT	ICT use and access Univeristy culture and technological leadership
Digital competences	Digital literacy Communication and collaborative work Digital citizenship

Note: The categories and subcategories to be considered in the research are presented above.

The investigation of this research work took place in a private university in the district of San Jeronimo, province and department of Cusco; it has 19 760 students enrolled until the semester 2022-I and 1 014 professors among ordinary and hired, 5 faculties, 21 professional schools, and a modern physical infrastructure according to the educational needs of the students, teaching and administrative staff with academic and technological advances, it also has a modern technological infrastructure to support the educational service according to the demands of the new trends having as an objective the adaptation to technology, promoting security and quality, as educational resources and information systems with trained personnel who manage these tools.

In qualitative research, the sample is the unit of analysis, group of individual or events where data is collected; a fundamental aspect for the interview is to know how to choose these participants (Albert, 2007). In this type of research, the qualitative interviews were of flexible design, due to the changes they have as the interview progressed, so neither the number of interviewees nor their standard was determined in advance, making it difficult to determine the initial state of the research, but it was relevant to choose a selection criterion considering the main problem of the research (Albert, 2007).

**Table 2**

*Coding of research participants*

<b>Code</b>	<b>Description</b>	<b>Function</b>
<b>G1</b>	Made up of students E1, E2, E3, E4, E5, E6	Motivation and interest in learning
<b>G2</b>	Made up of professors D1, D2, D3, D4, D5, D6	In charge of carrying out academic tasks

Note: The coding of the participants in this research is achieved.

In the qualitative approach, to collect the data, natural and usual places of those involved were entirely used, being done in two steps: Initial immersion in the environment (Useche, et al., 2019) and (Ballestín & Fábregues, 2019), which was chosen by the qualitative researcher who helping for the collection of the information and being sure that it is the appropriate context (Pérez, et al., 2017), to perform the research (Albert, 2007). In this step, the information was collected in order to analyze it, and the decision about the technique and instrument to be applied, was taken.

### 3. RESULTS

The results of this research were developed considering what was sustained by (Rodríguez et al.,1996), taking into account the assumptions given by (Miles y Huberman,1994) establishing that this process would be set up around three key aspects: data reduction, disposition and transformation and, finally, obtaining results and verification of conclusions.

(G2) The results show that, during the pandemic, the computer, laptop or conventional, and a smaller device such as a tablet or cell phone are resources used by teachers; likewise, they use a series of software and platforms. Some professors made a greater use of this software, due to the specialties they have or teach, making the work more feasible in order to use them; on the other hand, some professors also incorporated the usage of social networks in their classes to have faster or more relevant communications.

For the development of the class, (E-02) a student specified the use of a smart watch of wide range allowing to control the development of the academic activities. On the other hand, (E-04) the student expressed having difficulty with internet connectivity due to the area where he/she was located.

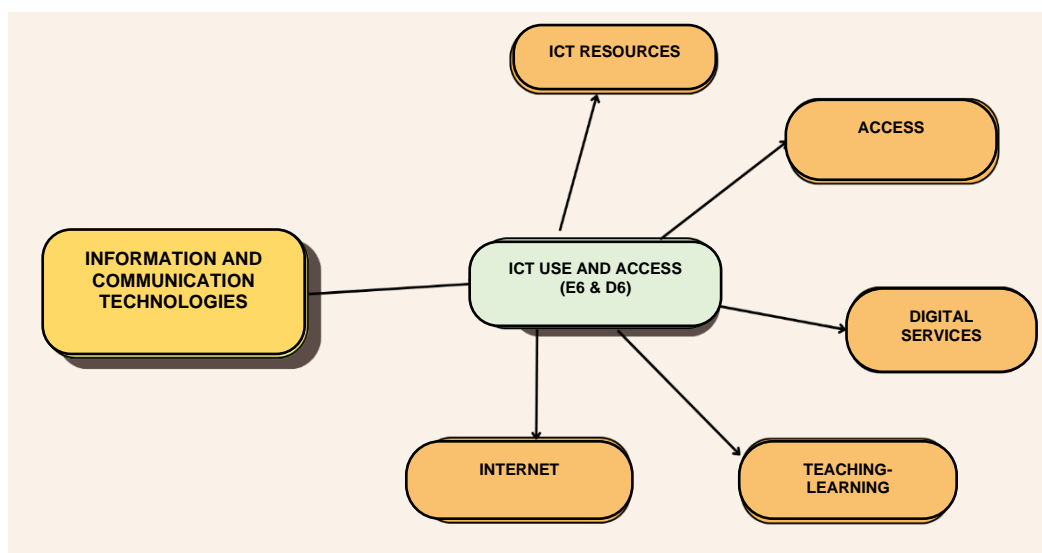
(G1) The students had full access to the platform of the university where they studied. On the other hand, there was a great difficulty among most of the students about the access to internet service from their homes, some were

forced to recharge their cell phones daily and this brought them an economic disadvantage; just few of them could cover the need for internet.

“The access to the internet was unstable, mainly for economic factor, because at that time, I did not have the resource to have internet and do academic work at home such as taking classes, doing and sending homework, etc.; but to take my clases I had to charge 5 pens a day and being a total of 150 pen a month, that was worrying” (E-04).

**Figure 2:**

*Subcategory ICT use and access*



The figure shows the subcategory ICT use and access that were analyzed, also the components that were developed from the interviews made to the students and professors.

**Table 3**

*Triangulation subcategory: ICT use and access*

Professors	Students	Researcher
Most of them received training on digital tolos. In addition, they had greater options to overcome the problem of connectivity.	Most of them had knowledge about the use of digital tools since they were already using them. Very few could overcome the problems they had regarding connectivity.	The presence of virtuality in education was definitely a challenge that finally it was possible to overcome, revealing advantages and disadvantages for both professors and students.

Note: The table shows a summary of the information obtained from the interviews.

The triangulation of the first specific objective let us to reflect that the professors did not necessarily have the best technological equipment for the development of their classes, since there were students with devices that were very practical in their use.

(G2) From the findings it is expressed that there are professors that are unfamiliar with the agreements that the university may have with other centers regarding to this topic, but there are others that do know about these and among them we find that they have conections with Microsoft, Google, CISCO,

(G1) Future professionals support the idea that the university has been constantly concerned about training its students in the use of virtual platforms and even facilitated them in making digital agreements with different companies; so, there is a kind of satisfaction with the digital training provided by the university having a direct impact on learning.

From the perspective (E-01)

*“I participated in different Cisco courses, network development, cybersecurity, etc., the agreement with Microsoft was very useful, because thanks to the university I have a Microsoft Office Plus Pro license included in the cost of tuition, I can access it directly with my email and I will be able to use the entire Microsoft suite. Regarding to digital competences, such as the ethics course, part of some activities make us to participate in a Cisco course, and in this way we are promoted to take part in these courses and agreements.*

*“Well, the university has given us support through training to be able to better manage these resources, it has promoted different types of training to be able to use many tools, such as Canva, using the interactive whiteboards that help us in the virtual method, but about the agreements I can state that I don't know them exactly” (D-05).*

Teachers know that the DTI provides virtual platforms and programs for the development of teaching, but they do not know how they do it; it is a constant fact that the Systems Engineering professors have a greater advantage in this situation (G2).

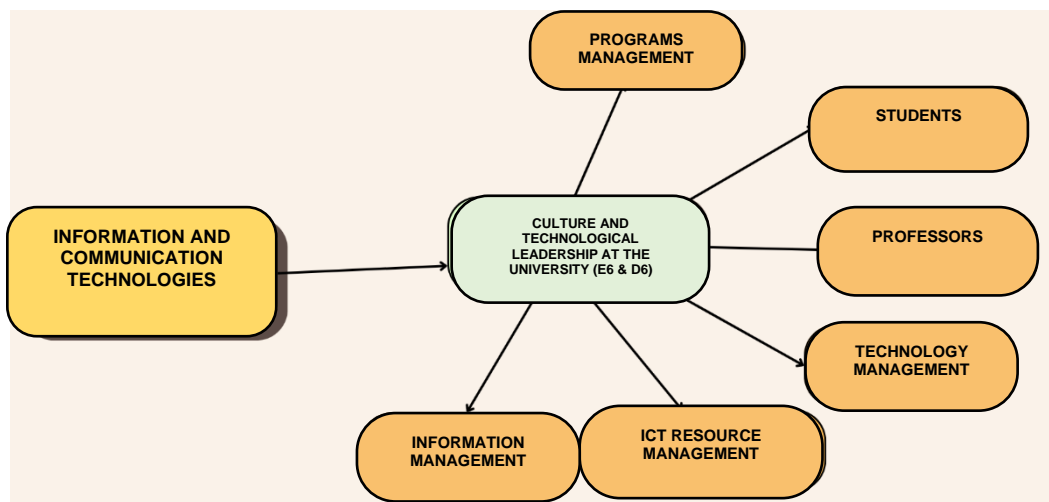
*(E-01) “All the information you need can be hidden under a menu, submenu or another submenu; for example, if you need to access to the virtual classroom you have to click on student, then in detailed reports, attendance reports, all this to know the attendance or condition of it; I think that this can be better simplified, but it gives me some valuable information, like the grades, average, historical average and also information if I attended or I was late in any course, it is very detailed; however, it asks for many submenus and there are too many steps, like in the ERP, there are like 7 or 8 steps only for seeing the grades, the same happens in the virtual classroom”.*

*(D-02) “There are many things that are now going to have to stay in the same way, such as the virtual procedures as part of the teaching because we have seen the advantages of these but there is also something important to develop, the necessary tools to in virtual laboratories depending of the specialty so that students can do better their activities remotely, in order to have a good learning process as a result of the pandemic; nevertheless, there are also certain things to start working so that we can use all these tools fully improving online teaching in students”.*



**Figure 3:**

*Subcategory culture and technological leadership at the university*



The figure shows the subcategory culture and technological leadership at the university analyzed, also the components that were identified from the interviews made to professors and students.

**Table 4**

*Triangulation subcategory culture and technological leadership at the university*

Professors	Students	Researcher
<p>They are aware of the university's agreements with technological companies, they know about the permanent concern the university has about promoting the digital digital competences in professors.</p> <p>They have no difficulties with the use of ERP. But the implementation of virtual laboratorios by specialty is needed.</p>	<p>They are aware of the university's agreements with technological companies, they know about the permanent concern the university has about promoting the digital digital competences in students. They consider that the ERP should be more accessible.</p>	<p>The university has a permanent concern about training both, professors and students in technological aspects, but the platform should be more easily accessible.</p>

Note: The table shows a summary of the information obtained from the interviews.

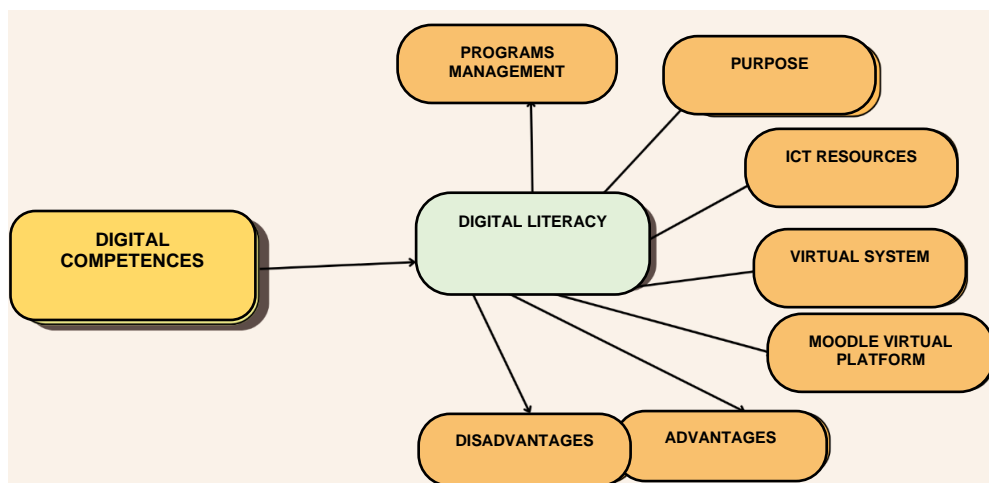
*(E-03) "There were programs that my computer could not process, there it worked slowly generating problems and it was also complicated to repair because there were not many technicians in the area where I was, which was Boca Colorado. In addition, I used Claro and Bitel network, due to Movistar and Entel did not work near where I lived, there was a time when Claro stopped working and I had to change it for Bitel, but I also had difficulties to repair my computer due to I had to travel to the city of Cusco or Puerto Maldonado to do it but the road was not safe because the trip is not direct, you still have to cross rivers and it was an insecure way".*

*"I think I have a good and high level of handling digital programs, I work constantly with all kind of programs and now in this virtual era I have learned to use or improve the management of those that were oriented mainly to the creation of digital material for students, like videos, slides, texts, games, etc. I use them mainly for the teaching and learning process, but I have had some problems with some ICT resources, basically because of the internet*

connection. For this problem, I used to solve it using the smartphone as a mobile hotspot, but apart from that I have not had any problem". (D-03).

**Figure 4:**

*Subcategory digital literacy*



The figure shows the subcategory of digital literacy analyzed, also it is identified the components that were developed from the interviews made to students and teachers.

**Table 5**

*Triangulation of the digital literacy subcategory*

Professors	Students	Researcher
They are well involved with virtual education and the use of basic programs, however some limitations appeared because of applying a specialized software. Most of them consider the advantages of virtual education that allows them to interact through videoconferencing and virtual platform. Most of them consider the advantages of virtual education that allows them to interact through videoconferencing and virtual platform.	They are well involved with virtual education and know how to handle basic programs very well, as well as digital tools for the realization of their academic activities. The main disadvantage they identify in the virtual system is the lack of socialization.	In general, it is observed that both, professors and students have a good level of programs and devices management, and clearly identify the advantages and disadvantages of ICT and virtual education.

Note: The table shows a summary of the information obtained in the interviews.

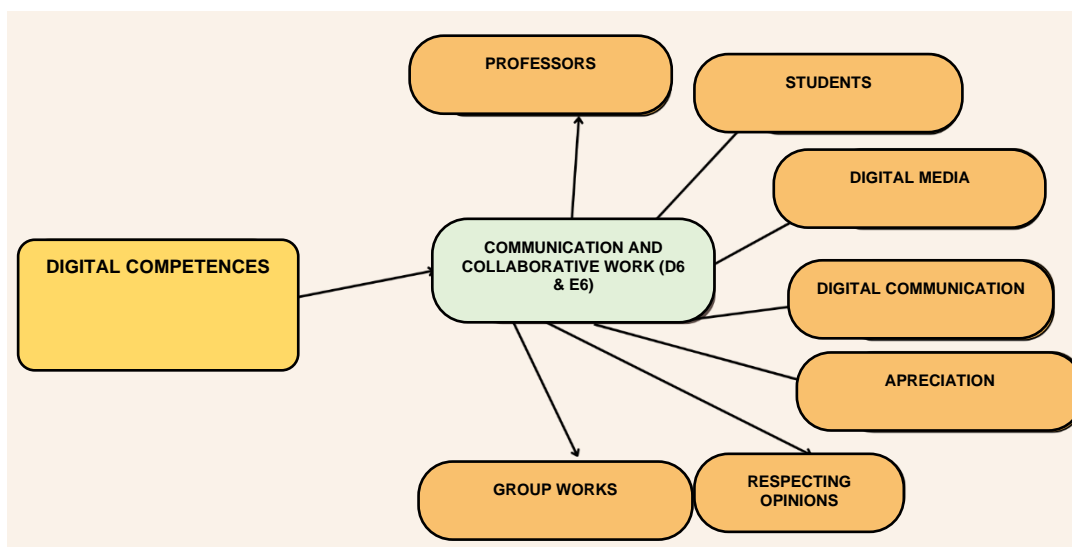
*"In my case, I can say that in our courses we work with a software where it is applied the teamwork activity as an alternative, something that is not frequently used in many courses, however in the design course of our career, we usually work in groups and at that time we could not go each other houses, so we started to use a tool called 'Archicad' that worked under the 'Vinglot' platform, thank to that we began to make chats not only in my classroom, but also through the 'school Facebook', letting us to do a collaborative work that can be done using 'Drive', a tool where you can share information, also 'Whatsapp' is also very effective for short files or to communicate, sometimes students tell the professor that they did not have internet connection or were not able to enter to the system, sending the homework through the app; I believe that all these types of applications have been repowered". (D-04).*

Communication, whether through the platform or a social network, has been efficient both between professors and students; generally, these communications took place out of class hours, something that demand extra time to professors, so some of them made these coordinations within working hours; whatever the case may be, communication was given but with certain doubts about the actions of the students in the sense that they may be performing inappropriate behaviors, in addition it should be analyzed how harmful it is for health to be for a long time in front of digital devices.

*“These media help to communicate and share information but I personally believe that there is an excessive saturation of information, because there is a big difference of schedule time compared to the traditional classes in universities, but with virtuality everything has changed, there have been times when workshops were scheduled out of classes, causing a lot of saturation at the point that affected my eyesight because of the many hours using the computer; that is my point of view about digital communication, because always for a meeting or another you must enter through your phone or computer all the time and at the end it was an out of control situation. Regarding to the respect with my students, I have always taken care of the treatment in the communication by digital media and it is the same situation with my colleagues”. (D-06).*

**Figure 5:**

*Subcategory communication and collaborative work*



The figure shows the subcategory communication and collaborative work analyzed, and also presents the components that were developed from the interviews made to professors and students.

**Table 6**

*Triangulation, communication and collaborative work*

Professors	Students	Researcher
They keep communication with their colleagues and students by e-mail and programs that allow collaborative work. They carry out and encourage collaborative work, always respecting in virtual communication.	They communicate with their classmates mainly by Whatsapp, virtual classroom, and videoconference rooms; they state that in the development of group work, respect among classmates and professors is maintained.	Educators have a clear view about how to communicate through digital media, maintaining respect for others and developing collaborative work in the right way.

Concerning the issue of how students felt while using the virtual system, they stated that they liked this way of working so much.

*“Well, I think it has been a good process because I adapted very well to it; I think the majority of professors has also adjusted so well, but just the first two semesters went well, then the students began to feel tired, there were session where nobody made questions with a total silence in the class, you could see the students feel exhausted, but not in my case, I really like to teach so I did not feel in that way” (E-04).*

*“In the virtual system, at the beginning, I was quite shocked because I get used to be more active, more on the move, being more in contact with the students and then to stay in front of a computer was a big change, there is a moment when it is too stressful because you spend time more than the normal working hours using the computer, if the normal time is two hours, then you spend four, six or even eight hours and even in early morning, which is quite exhausting at a time, but sometimes it is easier because you have everything in your hands due to the fact that you are at home, on the contrary, being static in one place can be harmful for the health, especially for the eyesight, we can say there are disadvantages at a healthy level. My opinion towards ICT in virtual teaching, on one hand, it is positive, because I am at home and being there surrounded by my family and having everything at hand is really nice, but on the other hand, being static basically worried me because of my health”. (D-05).*

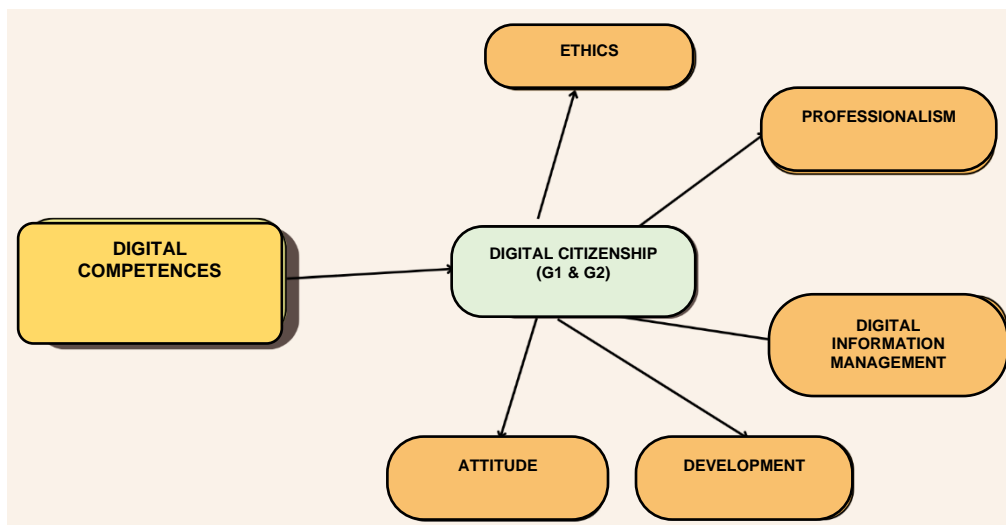
*I think, it has been a very good experience and I have adapted very well, I think that the number of professors has also adjusted, but as I said, the first two semesters went well, then there was a tiredness presented in students, there were no more participations during the sessions, they felt really tired, but not in my case, I really like teaching so I had not a problem (D-04).*

Concerning the issue of how students felt while using the virtual system, the student stated that:

*“Well, personally I am a little bit organized, so the fact that I had my sessions well scheduled was something I took advantage of, thanks to Google Calendar, while the rest of my partners did not do this, I think it was easier for me to have access to them, but in general, I have had a good experience and management of ICT in this virtual stage and at some point I have felt a little overwhelmed in this sense, because I have realized that perhaps the fact that it is virtual at the beginning of the pandemic, the professors thought they should leave more homework because it would be easier for them, everyone would copy from the internet, so they left too much homework, being at a point something exhausting, until they put in practice their work plan and started with it” (E-04).*

**Figure 6:**

*Subcategory digital citizenship*



The figure shows the subcategory of digital citizenship analyzed.

**Table 7**

*Triangulation subcategory of digital citizenship*

<b>s</b>	<b>Students</b>	<b>Researcher</b>
They behave ethically in the handling of digital information, they also use virtual libraries of the university and make the respective references.	They did not fully understand the question, so they focused more on the ethical use of ICT and not specifically on information.	The majority of professors use digital information appropriately and acknowledge authorship with the respective citations. Students are aware of the ethical use of ICT.

Note: The table shows a summary of information obtained from the interviews.

The triangulation shows that the majority of professors clearly understand and apply the ethical use of digital information, making the respective references to materials used in the virtual libraries of the university, while students do not understand the question well and focus more on answering in a general way that if they use ICT ethically. Some professors like the virtual education system, due to they see many opportunities in this type of education, while others feel that it is exhausting and requires many hours of work, even causing them physical ailments in the eyes and body fatigue, at the beginning, due to excessive hours of work in front of the computer.

**4. DISCUSSION**

This agrees with (Sánchez ,2021) who proposed to analyze the use of virtual resources in the academic process. It was determined that in relation to the analysis and explanation on the use of ICT in academic work during the pandemic, students have used a PC in 15%, laptops in 35%, and cell phones in 50%, which represents a lack situation of technological resources for virtual classes, as well as internet connection. On the other hand, 100% of the students stated that they were able ot continue their classes thanks to these devices and other digital tools, but there is a great limitation due to connection difficulties.

Likewise, (Flores et al.,2020) investigated, analytically, information technologies in Peru and determined internet accessibility and the existing digital gap. As important results, it was determined that 80.5% of adolescents and young people have more internet connection and that 81.0% used more cell phones (Chandam & Prema, 2019) and (Gómez et al., 2021). They concluded that we must raise awareness about the digital gap we have in different sectors of Peru, and also proportionally implement technological infrastructure and the possibilities of internet accessibility in Peru.

Regarding the subcategory culture and technological leadership of the university, in relation to the second specific objective: To explain and understand the culture and technological leadership of the university. The technology has been for more than 2 years, a guide element in the development of classes, so that students can continue acquiring knowledge, also the culture of those who manage the higher education institution is relevant, it means, the control over the technology provided, and the leadership of those in charge of technology should be reflected so that others can assimilate or improve its use.

About the triangulation, professors and students are well involved in digital literacy and are familiar with the subject; this will depend on the context or realities, since not all areas have the same internet coverage.

In relation to the theories on digital competence, the contributions found indicate that professor training in the educational field has a strategic and important value in the information society (Gómez et al., 2021) and (Ruiz et al. (2020), the professors' preparation is essential in virtual education to ensure that the incorporation of technologies contributes to the academic process (Tejada y Pozos, 2018). The stages of the development of digital competences must be integrated to the competences of professors, allowing them to work in a transversal way, enabling to adopt new ways in the pedagogical work individually and in groups.

Regarding to triangulation, professors and students maintain permanent communication (Fernández et ál.,2021) and (Delgado et al.,2018), using different tools such as Whatsapp, Moodle virtual platform, email, Google Drive and videoconference rooms; the way of working in the virtual system was through groups of students, manifesting it was very coordinated and good, and in most cases there was respect for the opinion of others involved. Professors and students have a clear idea about which tools to use in this type of communication, recognizing how useful they are.

## **CONCLUSION**

It was determined that during the pandemic, both professors and students used conventional computers, laptops and cell phones to carry out their academic activities; one student used a high-end watch to better control the delivery of their academic activities. Regarding the internet issue, professors had to support in a personal way and according to their limitations the adequate internet connection being easier to solve this problem for them, on the other hand, students also used permanently a good internet connection with some difficulties of the provider, but a student who was not in Cusco had many problems both with their devices and with the internet connection so it was very expensive to have adequate access to ICT.

The private university of Cusco shows a good culture and technological leadership before and during the pandemic because it has signed agreements with major technology companies such as CISCO, Google, Microsoft, it also has implemented the virtual platform in Moodle and the ERP University since the start of the pandemic, applied technological tools that supported virtual education from the time of the health emergency declared in Peru, the same that are very useful in academic processes for both students and professors. The university also has a DTI technology area responsible for the technological support of the entire university. It permanently promotes the training of the agents involved in the educational process in digital competences through the area of virtual education, the STIC course that all students take in second semester, various trainings, and the information technology training center that offers monthly some courses.

The development of the digital competences of students is evidenced at a higher level in the systems engineering

students, whom precisely are more expert, due to their professional training, in the handling of devices as well as basic and specialized programs; on the other hand, the students of the other careers also have good skills in the handling of devices and basic programs, highlighting the management of some programs of their specialty. Concerning the professors, most of them handle the devices very well and especially the basic programs for the development of virtual classes, however the professors of systems engineering are better prepared to solve problems that arise with the use of ICT, while professors from other careers prefer to seek professional help.

**Financing:** Financing was provided by the group of researchers.

**Conflicts of interest:** There is no conflict of author interest in this research work.

**Statement from the institutional review board:** It is part of the construction of a degree thesis.

**Data statement:** Data is from high-impact journal repositories, reviewed by blind peers.

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DOI: <https://doi.org/10.15379/ijmst.v10i3.3048>

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