

Evaluating digital literacy levels among students in two private Universities in Panama

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ABSTRACT

Digital literacy has become an indispensable skill in 21st century society because it is necessary for all citizens to function efficiently. The objective of this work was to know the level of digital literacy of undergraduate, graduate, and postgraduate students from two private universities located in Panama City (Universidad Internacional de Ciencia y Tecnología - UNICyT and Universidad Nuestra Señora del Carmen - UNESCA). An analytical survey developed and validated by Ramírez et al. (2019) was used as a data collection instrument. The type of questions selected was closed-ended. A total of 247 data were collected (47% men and 53% women). The study yielded relevant information on the level of digital literacy of the students of the two Panamanian universities studied: all students have devices and Internet connectivity; the most used tools are instant messaging, word processors and videoconferencing platforms; they are not frequent users of programs or information systems; they are familiar with basic file types and know how to search the Internet; they are users of social networks, the most popular being Instagram, Facebook and LinkedIn; they know how to use digital tools to obtain information and for collaborative learning. Regarding ethical use, they are aware of the importance of verifying the reliability of the source before transmitting information.

Keywords: digital literacy, information literacy, information skills, technology, use of TIC'S.

1 INTRODUCTION

In the 21st century, university students require new skills to participate in digital culture. Digital competencies are key and fundamental for living, working, and participating in the knowledge society (Martínez-Bravo et al., 2021). According to Georges Reyes & Avello-Martínez (2021), digital literacy, also known as digital literacy skills, is an indispensable skill for individuals to perform efficiently in today's society.

In the knowledge era, nothing is constant, so it is necessary to periodically review the evolution of technological infrastructure, the presence of new teaching models, the emergence of new digital skills, and, no less importantly, the critical skills necessary to navigate safely in digital environments and search, select, analyze, and use information. It is also necessary to be able to socialize the information found with ethical criteria in the different digital contexts in which students live (Georges Reyes & Avello-Martínez, 2021).

The objective of this work was to determine the level of digital literacy of undergraduate, graduate, and postgraduate students from two private universities located in the city of Panama (Universidad Internacional de Ciencia y Tecnología – UNICYT y Universidad Nuestra Señora del Carmen – UNESCA).

2 CONCEPTUAL FRAMEWORK FOR DIGITAL LITERACY

The knowledge acquisition practices that have emerged with the advent of information and communication technologies (ICTs) have conditioned all educational systems to transform in such a way that their beneficiaries acquire the appropriate way of appropriating the knowledge, limits, and potentialities offered by digital technologies.

Technologies are primarily developed through the internet, which, unlike other media, allows its users to determine how much information they need to review to understand and/or acquire the required knowledge. Digital literacy has become a construct, that is, a hypothetical entity that is difficult to define within the framework of a scientific theory. Glister (1997) defines it as the "ability that an individual can have, at the moment of understanding and making use of information in multiple formats and technological resources available today" or Matsuura (2006) by pointing out that it is the "complex set of critical competencies that allows individuals to express themselves, explore, question, communicate and understand the circulation of ideas among individuals and groups in rapidly changing technological contexts" (p. 5).

Various authors (Martínez et al., 2021; Churches, 2008; Cobo, 2011; Avello-Martínez et al., 2013; Fraiberg, 2017; Matamala, 2015; Bhatt & Mackensie, 2019; Area Moreira, 2014; Leaning, 2019) express

that digital literacy or other similar names are a set of skills and dynamics that guarantee effective use of ICT capabilities.

Almenara et al. (2009) point out that talking about digital literacy:

- a. Requires talking about a literacy that far exceeds mere technological and instrumental knowledge of ICTs.
- b. Not only implies the ability to receive messages but also their construction.
- c. Involves the ability to evaluate and select, according to our educational project and need, the amount of information that is coming to us through modern technologies.
- d. Requires the use of media and technologies in their daily lives not only as leisure and consumption resources but also as environments for expression and communication with other people.
- e. Involves understanding literacy as an attitude of use for communication.

As can be seen, it is not only understanding of technology but also the development of abilities or skills that allow us to receive and construct messages, evaluate, and know what type, quantity, etc., of information we need to express ourselves and communicate digitally.

For Avello (2012), digital literacy should be based on the following criteria:

- Instrumental skills with ICTs.
- Ability to search, select, organize, use, apply, and evaluate information.
- Collaboration, cooperation, effective communication, and the ability to share.
- Creation and publication of content.
- Critical thinking, creativity, innovation, and problem-solving.
- Social and cultural understanding, digital citizenship.
- Security and identity (p. 2)

Avello et al. (2013) cites Kelly, one of the experts who participated in the elaboration of the latest report from the Online Computer Library Center (OCLC), who lists the six new skills needed to be considered digitally literate:

Reading on screen. Our culture has been the culture of the book; however, we are becoming beings glued to screens that surround us continuously. This is the context in which new content is going to be published.

Interact. Our expectations are to interact with the contents intellectually, but soon also physically. We interact with voice, gestures, hands, and non-linearly.

Share. All our media activity becomes social: social reading and books that intersect in shared libraries.

Access. We no longer talk about ownership; the future of media is access and not ownership: what sense does ownership make when information can be accessed at any time?

Flow. Data circulates endlessly. The paradigm of the page is coming to an end. Instead, stories and information are constantly reconstructed. We are moving from the static to the permanent flow, as is the case with Twitter, RSS channels, Facebook walls, blogs, geolocation, and so on.

Generate. The generation of content in different formats and through new channels and media.

The work we do focuses on 4 dimensions: the first, identification data; the second, the use of devices and Internet connectivity; the third, knowledge and use of ICT tools; and the fourth, ethical use, in an effort to understand the digital skills of students from participating universities, and the need to establish collaborative research lines on this topic, to determine how well our students are digitally literate and whether training measures need to be put in place.

3 MATERIALS AND METHODS

The study was conducted under a quantitative approach, using a descriptive research type, with a cross-sectional, non-experimental design (Rios Cabrera, 2017). Data collection for quantitative analysis was done through a survey, which allowed obtaining numerical descriptions of some trends, attitudes, and opinions of the sample (Navarro Caro, 2009). The descriptive nature of the study allowed characterizing the knowledge and use given to ICT tools by the studied sample of university students (Piñero Martín & Rivera Machado, 2013).

3.1 POPULATION AND SAMPLE

The study population was composed of active students from two private universities: Universidad Nuestra Señora del Carmen (UNESCA) and Universidad Internacional de Ciencia y Tecnología (UNICyT), both located in Panama City.

The total estimated population (N) is 470 students (400 from UNICyT and 70 from UNESCA). The sample size for a 95% confidence level and a 5% margin of error (with equal probabilities for and against) was calculated and corresponds to $n=213$.

3.2 INSTRUMENT

An analytical survey developed and validated by Ramírez et al. (2019) was selected. The selected type of questions was closed-ended to facilitate quantification of results and to give them a more uniform character. Respondents could choose from a series of options presented in a list (Likert scale). The dimensions and items used are shown in Table 1.

Table 1. Dimensions and items used in the questionnaire.

Dimension	Item
Identification data	1. Indicate your gender
	2. Indicate your age range
	3. Where did you obtain the degree that allowed you to enter the university?
	4. Indicate the level of studies you are currently pursuing
	5. Which university are you currently studying at?
	6. Indicate the major(s) you are currently pursuing:
	7. In which shift do you study?
	8. Besides studying, do you work?
	9. Marital status?
	10. Do you have children?
	11. If you answered "Yes" to the previous question, please indicate how many children you have.
	12. Do you have grandchildren?
Use of devices and internet connectivity	13. Select which of the following digital devices you have
	14. Which of the following digital devices do you use for your academic activities?
	15. Do you connect to the internet through
	16. In which place(s) do you usually connect to the internet to perform your academic activities
	17. Indicate where and how you rate the quality of the internet connection you have in these places:
Knowledge and use of 2.0 ICT tools and resources	18. Select which of the following tools you use and how often
	19. From the list, select the five tools and/or ICT resources that you use the most in your academic activities
	19. De la lista, seleccione las cinco herramientas y/o recursos TIC que más utiliza en sus actividades académicas
	20. Which programs and/or information systems related to your area of knowledge do you frequently use?
	21. What are the file types you use most frequently?
	22. When you perform internet searches
	23. Indicate the use and frequency of the social networks listed below
	24. Indicate the use and frequency of the educational portals shown below
25. Select the statements below that you identify with the most	
Ethical use	26. Do you validate the information you find on the internet with various sources?
	27. Do you recognize which sources of information on the internet are reliable?
	28. Do you cite the author of the information you consult when you use it for your papers, projects, and/or assignments?
	29. On social networks, if I disseminate information from others, do I indicate the source from which I took it?
	30. Do you know the definition of plagiarism?
	31. Do you validate the information in several sources before publishing or using it?
	32. Do you know what reliable sources of information are and how to recognize them?
	33. Do you select, analyze, and use information ethically?
	34. Do you make legal and responsible use of information through ICT?

Source: Ramírez et al. (2019). Developed by: López de Ramos et. al (2021).

3.3 DATA COLLECTION

The data collection instrument was self-administered digitally through Google Forms and was available for a period of five weeks. The instrument was distributed to students from the two universities through email lists, WhatsApp messages, and student coordinators.

3.4 DATA ANALYSIS METHOD

To analyze the data, exclusively Microsoft Excel was used, both for the initial cleaning of records and to obtain all descriptive statistics and graphical representations. Some of the descriptive statistics calculated were the number of records by gender, age, and technological tools and equipment used.

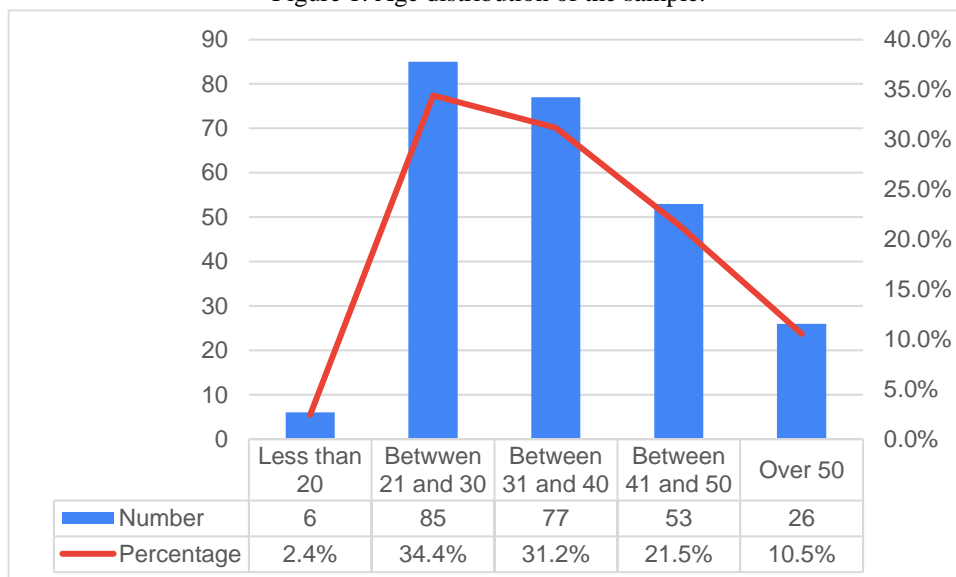
4 RESULTS AND DISCUSSION

Dimension 1: Identification Data

A total of 247 data were collected, which were processed for this study. 47% of those who responded to the questionnaire were male, and the remaining 53% were female.

The age distribution is shown in figure 1. There are very few students under the age of 20 (2.4% of the sample), and the student population of the two universities is an adult population that works (86.23% of the sample) and therefore takes semi-presential studies in night or Saturday shifts.

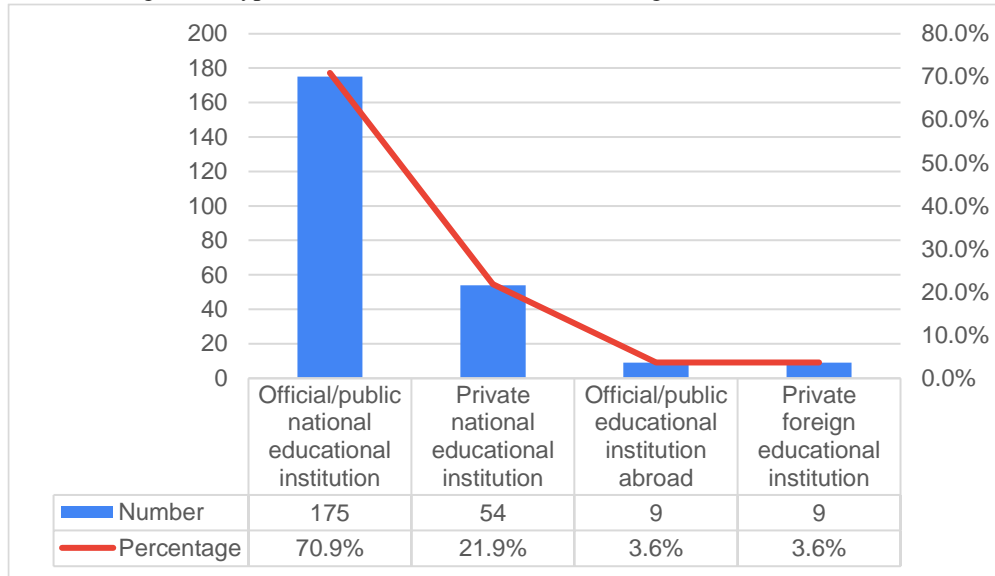
Figure 1. Age distribution of the sample.



Source: Lopez de Ramos et al. (2021).

As shown in Figure 2, most of the surveyed students studied high school in national official educational institutions (70.9%). A minority (7.2%) studied high school abroad.

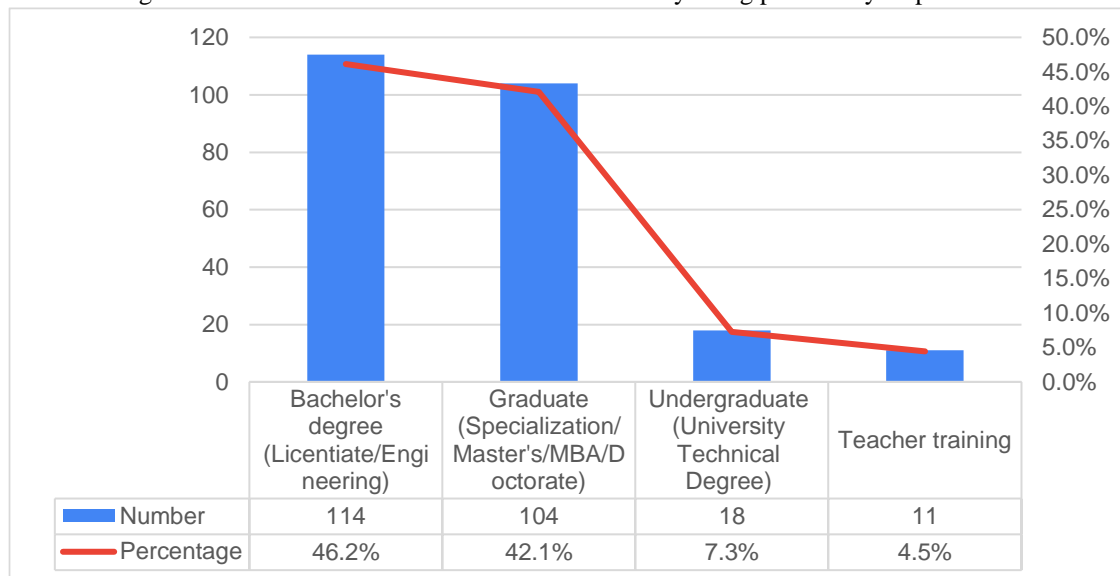
Figure 2. Type of educational institution where high school was studied.



Source: Lopez de Ramos et al. (2021).

Most of the surveyed students are studying undergraduate or engineering studies at the university (46.2%), followed by graduate studies (42.1%), and the remaining sample (11.8%) is studying technical careers or teaching (Fig. 3).

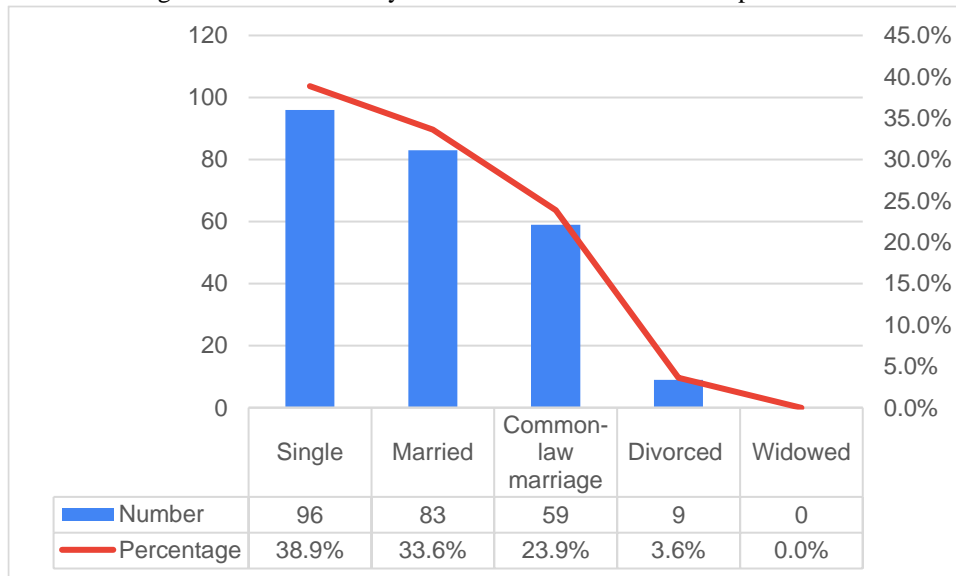
Figure 3. Distribution of the level of studies currently being pursued by respondents.



Source: Lopez de Ramos et al. (2021).

86.2% of respondents work, 59.9% have children (with an average of 2 children), and their marital status is shown in Figure 4. 5.7% of the sample already have grandchildren.

Figure 4. Distribution by current marital status of the respondents.



Source: López de Ramos et al. (2021).

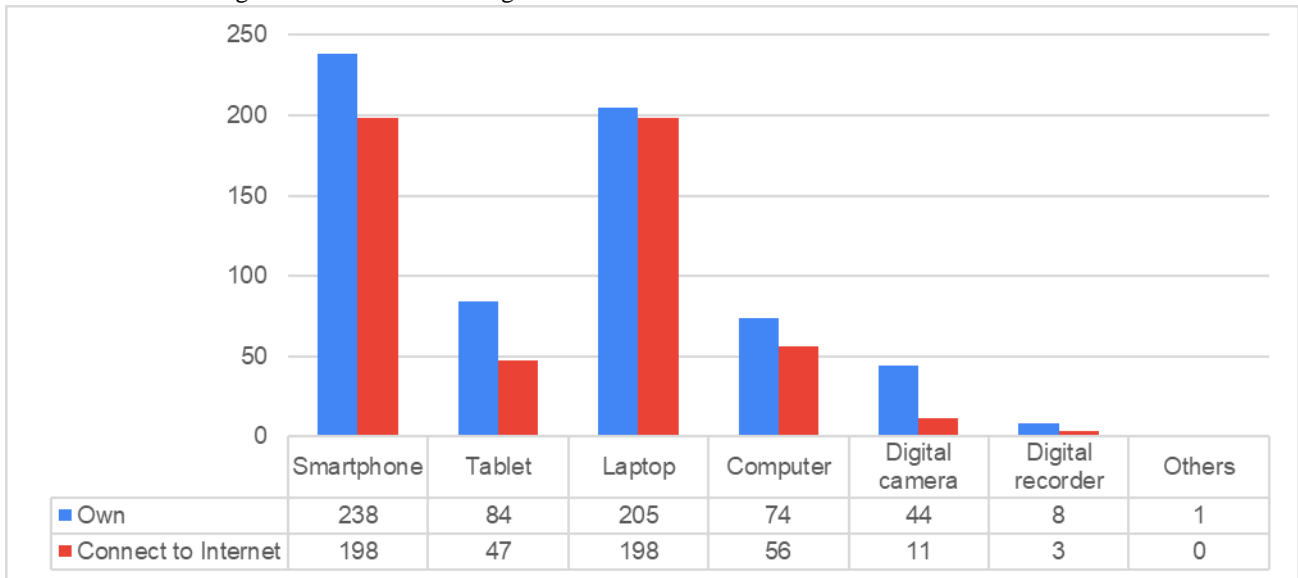
Dimension 2: Use of devices and Internet connectivity.

Regarding the type of digital device owned and used to connect to the Internet (Fig. 5), it can be observed that the digital devices most owned by surveyed students are smartphones (96.4% of the sample), followed by laptops (83.0% of the sample), tablets, desktop computers, cameras, and recorders. Digital cameras and recording devices may no longer be as common as smartphones have incorporated these functions in recent years.

Regarding the type of digital device used to connect to the Internet, there is a slight difference (Fig. 5) in that some of the surveyed students do not use their smartphones to connect to the Internet (80.2% of the sample) and prefer to do so with their laptops or computers (80.2% of the sample). The same applies to those who own tablets.

The use of smartphones, in addition to their communication function, is increasing. According to Hootsuite's report (Kemp, 2021), there are 4.69 million cell phone lines in Panama, representing 108% of the population as some people have more than one cellphone.

Figure 5. Distribution of digital devices owned and used to connect to the internet.



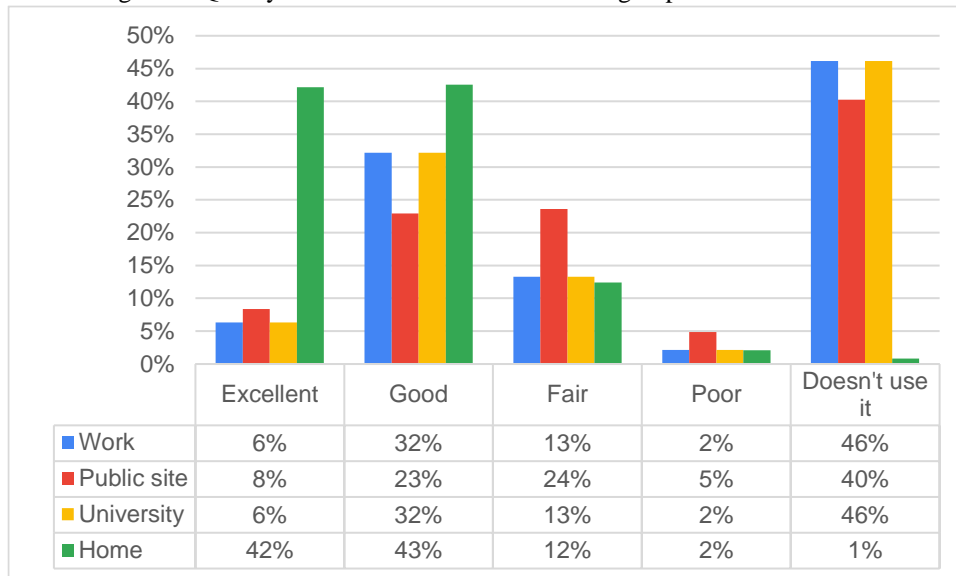
Source: López de Ramos et al. (2021).

In terms of the type of digital device owned and used to connect to the internet (Fig. 5), it is observed that the digital devices most owned by the surveyed students are smartphones (96.4% of the sample), followed by laptops (83.0% of the sample), tablets, desktop computers, cameras, and recorders. Digital cameras and recording devices are probably not as common as they used to be since smartphones have incorporated these functions in recent years.

Regarding the type of digital device used to connect to the internet, there is a slight difference (Fig. 5), and that is that some of the surveyed students do not use their smartphones to connect to the internet (80.2% of the sample) and prefer to do so with their laptop or desktop computer (80.2% of the sample). The same occurs with those who own a tablet.

The use of smartphones, in addition to the communication function, is increasingly common. According to the Hootsuite report (Kemp, 2021), there are 4.69 million mobile lines in Panama, representing 108% of the population since some people have more than one mobile phone.

Figure 6. Quality of internet connection according to place of connection.



Source: López de Ramos et al. (2021).

Dimension 3: Knowledge and use of ICT 2.0 tools and resources

Table 2 shows the frequency of use of some digital tools. The most used are instant messaging (WhatsApp), word processors (Word), video conferencing platforms (Google Meet), tools for preparing presentations and data processing, LMS platforms; followed by social networks, cloud storage, and Google Suite tools. It can also be seen that non-specialized social networks (Facebook, Instagram, Twitter, among others) are more used than educational ones (Edmodo, Scolartic or similar).

Table 2. Frequency of use of digital tools.

Digital tool	Distribution of frequencies (%)					Statistics	
	Always (5)	Almost always (4)	Sometimes (3)	Almost never (2)	Never (1)	Media	Mean Standard deviation
Social bookmarks	1.6%	4.9%	15.4%	24.7%	53.4%	1.77	0.99
Audioblogs and Videoblogs	2.8%	6.9%	30.4%	24.3%	35.6%	2.17	1.08
Blogs (Blogger, Wordpress or similar)	2.8%	10.1%	25.9%	23.1%	38.1%	2.17	1.13
Tools for creating digital books	5.3%	8.5%	17.0%	23.9%	45.3%	2.04	1.20
Mashups	8.1%	9.3%	19.8%	25.5%	37.2%	2.26	1.27
Tools for creating image galleries	4.9%	12.6%	17.8%	24.7%	40.1%	2.17	1.22
Tools for publishing audios	5.3%	13.8%	19.0%	25.9%	36.0%	2.26	1.23
Tools for publishing works	6.9%	12.1%	22.7%	23.5%	34.8%	2.33	1.26
Educational social networks	11.7%	16.6%	25.9%	17.0%	28.7%	2.66	1.36
Tools for publishing presentations	15.4%	17.8%	23.9%	18.6%	24.3%	2.81	1.39
Wikis	23.9%	27.9%	30.8%	6.1%	11.3%	3.47	1.24
Tools for publishing videos	31.6%	25.9%	23.1%	10.1%	9.3%	3.60	1.28
Google tools	35.2%	26.7%	21.5%	7.3%	9.3%	3.71	1.27

Cloud storage	40.9%	25.1%	21.5%	6.9%	5.7%	3.89	1.18
Social networks	48.2%	24.3%	19.8%	4.0%	3.6%	4.09	1.08
Tools for processing data	54.3%	20.6%	11.7%	6.5%	6.9%	4.09	1.24
LMS platforms	48.2%	27.5%	12.6%	4.5%	7.3%	4.05	1.20
Tools for presentation preparation	63.6%	19.0%	12.1%	2.4%	2.8%	4.38	0.98
Video conferencing	54.3%	30.0%	11.7%	2.4%	1.6%	4.33	0.89
Tools for editing and processing text documents	63.6%	23.5%	8.1%	2.8%	2.0%	4.44	0.91
Instant messaging	72.9%	15.0%	8.5%	0.8%	2.8%	4.54	0.90

Source: López de Ramos et al. (2021).

The 5 most used tools for academic purposes were: video conferencing platforms, instant messaging, LMS platform, tools for preparing presentations, and tools for editing and processing text (Table 3).

Table 3. Most used ICT tools and/or resources in academic activities.

Tools and/or ICT resources most used in academic activities	Percentage* (%)
Videoconferencing (Meet, Zoom, Skype, or similar)	83%
Instant messaging (WhatsApp, Telegram, or similar)	78%
LMS platforms (Moodle, Educativa, Blackboard, or similar)	65%
Tools for preparing presentations (PowerPoint, Prezi, or similar)	57%
Tools for editing and processing text documents (Word or similar)	53%
Tools for publishing videos (YouTube or similar)	42%
Cloud storage (Dropbox, Drive, iCloud, or similar)	40%
Social networks (Twitter, Facebook, Instagram, or similar)	34%
Social networks (Twitter, Facebook, Instagram, or similar)	30%
Tools for processing data (Excel or similar)	30%
Wikis (Wikipedia or similar)	25%
Google tools (Calendar, Documents, or similar)	25%
Educational social networks (Facebook Groups, Edmodo, Scolartic, or similar)	18%
Blogs (Blogger, WordPress, or similar), Audioblogs, and Videoblogs	13%
Tools for publishing presentations (Slideshare or similar)	11%
Tools for publishing papers (Scrib or similar)	8%
Tool for publishing audios (Podcasts or similar)	8%
Mashups (Scoop.it, Pinterest, or similar)	5%
Tools for creating digital books (Issuu or similar)	4%
Tools for creating image galleries (Flickr or similar)	4%
Social bookmarks (del.icio.us or similar)	2%

(*) Percentage of students who selected that option among the five requested.

Source: López de Ramos et al. (2021).

The most used programs by the surveyed students are Adobe Illustrator, SAP, and AutoCAD. In general, it can be stated that they are not frequent users of programs or information systems related to their area of knowledge (Table 4).

Table 4. Frequently used programs and/or information systems.

What programs and/or information systems related to your area of knowledge do you frequently use?	Percentage* (%)
None	49%
Adobe Illustrator	21%
SAP	14%
AutoCAD	12%
Others	9%
ORACLE	8%
Corel Draw	7%
Gimp	2%
SPSS	2%
FluidFlow	0%

(*) Percentage of students who selected that option among the five requested.
 Source: López de Ramos et al. (2021).

Table 5 shows the types of files that the students who participated in the survey use most frequently. It can be noted that the most used are those corresponding to the Windows Office application, but they also use executable and graphic design files.

Table 5. Types of files that surveyed students use most frequently.

What are the types of files that you use most frequently?	Percentage* (%)
.doc	81%
.ppt	74%
.jpg	74%
.mp4	62%
.png	51%
.mp3	48%
.txt	45%
.xls	43%
.exe	42%
.gif	36%
.avi	15%
.tif	6%
.vbs	3%
.obj	2%
.bas	1%
.rtf	0%

(*) Percentage of students who selected that option among the five requested.
 Source: López de Ramos et al. (2021).

Table 6 shows the frequencies and statistics for the questions related to internet search. Most students state that they are clear about what they are searching for on the internet and that they use representative keywords when doing so. Between 15 and 20% of those surveyed almost never use logical operators and Google Scholar.

Table 6. Table of frequencies and statistics for internet searches

	Distribution of frequencies (%)					Statistics	
	Always (5)	Almost always (4)	Sometimes (3)	Almost never (2)	Never (1)	Media	Mean Standard deviation
I am clear about what I am looking for	64.4%	33.6%	0.0%	1.6%	0.4%	4.60	0.62
I use keywords or representative words to find what I am looking for	59.1%	35.2%	0.0%	4.5%	1.2%	4.47	0.82
I use logical operators for advanced searches	38.5%	34.4%	0.0%	19.0%	8.1%	3.76	1.35
I use Google Scholar for specialized searches	45.7%	30.8%	0.0%	15.4%	8.1%	3.91	1.34

Table 7 shows the frequency of use of social media by the surveyed students. The most used social networks by the students are Instagram, Facebook, and LinkedIn. In the latter, which is a professional network, TSU and undergraduate students who are about to graduate receive workshops to prepare for job interviews.

Table 7. Use and frequency of the following social networks.

	Distribution of frequencies (%)					Statistics	
	Always (5)	Almost always (4)	Sometimes (3)	Almost never (2)	Never (1)	Media	Mean Standard deviation
Facebook	32.4%	35.2%	0.0%	23.5%	7.3%	3.57	1.35
Twitter	13.0%	15.4%	0.0%	33.2%	33.6%	2.26	1.45
Instagram	53.0%	28.3%	0.0%	13.0%	3.2%	4.08	1.16
Pinterest	12.1%	21.9%	0.0%	34.0%	26.7%	2.43	1.43
LinkedIn	18.2%	24.3%	0.0%	32.0%	20.6%	2.73	1.49
Snapchat	4.9%	6.1%	0.0%	26.7%	53.8%	1.56	1.12
TikTok	13.0%	13.8%	0.0%	18.2%	49.8%	2.06	1.52

The surveyed university students participate little in educational portals. The one they use the most is Google Activate, followed by Coursera and Eduteka (Table 8).

Table 8. Indicate usage and frequency of educational portals.

Indicate usage and frequency of educational portals shown in education:	Distribution of frequencies (%)					Statistics	
	Always (5)	Almost always (4)	Sometimes (3)	Almost never (2)	Never (1)	Media	Mean Standard deviation
EDX	1.6%	12.6%	47.4%	20.6%	65.2%	1.65	1.09
Coursera	6.1%	19.0%	55.9%	27.9%	47.0%	2.09	1.33
EDUTEKA	5.3%	12.6%	0.0%	22.3%	59.9%	1.81	1.24
ScolarTIC	2.0%	10.9%	0.0%	23.9%	63.2%	1.65	1.06
Miriadax	2.0%	6.5%	0.0%	23.5%	68.0%	1.51	0.94

Google Activate	25.5%	25.9%	0.0%	15.0%	33.6%	2.95	1.67
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The last question of Dimension 3 refers to a series of statements and the student selected which of those statements they identified with. Table 9 shows that most respondents use digital tools to obtain information and consider that they use the main computer and networking resources. The use of ICTs as both learning tools and for collaboration and social communication is highly valued.

Table 9. Statements about digital tools with which students identify themselves.

Please select the following statements with which you identify:	Percentage* (%)
Apply digital tools to obtain information	70%
Use the main computer and networking resources	69%
Value ICTs as instruments for lifelong learning	66%
Value ICTs as a means of collaboration and social communication	56%
Interact and collaborate with my classmates using a variety of digital resources	54%
Solve problems and make informed decisions using digital tools	49%
Plan and organize the activities necessary to solve a problem or carry out a project	48%
Effectively communicate information and ideas using a variety of media and formats	47%
Create original works as a means of personal expression	36%
Participate in groups that develop projects to produce works or problem solving	34%
Use models and simulations to explore complex topics	32%
None of the above.	3%

(*) Percentage of students who selected that option among the five requested.

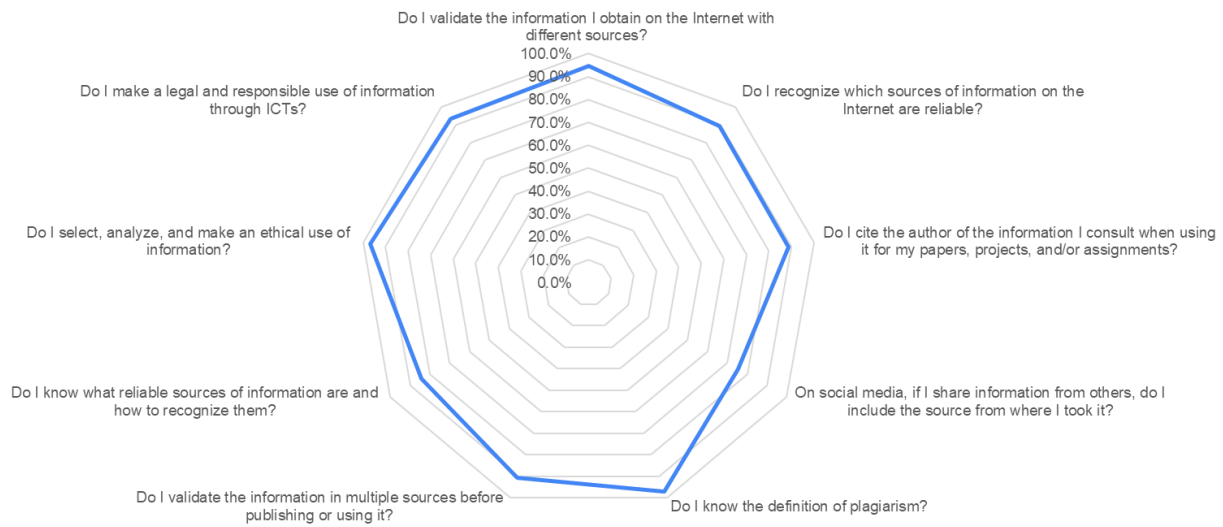
Source: López de Ramos et al. (2021).

Dimension 4: Ethical use

Regarding the ethical use dimension of digital tools, 9 questions were asked, and their responses were analyzed and presented in the pie chart shown in Figure 7. The percentages shown in the chart correspond to users who answered affirmatively to the questions. The blue line coincides with the outer nonagon if all answers are affirmative.

We can see that the question with the least positive responses corresponds to "Do I place the source where I took the information from if I disseminate information from others on social networks?" followed by "Do I know what reliable sources of information are and how to recognize them?". Approximately 10% of the surveyed students do not recognize what reliable sources of information are on the Internet and acknowledge not citing the authors of the information they consult when using it for their assignments, projects, and/or papers.

Figure 7. Positive responses to ethical questions regarding ICTs.



Source: López de Ramos et al. (2021).

5 CONCLUSIONS

The study provided relevant information on the level of digital literacy of students from the two Panamanian universities studied:

Dimension Use of devices and Internet connectivity: The surveyed students have digital devices and good quality internet connectivity in their homes. They prefer using laptops or computers for internet connection.

Dimension Knowledge and use of ICT tools and resources: The three most used tools are instant messaging (WhatsApp), word processors, and videoconferencing platforms. The latter is the most frequently used for academic purposes. The surveyed students are not frequent users of information programs or systems, but the most used ones are Adobe Illustrator, SAP, and AUTOCAD. All of them are familiar with basic file types such as .doc, .ppt, .jpg, and .mp4. Most of the students claim to know what they are looking for on the Internet, but few uses advanced searches with logical operators. All surveyed students use social networks, with Instagram, Facebook, and LinkedIn being the most popular. Students use educational portals little. The most used is Google Activate. Most surveyed students use digital tools to obtain information, but also for collaborative learning.

Dimension Ethics: The surveyed students claim to be aware of the importance of verifying the reliability of the source, but do not take precautions when disseminating information on their social networks and acknowledge having certain weaknesses in recognizing reliable sources of information.

RECOMENDACIONES

It is recommended to design and offer a series of workshops and/or courses to students such as:

- Use of logical operators and Google Scholar for efficient academic searches.
- Managing and validation of information sources and use of citations and references for students at both universities.
- Use and advantages of educational portals.

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