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Journal Applied Computing

Definition of the Journal

Scientific Objectives

Support the International Scientific Community in its written production of Science, Technology in Innovation in the Humanities and Behavioral Sciences Area, in the Sub-disciplines of international architecture, technological innovation in architecture, industrial design, business design techniques, multimedia design, advertising design, web system design, residential architecture.

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The works must be unpublished and refer to issues of systems theory, networks, interconnectivity of companies, corporate governance, satellite communication, connectivity, TV transmitters and transmission, microwave links, radio communications and radio receivers, radio communication, radio receivers. radio, TV receivers, Telephony, Radio and TV transmitters and other topics related to Engineering Sciences and Technology.

Presentation of the Content

In Issue 18, is presented an article Virtual environments for the practical training of ICT engineering students: supported by the e-learning modality, by VAZQUEZ-MORENO, Erika Ercilia, VAZQUEZ-MORENO, Dolores Guadalupe, PORTELA-PENÚÑURI, Luis Tadeo and TOLANO-GUTIERREZ, Karina, with adscription at Universidad Tecnológica del Sur de Sonora, in the next article Fintech, the digital age of financial services, by NAREZ-SÁNCHEZ, Iris Abril & BERTTOLINI-DÍAZ, Gilda María, with adscription at Universidad Juárez Autónoma de Tabasco, in the next section Analysis of the use of the cell phone in the learning process of the students of the superior technique logistics and the superior technique marketing of the UTNA, by VAZQUEZ-GUTIERREZ, Rosa Inés, with adscription at Universidad Tecnologica del Norte de Aguascalientes, in the next section Processor and memory performance with design patterns in a native Android application, by SAMPAYO-RODRÍGUEZ, Carmen Jeannette, GONZÁLEZ-AMBRIZ, Rosalba, GONZÁLEZ-MARTÍNEZ, Blanca Areli and ALDANA-HERRERA, Jonathan, with adscription at Instituto Tecnológico Superior de Huauchinango.

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Virtual environments for the practical training of ICT engineering students: supported by the e-learning modality

Entornos virtuales para la formación práctica de estudiantes de ingeniería TIC: apoyados en la modalidad e-learning

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Abstract

This work consists of a mixed-type investigation that consists of the development of digital materials for teaching-learning through a digital platform, for the academic performance of the students of the engineering career in information technologies of the ninth semester of the Technological University of the South of Sonora.

Resumen

Este trabajo consiste en una investigación de tipo mixto que consiste en el desarrollo de materiales digitales para la enseñanza-aprendizaje a través de una plataforma digital, para el rendimiento académico de los estudiantes de la carrera de ingeniería en tecnologías de la información del noveno semestre de la Universidad Tecnológica del Sur de Sonora.

Virtual environments, e-learning, Students, Technologies

Entornos virtuales, e-learning, Estudiantes, Tecnologías

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† Researcher contributing as first author.

Introduction

In the Technological University of the South of Sonora there have been some situations with engineering students in information and communication technologies regarding the attention of transversal subjects, they give them little importance and attend them in a simple way, because they already work and They do not arrive on time because they are in the first hours of attention in the afternoon.

This is due to the fact that the time of entry is at 3:00 pm and that due to the model of technological universities that is 70% practical and 30% theoretical, they become confused and due to this situation they do not give it the necessary importance and tend to failing even to fail the subjects for the above, a possible solution is presented in this regard. (www.uts.edu.mx, 2020).

This condition seems necessary in some cases, to support the gratuity in others, since a project of costs and investment expenses must be developed in the headquarters, centers and nuclei involved. The consideration of all these elements can guide and guarantee quality work in online and distance education.

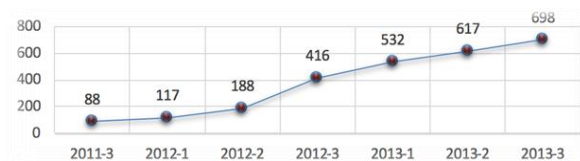
In the Technological University of the South of Sonora (UTS), in 2009 the continuity of studies from University Higher Technical level to Engineering in: Business Development and Business Management, Information Technologies, Production Technologies and Technologies began. of Automation, which has increased enrollment and in the face of this situation, needs and priorities are generated, such as the growing demand for new entrants to engineering and the installed capacity to serve students.

In our institution, in the development of its educational model, it foresees an institutional strategy for the fulfillment of its mission and vision, and takes into consideration fundamental aspects in the teaching-learning process, as established by the Quality Assessment Model of the Education Subsystem. Technological Universities.

This university openly faces the use of new trends that are important to accelerate the adoption of technology in higher education. Modalities as Mixed Modality in Information Technology and Communication Engineering (I.T.I.C).

As a point of reference, the results obtained at the Technological University of Fidel Velázquez, with the implementation of the Mixed Modality, have made it possible to considerably increase enrollment from 88 to 510 students at the engineering level during the transition process of the educational model. For more detailed information, see Graph 1.

Behavior engineering program



Graphic 1 Behavior engineering program

Source: Fidel Velázquez Technological University Income Statistics (2014)

Therefore, when analyzing the growth of enrollment in a technological university that transitioned to the Mixed Modality in engineering, it can be seen that this modality offers study opportunities to people who are actively working, since it is flexible with schedules and takes advantage of communication technologies. information. This University openly faces the use of new trends that are important to accelerate the adoption of technology in Higher Education. Modalities such as Mixed Learning, Flipped Classroom and Distance Learning.

For this reason, this proposal intends to carry out the promotion of the material of the cross-sectional engineering subject in a Virtual Learning Environment (EVA) with the purpose of making available several courses that are useful for students of Information Technology Engineering and Communication (ITIC), and that serve as exploratory courses, for the development of other courses.

In this proposal, the courses are proposed in the Moodle platform used by the University as a feasible option for accreditation of compulsory theoretical subjects of the terminal stage of the (ITIC) career. The constructivist pedagogical proposal where the student is responsible for their learning, accompanied by a tutor, with a competency-based and student-centered approach.

The proposal as a whole is integrated by technology, materials for subjects, human resources such as tutors, administrative, teaching and operational staff. Incorporate an EVA to the teaching practice in the transversal subject, in order to serve students in the last semesters of engineering in Information and Communication Technologies who cannot attend the UTS in person.

Justification

Offering subjects remotely through the Modular Object-Oriented Dynamic Learning (MOODLE) platform is intended for students to participate and study according to their own time. A Virtual Learning Environment (EVA) is ideal for expanding subjects. From the aspect of the subjects, its type facilitates the development of contents.

It allows students to manage and promote their time, advance adequately in the program, in addition to participating in an EVA that allows them to expand skills and technological competencies, and is a viable alternative because all students in the subjects have access to technology. (Lap-top, Tablet, Cell phone and internet). The transversal subjects have been worked on both face-to-face and semi-face-to-face, which is an indicator of progress to work online.

The context of the problem the transversal subjects belong to the stage of the educational program of Engineering in Information and Communication Technologies. The transversal subjects are theoretical subjects, which becomes a challenge with engineering students who only want to study practical subjects, everything else sounds like padding. Despite this, the subjects have been maintained even with the change of plan.

The students enroll in the transversal subjects, in the seventh, eighth, ninth and tenth quarters, they are mostly men (no more than three women per group) their ages range between 21 and 23 years. Most of them have a company job. They have an evening schedule for most subjects.

In addition, the case of students who participate in student mobility and wish to study the subject at a distance is presented. The students in general, due to the profile of the career, are not very participative, they are also used to practical subjects, programming; they like to work on projects, they don't like to speak in public, they don't like to have debates, and although they have the knowledge they avoid the part of the voluntary participation, they have to be invited by name to participate in front of the group, and still their answers are too concrete.

The challenge is for students to participate in the subjects, not just to take them and pass them. Approximate number of students enrolled in the subject between 20 and 25, most of the students have had experiences in the institutional platform, since they are in the last semesters, they work most of the time on projects autonomously, and they only present themselves to the subjects in some opportunities to deliver advances and consult doubts with their advisors. And they intend to do the same in these subjects.

The Technological University of Southern Sonora (UTS) is a public university in Ciudad Obregón, Sonora Mexico and has five campuses: in Sonora. It serves around 3,000 students and 300 employees between teachers and administrators: at the Cd. Obregón campus. Transversal subjects are taught in the Information Technology Engineering career, with an average of 30 students per semester, attended by 2 teachers every four months.

In Cd. Obregón, the subjects are currently taught in person and the other faculties must be the same or at least the institutional platform is not being used, since there is no record of activation of these subjects in Moodle. The UTS promotes the implementation of a flexible education approach, focused on student learning.

Regarding the use of ICT, Moodle is the institutional platform (<http://campusvu.uts.edu.mx/login/index.php>) with the guidelines to activate courses and evaluate content for the distance modality. Through the institutional platform Moodle seeks to maintain communication between teachers and students and promote the learning process, in addition to supporting academic activities with ICT.

There is sufficient and adequate technological infrastructure for the creation and development of the activities of the subjects, with sufficient bandwidth and computer laboratories equipped with updated equipment and software in each laboratory, as well as an institutional computer center. Within the Campus there is also a wireless Internet signal which makes it easier for students to connect to Moodle.

Problem statement

The transversal subjects are offered in the four semesters of the Information Technology Engineering educational program, they are theoretical subjects, and are offered in the morning; Most of the students are already working, so absenteeism in them leads them to drop out or to obtain low grades.

Objective

Overall objective

Develop an alternative proposal for the transversal subjects of ICT engineering, through a virtual environment that facilitates and accompanies the learning of the students of the ICT career.

Specific objectives

- Plan and prepare the didactic material that will plan the academic work that the student must carry out to gradually develop the competences proposed in the profile in the transversal subjects designed by the teachers.
- Facilitate the Teaching-Learning process with tutorial follow-up and where technologies mediate so that students integrate into the ICT field.

- Apply the criteria for diagnosis and evaluation of the learning of the activities and tasks reported by the students of the subject according to the Virtual modality.

Hypothesis

A correlational hypothesis has been generated between the b-learning variables and academic performance.

Using the b-learning methodology has a positive impact on the academic performance of ICT Engineering students in the transversal subject.

Variables

Independent variable: B-Learning

For Sanz and others (2009), b-Learning means the combination of face-to-face teaching with Web technologies, that is, those learning processes carried out through digital networks where face-to-face sessions are established that promote face-to-face contact.

Dependent variable: Academic performance

For Jiménez (2000), academic performance is a "level of knowledge demonstrated in an area or subject compared to the norm for age and academic level. For this research, academic performance is based on this definition and will be measured through the results of the experimentation instruments, which will be developed to make use of this tool.

Methodology

The research is carried out at the Technological University of the South of Sonora, in Cd. Obregón, Sonora, the ICT engineering groups of the seventh, eighth, ninth and tenth semesters are considered for this research, where transversal management-level subjects are taught. one in each quarter.

The objective of this research is to examine the Blended Learning methodology and how it intervenes in the academic exercise of students, this research is in a context of educational innovation, so the benefits that will be compensated in students with its application must be analyzed.

To carry out, it is considered to do an experiment that validates it on the Blended Learning methodology, differentiating the information generated with the focus groups related to the transversal subjects that use the Blended Learning methodology.

This research is solved through quantitative methodology, combined in some cases with qualitative methodology.

Three types of scientific research can be distinguished referring to three epistemological-methodological approaches to doing research: the quantitative approach typical of the natural sciences, which was extended to the social sciences; the qualitative approach that emerged from the social sciences as a different response to doing science without resorting to quantitative methods; Finally, there is talk of a third approach that some call mixed, multi-method or total. (Hernandez, 2010).

Before properly defining mixed methods, they add more followers every year and their development during the first decade of the 21st century has been vertiginous. They have received various names such as integrative research (Johnson and Onwuegbuzie, 2004), and mixed research (Tashakkori and Teddlie, 2009; Plano and Creswell, 2008; Bergman, 2008; and Hernández and Mendoza, 2008).

Some of the most significant definitions of the mixed approach or mixed methods would be the following:

1. Mixed methods represent a set of systematic, empirical and critical research processes and involve the collection and analysis of quantitative and qualitative data, as well as their integration and joint discussion, to make inferences as a result of all the information collected (meta-inferences.) and achieve a better understanding of the phenomenon under study (Hernández and Mendoza, 2008).
2. Mixed research methods are the systematic integration of quantitative and qualitative methods in a single study in order to obtain a more complete "photograph" of the phenomenon.

These can be brought together in such a way that the quantitative and qualitative approaches retain their original structures and procedures ("pure form of mixed methods"). Alternatively, these methods can be adapted, altered, or synthesized to conduct research and deal with study costs ("mixed methods modified form") (Chen, 2006; Johnson et al., 2006).

Hernández and Mendoza (2008), who in turn took into account the classification of Teddlie and Tashakkori (2006) in relation to the mixed part. The quantitative and qualitative methods are monomethodical (they imply a single method). Mixed methods, as has been pointed out, are multi-method, they represent the "third way" (Hernández and Mendoza, 2008).

Hypotheses

A correlational hypothesis has been generated between the b-learning variables and academic performance. Using the b-learning methodology has a positive impact on the academic performance of ICT Engineering students

Independent Variable: Use of Technology

Variable

Mentoring and advice

(Academic achievement)

Dimensions

Use of technology

Teamwork

Indicators

Participation in academic activities.

Compliance activities

Ratings

Instruments

Checklist (academic performance of student groups)

Documentary analysis (Documentary file)

Dependent variable

Tutoring and Counseling

Variable

Use of technology (b-learning)

Dimensions

Class planning with b-learning

Technological resources used in the EVA of pedagogy

Indicadors

Syllabus

Tools

Access

Connection

Virtual platform

web communities

Methodology

Tutorships

Evaluation

Instruments

Checklist (resource availability)

Questionnaire (applied to UTS students, on the methodology applied by the teacher)

Scope and Research Design

The current study will be carried out at the Technological University of the South of Sonora, during the last year of engineering studies and will be applied to students in the ninth semester who will finish their studies in the semester May - August 2020.

Population

The population of the present investigation is made up of the Students of the Technological University of the South of Sonora, of the Career of Information Technologies specifically of engineering.

Sample

The sampling technique will be intentional, non-probabilistic. This will be made up of 100% of the total number of students who attend the transversal subject taught in the Information Technology Engineering career, with a total of 30 students and as a sample the 30 students.

To carry out the diagnosis of the Blended Learning methodology applied in the Technological University of the South of Sonora, a survey was designed and applied, in which the following Population of 100% of students of 9th semester was considered

Criteria

The study was carried out at the Universidad Tecnológica del Sur de Sonora with the students of Engineering in Information and Communication Technologies of the last semester, with the subject of business negotiation. This is because it is one of the transversal subjects and it is one of the first in its evening hours, engineering is in the afternoon, because when students leave their university higher technical level, they are placed in companies to do the stays and in several cases they stay to work, so some students do not make it to the first hours of classes since they start at 3:50 pm in addition to not giving it much importance because they are administrative or managerial role matters. Due to the above, the study is made of engineering students who take transversal subjects in the early hours of the afternoon to offer them semi-face-to-face because they are 3 hours a week and they could take two virtual and one face-to-face. With this they would take more advantage of the topics and would credit more easily.

In addition to taking care of the permanence and increasing the enrollment in engineering because with the case of the Universidad Tecnológica de Fidel Velázquez, we remain as a reference to apply the same strategies of applying executive engineering, that is, working with engineering students on Fridays 6:00 pm to 10:00 pm and Saturday from 9:00 am to 7:00 pm With this strategy, young people can fulfill their work and their classes, in addition to respecting what is established by the General Coordination of Technological Universities, which is that young people practice in the workshops, either with dual or blended education, but it is not allowed 100% virtual.

Resources

Full-time professors from the IT engineering program are available to develop digital materials.

The academic body of the educational program has the necessary resources (financial and technological) to carry out the activities of this work.

It also has a line of research called development of digital and multimedia materials.

There are adequate technical specifications for the implementation of semi-face-to-face education, with sufficient bandwidth and dedicated servers for the corresponding applications. In addition; There are computer rooms and wireless internet, as shown in the interviews and checklists made to those in charge of computer centers and communications sites.

Measurement tools

This research, in general, is solved with a quantitative research methodology, adopted in some cases with qualitative methodology.

This is due to the type and characteristics of the research:

1. To carry out the diagnosis of the Blended Learning methodology applied at the Universidad Tecnológica del Sur de Sonora, the research methodology used is quantitative, not experimental. (Questionnaire and Checklist)

2. To establish the levels of association developed by the application of the Blended Learning methodology, the research methodology used is quantitative quasi-experimental. (Checklist)
3. Finally, in the case of the teaching technicians who support the computer laboratories, they were interviewed with a checklist to verify the state of the technology available to the UTS.

| |
|------------------------|
| Carrer |
| Course |
| Teacher |
| Date |
| Indicators forever = 3 |
| Usually = 2 |
| Rarely =1 |
| Never = 0 |

Table 1 Checklist 1 for students

1. Manages digital information in the contents in several
2. Shapes.
3. Possesses information research skills on the Internet.
4. He makes writings, exhibitions and other archives in programs.
5. Participate in forums, chat and internet activities.
6. Run research on virtual library databases.
7. Make exhibitions supported by technological resources.
8. Manage mobile devices for academic actions.
9. Use mobile devices for academic activities works collaboratively.
10. They have good communication between team members.
11. They use web resources to do teamwork.
12. Suggest ideas for work improvement.
13. He performs his part of the work on time in the terms.
14. Agreed.

15. Favorably performs research projects classroom.
16. Participate in extracurricular academic activities.
17. Favorably performs the activities arranged.
18. Execute your work with a good level of quality.

Universidad Tecnológica del Sur de Sonora

Objective: To establish the B-learning methodology applied at the Universidad Tecnológica del Sur de Sonora.

Career

Course

Teacher

Date

Responsible

Respond yes no partially

No. Tools usable in the classroom

1. Has computer equipment.
 2. It has an image projector.
 3. It has a digital screen.
 4. It has an audio system.
 5. It has wireless internet system.
 6. It has a wired internet system.
 7. It has enough electrical connections.
- No. Tools usable in college.
8. How much free internet access service?
 9. It has an online academic management system.
 10. It has access to a virtual platform.
 11. It has access to virtual libraries.
 12. It has an institutional repository to host and consult research.

13. They have institutional mail for teachers
14. They have institutional mail for students
15. Forums or virtual conferences are held to share knowledge
16. Students have mobile technological resources
17. Access to web communities is free (Facebook, WhatsApp, YouTube)
18. They have free electrical installations

Technological University of Southern Sonora

Illustration 3 Survey 1

Career:

Survey addressed to engineering students at the Technological University of the South of Sonora.

Specific objective: To establish the B-Learning Methodology used in the Technological University of the South of Sonora.

1 From your point of view, what level of importance deserves the use of web resources as didactic support in the teaching-learning processes?

Necessary

Optional

Not applicable

2 Does the teacher plan activities in virtual learning environments?

Yes

No

3 With what continuity does the teacher plan activities in virtual learning environments?

Repeatedly

Casually

| | |
|--|---|
| Little usual | 10 Are web communities created (Facebook, LinkedIn, Twitter, Google apps) for the reciprocity of information and communication between teachers and students? |
| Does not use | |
| 4 What platform does the teacher use to advance their virtual activities? | Yes |
| Moodle | No |
| Dakeos | 11 What are the most used applications in web groups for communication and exchange of information? |
| Chamilo | |
| 5 Does the bibliography contain electronic information services such as: books, magazines, articles, videos? | Facebook |
| Yes | WhatsApp |
| No | LinkedIn |
| 6 What percentage is there between the physical and electronic bibliography? | Twitter |
| Physics – Electronics | Googleapps |
| 80% 20% | Youtube |
| 60% 40% | 12 Is the use of mobile devices (Tablet, Smart Phone) allowed to develop academic activities in the classroom? |
| 50% 50% | Yes |
| 40% 60% | No |
| 20% 80% | The teacher |
| 7 Do you use virtual library databases in the planning and progress of activities? | 13 Is the data cloud used to place and share electronic files between teachers and students? |
| Yes | Yes |
| No | No |
| 8 Are academic activities planned in Blogs, forums, wikis, Chat? | 14 Do you use the institutional repository of the University as a reference source for your work? |
| Yes | Yes |
| No | No |
| 9 Have video conferences been scheduled for exhibitions? | 15 Are electronic data collection materials (online surveys) used in research projects? |
| Yes | Yes |
| No | No |

16 Are the results of the investigations published in any Web resource?

Yes

No

Some cases

17 The technological tools provided by the university (PC, Lap Top tablets) are considered to be:

Enough

Insufficient

18 Internet access provided by the university for free use by students is considered:

Very good

Okay

Unsatisfying

Deficient

19 How do you observe the methodology used by the teacher in the progress of the b-Learning activities?

Very good

Good

Unsatisfactory

Inadequate

20 How do you observe the accompaniment of the teacher in the b-Learning activities?

Very good

Okay

Unsatisfying

Deficient

21 How do you evaluate the b-Learning practice within your academic training process?

Very good

Good

Unsatisfactory

Deficient

22 Do you think that the b-Learning methodology increases your academic performance in the following ways:

Very eloquently

Eloquently

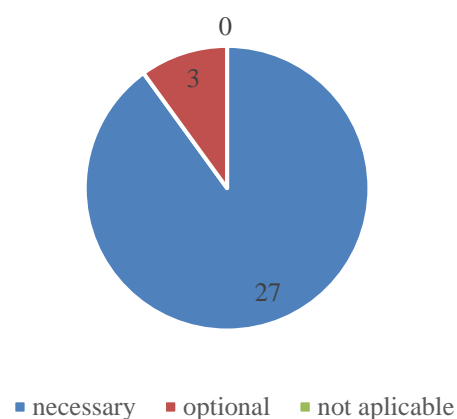
Little bit

It doesn't make it better

Illustration 4 Checklist 1

Specific objective: To establish the B-Learning Methodology used in the Technological University of the South of Sonora.

1 From your point of view, what level of importance does the use of web resources deserve as didactic support in the teaching-learning processes?



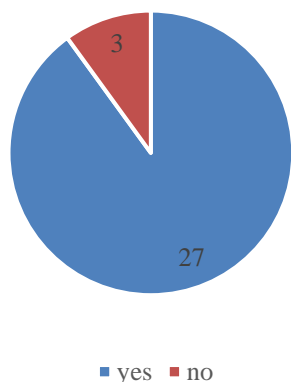
Graphic 1 Represents the answer to question 1

In the answer to question number 1 of the survey addressed to ICT engineering students, they state that the use of web resources as a didactic support in their teaching-learning process is necessary, giving as a necessary answer 27 students out of 30 that make up the group.

Analyzing the data received, it can be identified that students, due to their current characteristics, do use web resources to take advantage of their learning.

By way of inferring the results, it can be said that in the future it will be an essential requirement that students entering this degree have mandatory use of ICT.

2 Does the teacher plan activities in virtual learning environments?



Graphic 2 Represents the answer to question 2

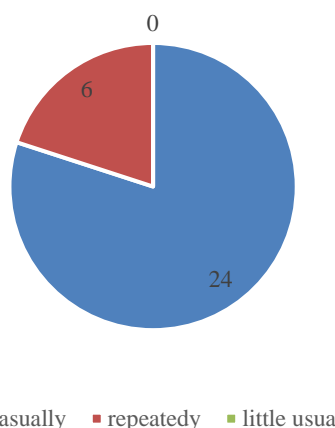
In the answer to question number 2 of the survey addressed to ICT engineering students, they state that the teacher does plan activities in EVA, 27 students out of 30 declare so, making it clear that the teacher has the necessary skills for their job.

Analyzing the data received, it can be identified that teachers have the necessary skills to use web resources.

By way of inferring the results, it can be said that in the future teachers will be able to update themselves more quickly and apply it to their digital materials.

3 With what continuity does the teacher plan activities in virtual learning environments?

3. Represents the answer to question 3



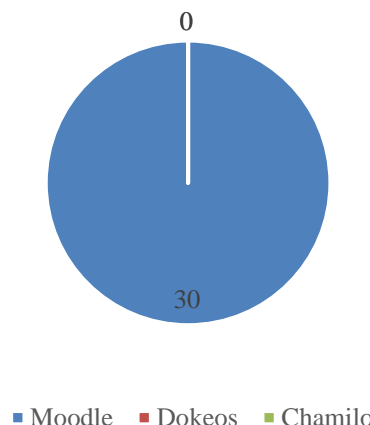
Graphic 2 Represents the answer to question 2

In the answer to question number 3 of the survey addressed to ICT engineering students, 24 state that the teacher casually plans virtual activities, and 6 of them respond quickly.

Analyzing the data received, it can be identified that the teachers plan it casually because their participation is once a week because they are subjects of 3 hours a week.

As a way of inferring the results, it can be said that the teachers will continue to do it in the same way in the future, because this is the UTS program, two virtual hours and one face-to-face.

4 What platform does the teacher use to advance their virtual activities?



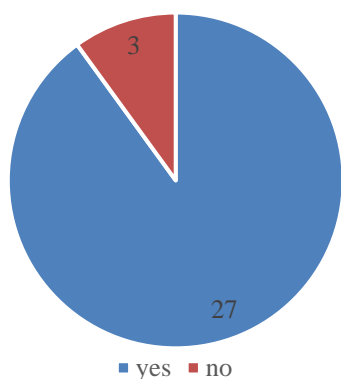
Graphic 4 Represents the answer to question 4

In the answer to question number 4 of the survey addressed to ICT engineering students, the 30 students in the control group state that the teachers use the Moodle platform, ruling out the Dokeos and Chamilo platforms.

By analyzing the data received, it can be identified that teachers use the Moodle platform, because it is a free platform, in addition to being used since the beginning of the UTS, in addition to the fact that it is from the platform that they have received training from its updates.

As a way of inferring the results, it can be said that teachers will continue to do it in the same way in the future, because, by fine-tuning their skills in handling this technology, it will be easier for them to use it over time.

3 Does the bibliography contain electronic information services such as: books, magazines, articles, videos?



Graphic 5 Represents the answer to question 5

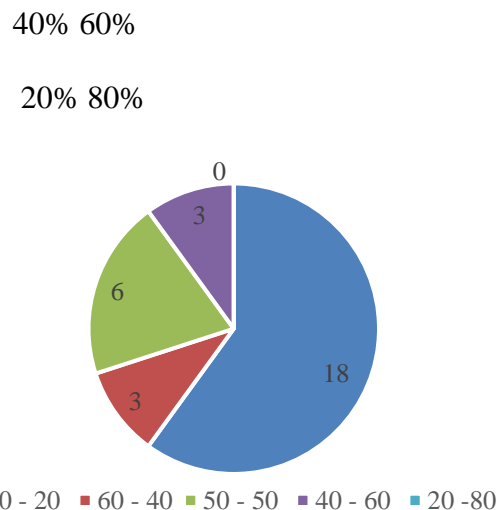
In the answer to question number 5 of the survey addressed to ICT engineering students, 27 out of 30 students state that they do have digital materials to prepare their work.

By way of analysis of the data obtained, it can be said that students can access digital information both on the internet and in the databases of the professional residency jobs of UTS graduates.

For in the future it can be inferred that all students will be able to access these materials, because they will have more bibliography and laboratories available with the Internet.

4 What percentage is there between the physical and electronic bibliography?

- Physics – Electronics
- 80% 20%
- 60% 40%
- 50% 50%



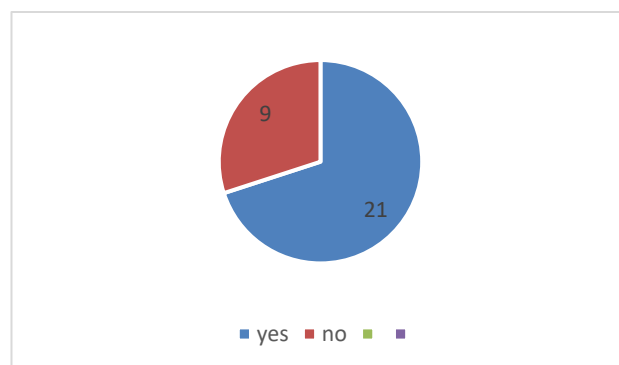
Graphic 6 Represents the answer to question 6

In the answer to question number 6 of the survey addressed to ICT engineering students, they state that there is 80% electronic bibliography and 20% physical bibliography; evidencing that they have the necessary materials for their online work.

Analyzing the data obtained, it can be said that more dissemination should be done among students regarding the digital materials that the university has for free access by students.

Likewise, it can be inferred that in the future young people will be able to access a higher percentage of digital materials.

7 Do you use virtual library databases in the planning and progress of activities?

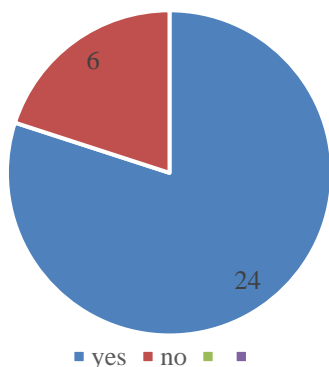


Graphic 7 Represents the answer to question 7

In the answer to question number 7 of the survey addressed to ICT engineering students, 21 students out of 30 state that they use virtual library databases in the planning and progress of their activities.

By analyzing the data obtained, we can identify that in order to get all students to use virtual platforms, training and information about them may be necessary. By inferring the results we can say that in the future all young people will be consulting virtual libraries.

8 Are academic activities planned in Blogs, forums, wikis, Chat?



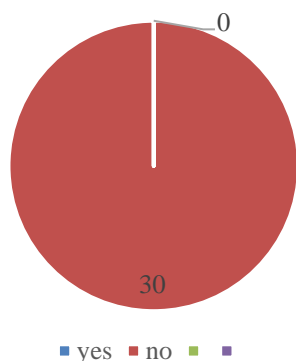
Graphic 8 Represents the answer to question 8

In the answer to question number 8 of the survey addressed to ICT engineering students, 24 out of 30 students state that academic activities are planned in blogs, forums, wikis and chat.

By analyzing the data obtained, the interaction of students and teachers with technological tools is identified.

From what can be inferred from the previous results in the interaction of students with teachers through academic activities attended through forums, blogs, among others, will contribute to the development of new learning skills.

9 Have (Video conferences) been scheduled for exhibitions?



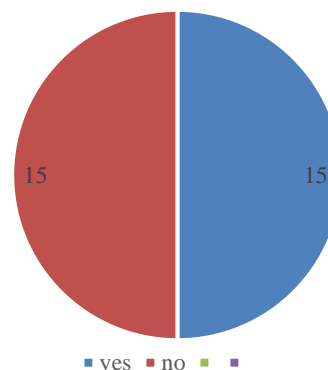
Graphic 9 Represents the answer to question 9

In the answer to question number 9 of the survey addressed to ICT engineering students, the 30 students in the control group state that they have not held videoconferences for exhibitions.

When analyzing the data obtained in this question, it is identified that they do this in person, due to the fact that the subject program requires it.

By inferring from the above data, we can say that with the demand for the programs and needs that this program requires, videoconferences for this subject should be given.

10 Are web communities created (Facebook, LinkedIn, Twitter, Google apps) for the reciprocity of information and communication between teachers and students?



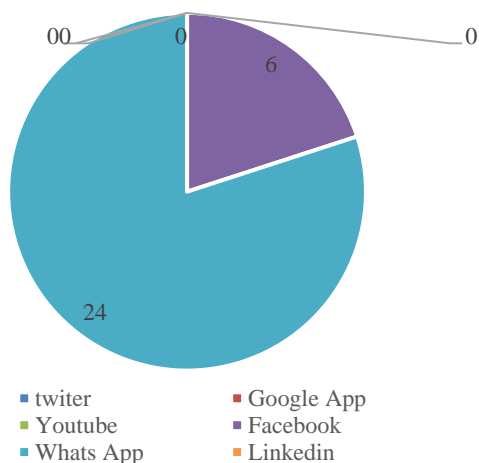
Graphic 10 Represents the answer to question 10

In the answer to question number 10 of the survey addressed to ICT engineering students, 15 out of 30 students state that they do make web communities and the other 15 mention that they do not.

When analyzing the data obtained, we can identify that according to the assignment of activities assigned in the subject program, sometimes it is required and sometimes it is not. Likewise, it can be inferred from the above that in the future web communities will be able to be carried out in more subjects of the educational program.

11 What are the most used applications in web groups for communication and exchange of information?

WhatsApp, LinkedIn, Twitter, Googleapps and YouTube.



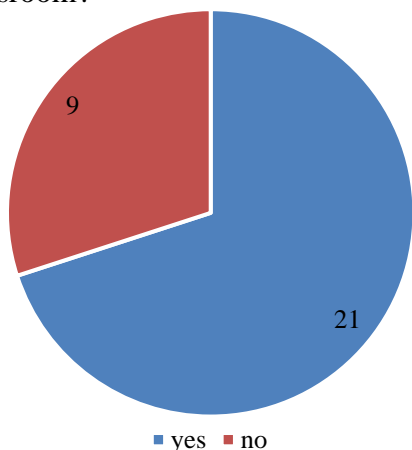
Graphic 11 Represents the answer to question 11

In the answer to question number 11 of the survey addressed to ICT engineering students, 24 students state that the most used app is WhatsApp, while 6 comment that Facebook and the rest of the Apps are not used for communication and communication. exchange information with their teachers and classmates.

When analyzing the data obtained in question 11, we identify that the rest of the social networks are not used by the vast majority because they are not required by their teachers, and also because they do not yet have the necessary qualifications or knowledge to use them. they.

In the future we can infer that they will be able to make use of all the social networks that are implemented here both to make themselves known as professionals as well as to complement their subjects.

12 Is the use of mobile devices (Tablet, Smart Phone) allowed to develop academic activities in the classroom?



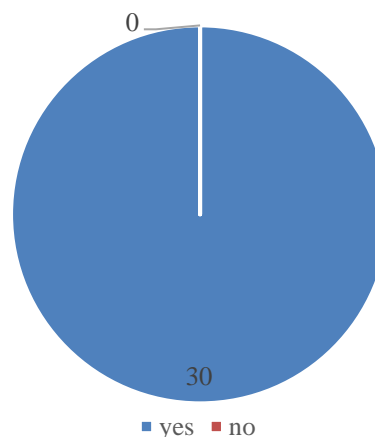
Graphic 12 Represents the answer to question 12

In the answer to question number 12 of the survey addressed to ICT engineering students, 21 students state that they do use mobile devices in class and 9 do not.

When doing an analysis of the data obtained, we identified that due to the fact that they test web systems that they develop in the areas of programming and databases, not all students reach portable equipment, because handling them is for those who arrive. earlier or has one of its own.

It can be inferred from the above data that, in the future, each student will be able to have a computer for individual use, since equipment is required for the ICT career each year in the federal support programs.

13 Is the data cloud used to place and share electronic files between teachers and students?



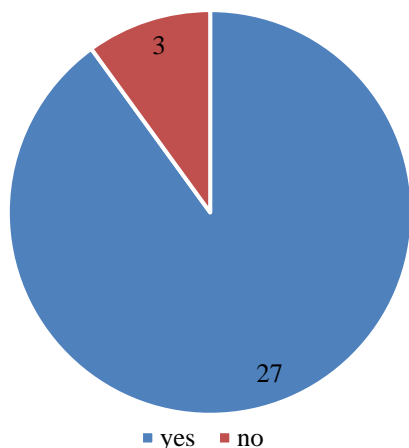
Graphic 13 Represents the answer to question 13

In the answer to question number 13 of the survey addressed to ICT engineering students, the 30 students state that they use the cloud to share jobs.

When analyzing the data obtained, it is identified that it again demonstrates the interaction with the teacher and students.

Where we can infer that the interaction between students and teachers through the cloud helps for the development of digital skills of our students and the optimization of delivery and response times of teachers.

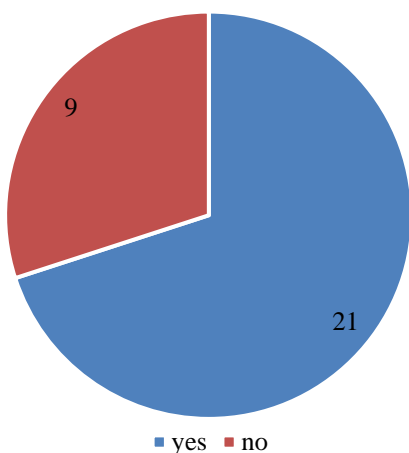
14 Do you use the institutional repository of the University as a reference source for your work?



Graphic 14 Represents the answer to question 14

In the answer to question number 14 of the survey addressed to ICT engineering students, 27 students out of 30 state that they do use said repository. When analyzing the data obtained, we identified that it is one more tool for online consultation. So, we can infer that in the future all students will review this repository of digital materials.

15 Are electronic data collection materials (online surveys) used in research projects?



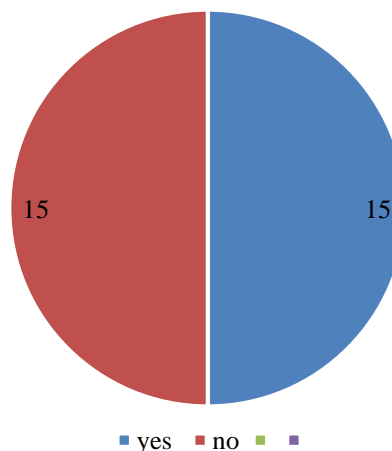
Graphic 15 Represents the answer to question 15

In the answer to question number 15 of the survey addressed to ICT engineering students, 21 students out of 30 state that they do participate in electronic data collection for research projects.

When analyzing the data obtained, we identified that not all students participate in research, it is according to their interest in the subject and the teacher is the one who chooses the students.

From what we can infer that in the future there will be more students who participate in the investigations, since most of them manifest it.

16 Are the results of the investigations published in any Web resource?



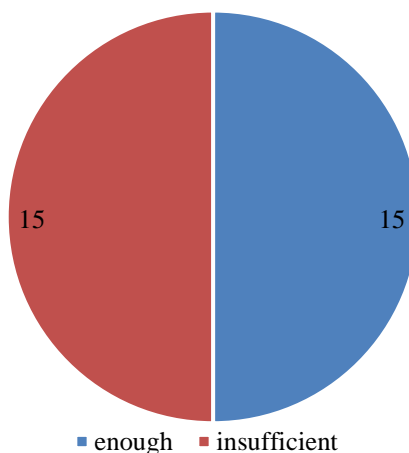
Graphic 16 Represents the answer to question 16

In the answer to question number 16 of the survey addressed to ICT engineering students, 15 say yes and 15 no.

When analyzing the results obtained, we identify that this is due to the fact that not everyone participates and also because not all articles are published due to lack of resources on occasions and sometimes due to lack of interest from the work team itself.

Therefore, it can be inferred that support should be generated for the publication of articles in which students participate; and this generates motivation for the publication of new articles.

17 The technological tools provided by the university (PC, Lap Top tablets) are considered to be:



Graphic 17 Represents the answer to question 17

In the answer to question number 17 of the survey addressed to ICT engineering students, 15 state that they are sufficient and the other 15 that they are insufficient.

Analyzing the data obtained, this is due to the fact that the UTS equipment is not always in good condition or maintenance periods also enter the semester and this prevents the 30 students from having equipment in optimal conditions in all classes.

Making inference in the future, students will be able to count on individual equipment, recommending to the teaching technicians that they generate maintenance periods outside class hours.

18 Internet access provided by the university for free use by students is considered:

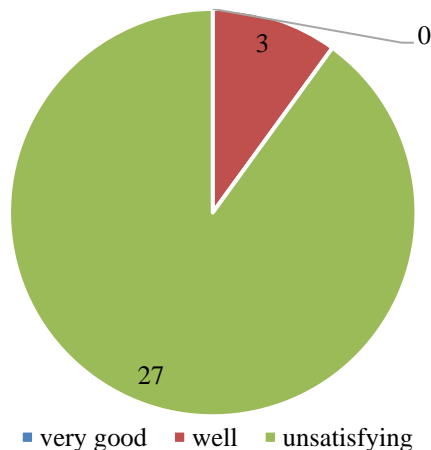


Graphic 18 Represents the answer to question 18

In the answer to question number 18 of the survey addressed to ICT engineering students, the 30 control group students state that the Internet is not very satisfactory. Analyzing the data obtained, it is identified that this is due to the fact that there are more and more users in the UTS, which requires an increase in bandwidth.

It can be inferred that, in the future, in addition to increasing the bandwidth, this resource will be managed with security policies and service management.

19 How do you observe the methodology used by the teacher in the progress of the b-Learning activities?



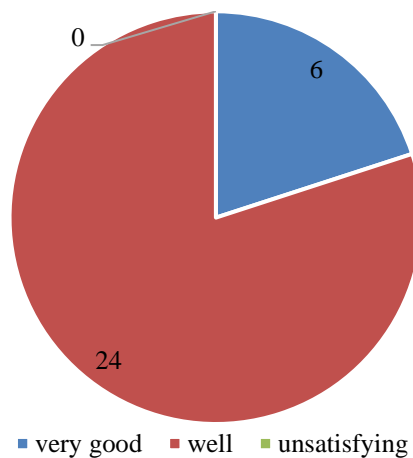
Graphic 19 Represents the answer to question 19

In the answer to question number 19 of the survey addressed to ICT engineering students, 27 out of 30 students state that the methodology used by the teacher is good.

When analyzing the data obtained, it is identified that this is an indicator to improve the B-Learning strategy currently implemented in ICT Engineering courses.

By inferring in the future, teachers will master the B-Learning methodology.

20 How do you observe the accompaniment of the teacher in the b-Learning activities?



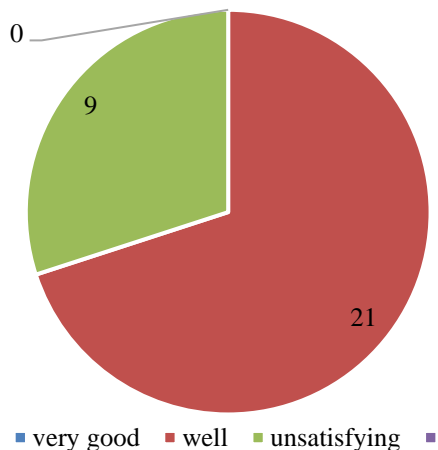
Graphic 20 Represents the answer to question 20

In the answer to question number 20 of the survey addressed to ICT engineering students, 24 students state that the teacher's accompaniment is good in the B-Learning methodology.

When analyzing the results obtained, we can identify that this is due to the fact that the teachers are in training regarding the virtual once a year.

So, it can be inferred that in the future the teacher's performance will be very good.

21 How do you evaluate the b-Learning practice within your academic training process?



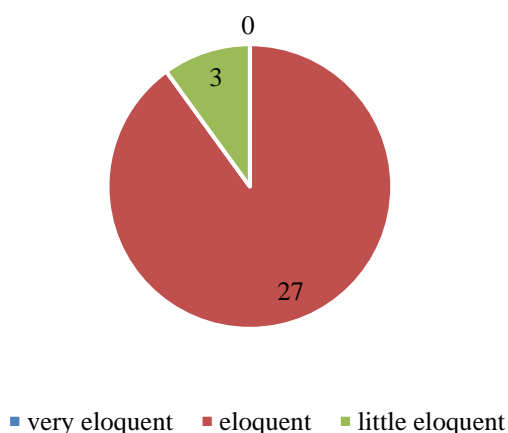
Graphic 21 Represents the answer to question 21

In the answer to question number 21 of the survey addressed to ICT engineering students, 21 out of 30 students state that B-Learning practice is good within their academic training process.

When analyzing the data obtained, it is identified that the continuous improvement of teachers to perform better in their mixed class through annual training, has improved the practice of the methodology.

So, it can be inferred that in the future the management of the B-Learning methodology will be very good.

22 Do you think that the b-Learning methodology increases your academic performance in the following ways:



Graphic 22 Represents the answer to question 22

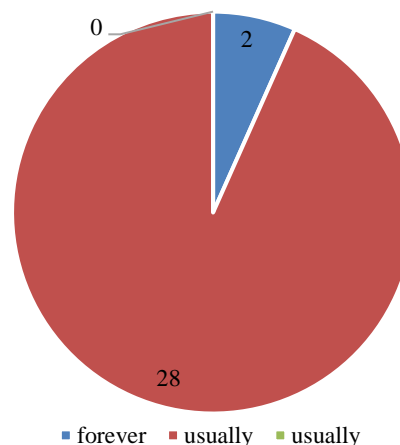
In the answer to question number 22 of the survey addressed to ICT engineering students, 27 out of 30 students state that their academic performance eloquently increases.

When analyzing the data obtained, it can be identified that the use of technology has supported students to raise their academic performance, through the management of various information resources.

Therefore, it can be inferred that in the future the subject could be performed in its entirety virtually.

Illustration 2 Checklist 2

1.-Do you manage digital information in the contents in various ways?



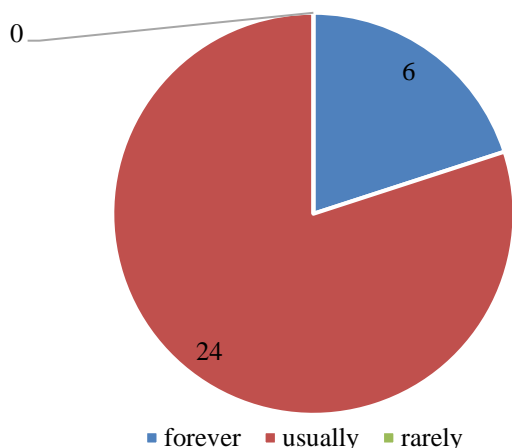
Graphic 23 Represents the answer to question 1 of checklist 2

In the answer to question number 1 of checklist 2 addressed to ICT engineering students, 28 out of 30 students state that they almost always handle digital information in various formats.

When analyzing the data obtained, it is identified that the students have the necessary skills to handle information online.

So, it can be inferred that this will facilitate their transition to b-Learning modality.

2.- Do you have information research skills on the Internet?



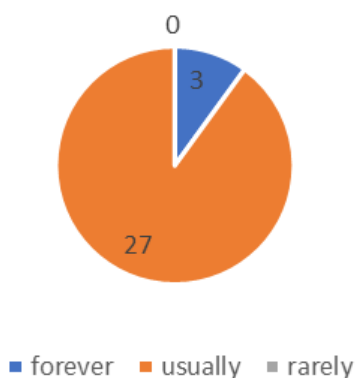
Graphic 24 Represents the answer to question 2 of checklist 2

In the answer to question number 2 of the checklist addressed to ICT engineering students, 24 out of 30 students state that they almost always have the necessary skills to investigate information on the Internet.

When analyzing the data obtained, it is identified that it demonstrates as further evidence that students will be able to carry out their activities online when necessary.

Therefore, an inference is made that in the future it will be easier to perform in virtual classes.

3.- Do you make writings, exhibitions and other files in programs?



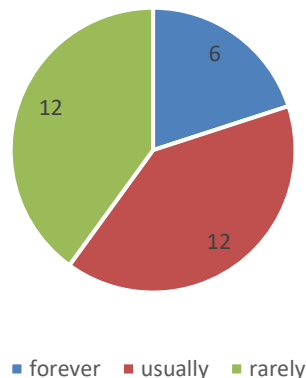
Graphic 25 Represents the answer to question 3 of checklist 2

In the answer to question number 3 of checklist 2 addressed to ICT engineering students, 27 out of 30 students state that they almost always make presentations and writings in different programs.

By analyzing the data obtained, we can identify as evidence the software management of different functions that students perform.

It is inferred that in the future a total of students will better handle computer tools.

4.- Do you participate in forums, chat and internet activities?



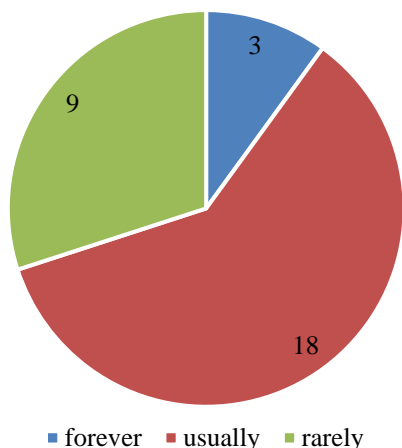
Graphic 26 Represents the answer to question 4 of checklist 2

In the answer to question number 4 of checklist 2 addressed to ICT engineering students, 6 students state that they always participate in forums and events on the Internet, 12 almost always and 12 rarely.

By analyzing the data obtained, we can identify that this is due to the fact that sometimes forums or events on the Internet have an economic cost that students are not always willing to pay.

To which it can be inferred that, in the future, events must be held or resources managed so that all students can access said events.

5.- Do you carry out research on virtual library databases?



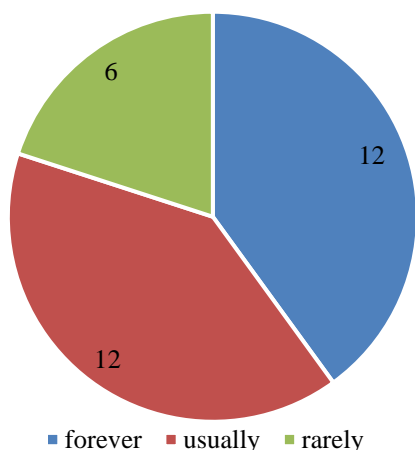
Graphic 27 Represents the answer to question 5 of checklist 2

In the answer to question number 5 of checklist 2 addressed to ICT engineering students, 18 out of 30 students state that they almost always use virtual library databases.

By analyzing the data obtained, we can identify that this is because it depends on the activity in which it is required and the skills of the students.

To which it can be inferred that in the future training should be done regarding the use of virtual libraries, so that a total of students can access these resources.

6.- Do you hold exhibitions supported by technological resources?



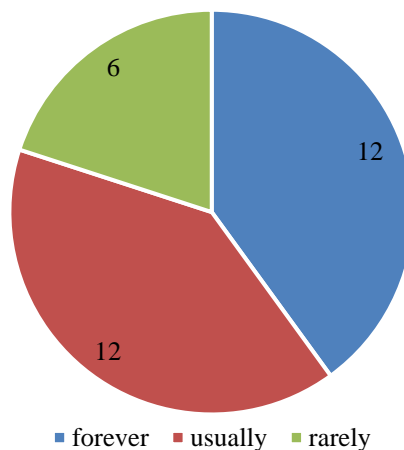
Graphic 28 Represents the answer to question 6 of checklist 2

In the answer to question number 6 of checklist 2 addressed to ICT engineering students, 12 state that they always use technological resources, another 12 almost always and 6 rarely.

By analyzing the data obtained, we can identify that this is because it is not always required, but there are students who, although not required, present it technologically.

To which it can be inferred that in the future the majority will do it in a technological way, because the indicator represents the average of the students.

7.- Do you use mobile devices for academic actions?



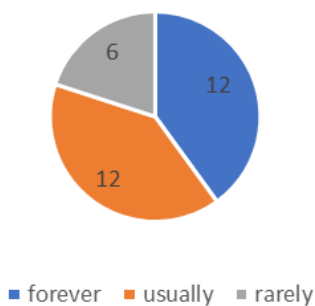
Graphic 29 Represents the answer to question 7 of checklist 2

In the answer to question number 7 of checklist 2 addressed to ICT engineering students, 12 students state that they always use mobile devices, another 12 almost always and 6 rarely.

By analyzing the data obtained, we can identify that this is due to the fact that not everyone has mobile devices and those that the university has are not always in good working order.

To which it can be inferred that in the future a preventive and corrective maintenance plan should be made so that all students have individual equipment.

8.- Do you use mobile devices for academic activities? Graph 30. Represents the answer to question 8 of checklist 2



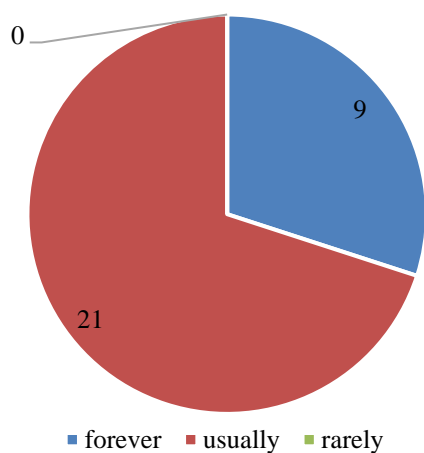
Graphic 30

In the answer to question number 7 of checklist 2 addressed to ICT engineering students, 12 students state that they always use mobile devices, another 12 almost always and 6 rarely.

By analyzing the data obtained, we can identify that this is due to the fact that not everyone has mobile devices and those that the university has are not always in good working order.

To which it can be inferred that in the future a preventive and corrective maintenance plan should be made so that all students have individual equipment.

9.- Do you work collaboratively?



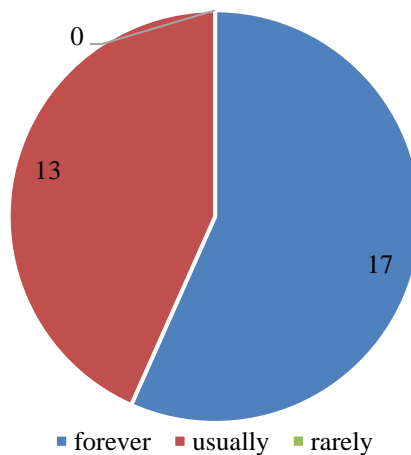
Graphic 31 Represents the answer to question 9 of checklist 2

In the answer to question number 9 of checklist 2 addressed to ICT engineering students, 9 out of 30 students state that they always work in a team and 21 that they almost always work in a team.

Analyzing the data obtained, we identified that this is due to the fact that most of the students eventually work and it is difficult for them to work as a team due to their work schedules.

To which it can be inferred that in the future all the students will work and must improve the balance of their times so that they can perform the skill of teamwork.

10.- Do you have good communication between team members?



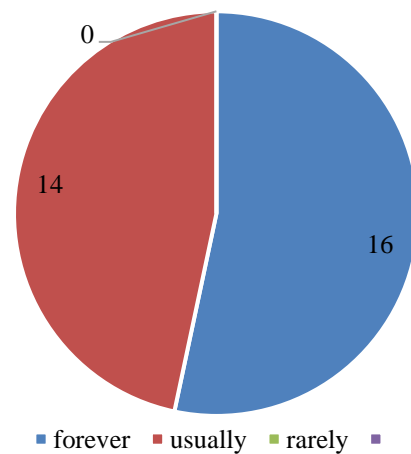
Graphic 32 Represents the answer to question 10 of checklist 2

In the answer to question number 10 of checklist 2 addressed to ICT engineering students, 17 state that they always have good communication with the rest of the team, 13 almost always.

Analyzing the data obtained, it can be identified that this is due to the fact that sometimes some young people work and prefer to do their jobs individually.

To which it can be inferred that, in the future, they must receive seminars on social skills so that they can carry out that competence.

11.- Do you use web resources to do teamwork?



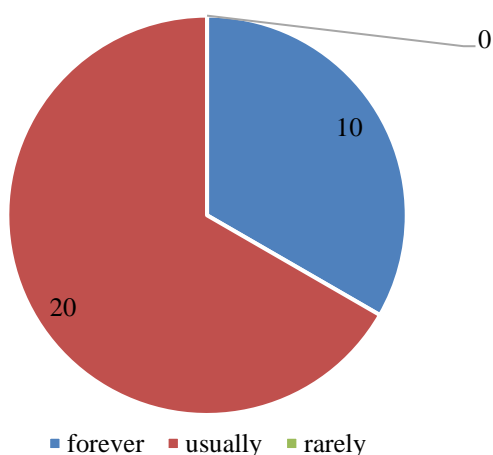
Graphic 33 Represents the answer to question 11 of checklist 2

In the answer to question number 11 of checklist 2 addressed to ICT engineering students, 16 state that, if they use web resources to work, 14 that they do not.

Analyzing the data obtained, it can be identified that this is due to the fact that, as mentioned in the previous answers, some students work and decide to work at their own pace and individually.

To which it can be inferred that in the future they will develop the social skills that the engineering group needs because the majority state that they always use web resources.

12.- Does it propose ideas to improve the work?



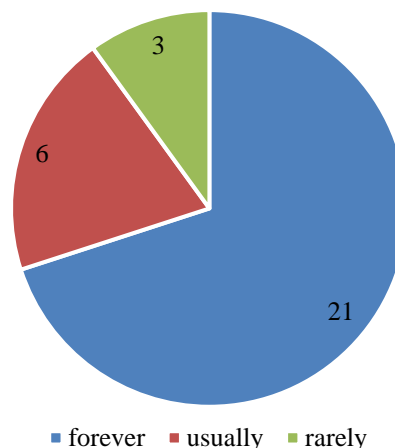
Graphic 34 Represents the answer to question 12 of checklist 2

In the answer to question number 12 of checklist 2 addressed to ICT engineering students, 10 state that they always and 20 almost always come up with ideas to improve the work.

Analyzing the data obtained, it can be identified that, in general, there are always between 7 and 10 students in the ICT group who excel more than the rest of the group and this is a case.

It can be inferred that in the future ideas for improvement should be proposed so that the rest of the group can develop skills and can propose ideas in the work that is developed.

13.- Do you perform your part of the work on time in the agreed terms?



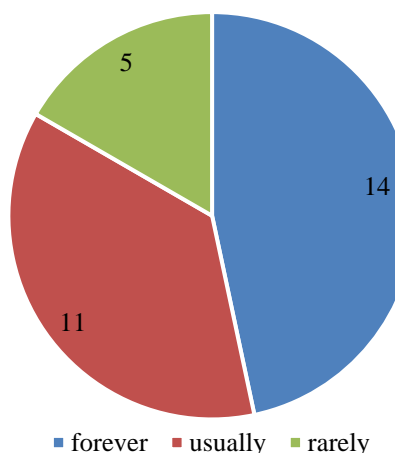
Graphic 35 Represents the answer to question 13 of checklist 2

In the answer to question number 13 of checklist 2 addressed to ICT engineering students, 21 students state that they perform their part of the work on time and 6 almost always.

By analyzing the data obtained, it can be identified that in this group there are students who work from 6 to 10 students who worked this semester.

To which it can be inferred that in the future most of the students will be able to participate on time in the assigned works since the majority manifest it.

14.- Do you perform research projects favorably?



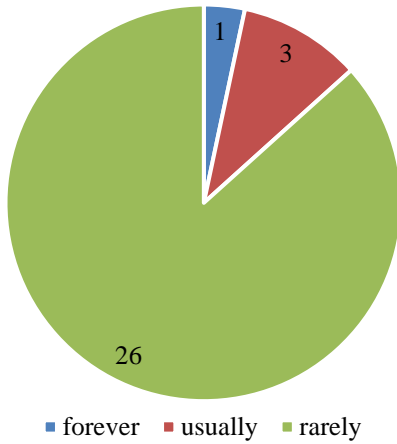
Graphic 36 Represents the answer to question 14 of checklist 2

In the answer to question number 14 of checklist 2 addressed to ICT engineering students, 14 always perform their research project favorably, 11 almost always and 5 students seldom.

Analyzing the data obtained, it can be identified that this indicates that most of the students achieve the objective of research projects.

It can be inferred that in the future all students will participate in such projects.

15.- Do you participate in extracurricular academic activities?



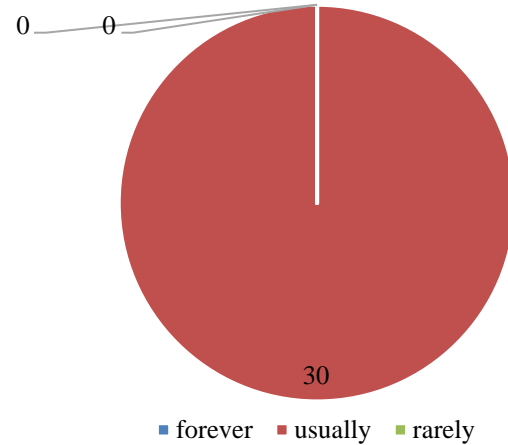
Graphic 37 Represents the answer to question 15 of checklist 2

In the answer to question number 15 of checklist 2 directed to ICT engineering students, 26 students out of 30 stated that they rarely participate in extracurricular events, 3 almost always and 1 always.

Analyzing the data obtained, it can be identified that this is due to the profile of the career, in general they are students who do not participate in these events.

It can be inferred that in the future there should be seminars on administrative and managerial skills so that they can interact and participate more in these events.

16.- Do you perform favorably the activities arranged?



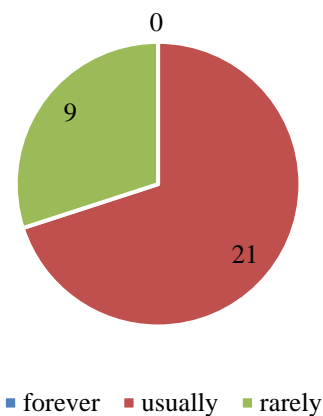
Graphic 38 Represents the answer to question 16 of checklist 2

In the answer to question number 16 of checklist 2 addressed to ICT engineering students, the 30 students state that they almost always comply with what is assigned to them.

By analyzing the data obtained, it can be identified that the students are responsible and comply with what is assigned to them.

To which it can be inferred that in the future it will not be difficult for them to fulfill the assigned activities.

17.- Do you carry out your work with a good level of quality?



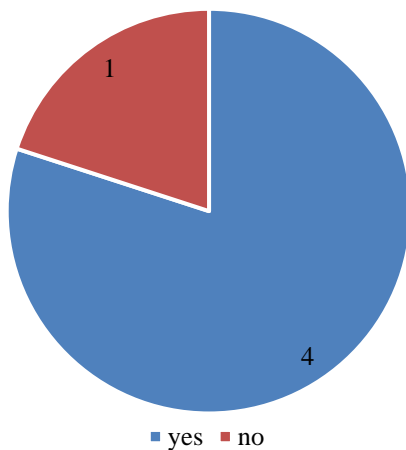
Graphic 39 Represents the answer to question 17 of checklist 2

In the answer to question number 17 of checklist 2 addressed to ICT engineering students, 21 students out of 30 state that they do their work with quality and 9 rarely.

By analyzing the data obtained, it can be identified that this is due to the fact that they meet the requirements that the teacher requests, they comply as far as possible and those who do not fully comply, it is due to external factors such as work or business. personal.

To which it can be inferred that in the future the teacher must design an evaluation instrument where the evaluation criteria are well established with delivery time, methodological specifications and content of the work to be delivered.

Illustration 45 Checklist 3 Computer Laboratory Technicians



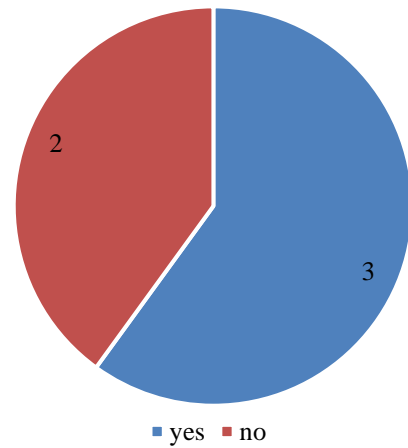
Graphic 40 Represents the answer to question 1 of checklist 3

In the answer to question number 1 of checklist 3 addressed to computer laboratory technicians, they state that 4 laboratories have computer equipment and 1 does not.

By analyzing the data obtained, it can be identified that this is due to the change of electrical wiring that is carried out in a computer laboratory.

To which it can be inferred that in the future there will be 5 laboratories in good condition.

2.- Does it have an image projector?



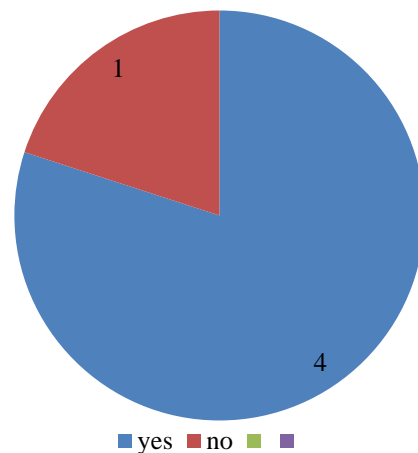
Graphic 41 Represents the answer to question 2 of checklist 3

In the answer to question number 2 of checklist 3 addressed to computer lab technicians, they state that 3 of 5 computer labs have a projector.

By analyzing the data obtained, it can be identified that 2 projectors are under repair.

From which it can be inferred that in the future there will be 5 computer labs with independent projectors.

3.- Does it have a digital screen?



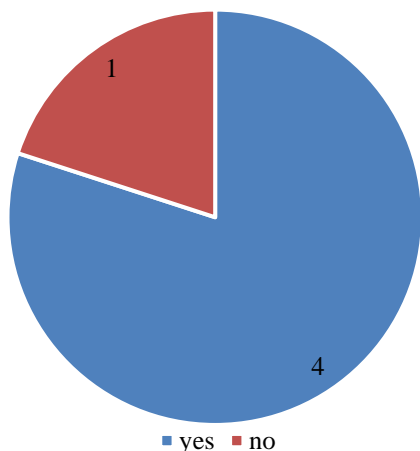
Graphic 42 Represents the answer to question 3 of checklist 3

In the answer to question number 3 of checklist 3 addressed to computer lab technicians, they state that 4 labs out of 5 have a digital screen.

By analyzing the data obtained, it was possible to identify that the screen of the fifth laboratory is in the process of being purchased.

From which it can be inferred that in the future there will be 5 fully equipped computer labs.

4.- Does it have an audio system?



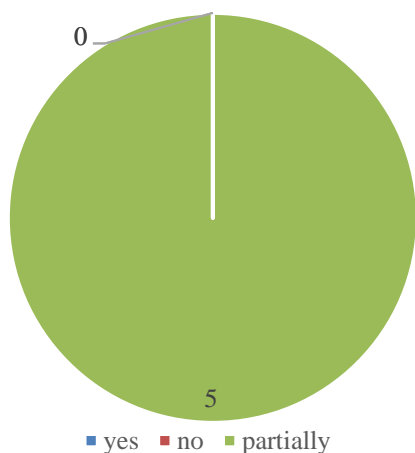
Graphic 43 Represents the answer to question 4 of checklist 3

In the answer to question number 4 of checklist 3 addressed to computer lab technicians, they state that 4 out of 5 computer labs have an audio system.

By analyzing the data obtained, it can be identified that the installation of the sound system in the fifth laboratory is in process.

From which it can be inferred that in the future there will be 5 fully equipped computer labs.

5.- Do you carry out research on virtual library databases?



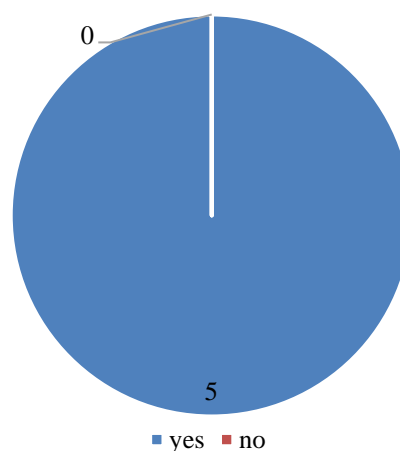
Graphic 44 Represents the answer to question 5 of checklist 3

In the answer to question number 5 of checklist 3 addressed to computer laboratory technicians, they state that they partially use the computer equipment in the laboratories to consult digital libraries from school.

Analyzing the data obtained, it can be identified that young people visit virtual libraries from home or work.

To which it can be inferred that in the future students will develop more skills for managing virtual libraries, without the support of the teacher.

6.- Do you have a wired internet system?

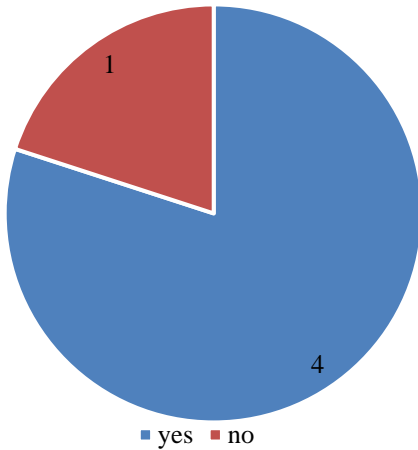


Graphic 45 Represents the answer to question 6 of checklist 3

In the answer to question number 6 of checklist 3 addressed to computer lab technicians, they state that the 5 labs have wired internet.

By analyzing the data obtained, it can be identified that the laboratories have network facilities in good working order for the students. To which it can be inferred that in the future students will be able to take their class without internet connection problems.

7.- Do you have a wireless internet system?



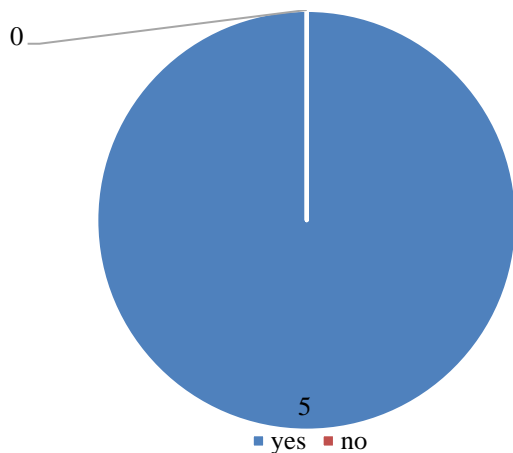
Graphic 46 Represents the answer to question 7 of checklist 3

In the answer to question number 7 of checklist 3 addressed to computer lab technicians, they state that 4 out of 5 computer labs have wireless internet.

By analyzing the data obtained, it was possible to identify that the antennas to provide wireless internet in the fifth laboratory are in the process of being purchased.

From which it can be inferred that in the future there will be 5 fully equipped laboratories.

8.- Does it have sufficient electrical connections?



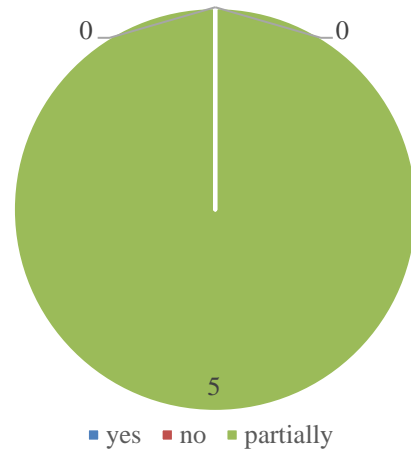
Graphic 47 Represents the answer to question 8 of checklist 3

In the answer to question number 8 of the checklist addressed to computer laboratory technicians, they state that the 5 laboratories have sufficient electrical installations.

Analyzing the data obtained, it can be identified that there are connections for laboratory computer equipment and 7 laptops.

To which it can be inferred that in the future, if the equipment installed in the laboratories does not reach and if a student arrives with his laptop, he will be able to connect it and join the class without problem.

9.- Do you have an online academic management system?



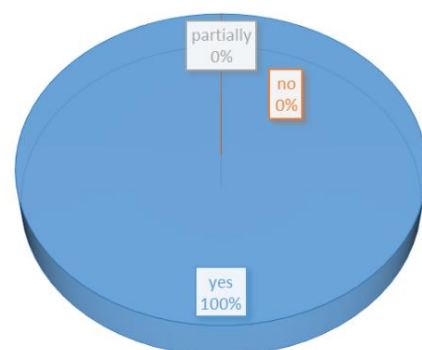
Graphic 48 Represents the answer to question 9 of checklist 3

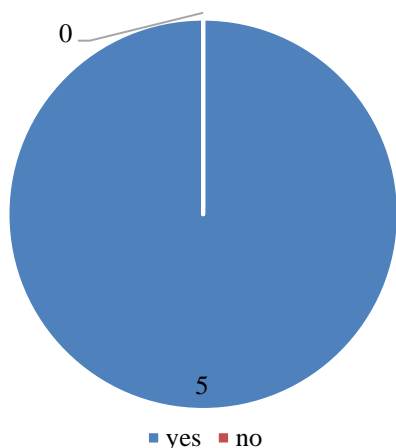
In the answer to question number 9 of checklist 3 addressed to computer laboratory technicians, they state that academic management is partially carried out in the laboratories.

Analyzing the data obtained, it can be identified that when they access the systems in the laboratories, they access the academic management systems depending on where they have tutoring and advising sessions.

To which it can be inferred that in the future students will be able to access from anywhere once the tutoring systems are outside the school intranet.

10.- Do you have access to the virtual platform?





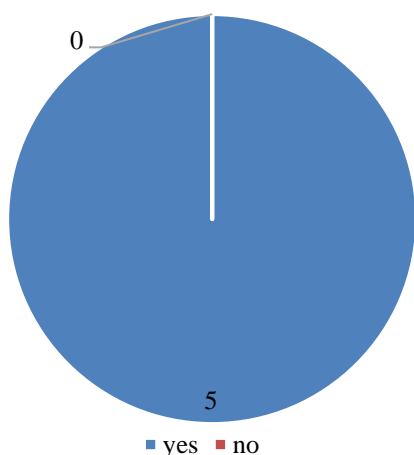
Graphic 49 Represents the answer to question 10 of checklist 3

In the answer to question number 10 of checklist 3 addressed to computer lab technicians, they state that in the 5 computer labs they can access the virtual platform.

By analyzing the data obtained, it can be identified that access to the virtual platform is already outside the school's intranet since they can access it from their homes or jobs, or mobile devices at all times.

To which it can be inferred that in the future they will be able to be in line with all the processes that are related to the attention of the students.

11.- Do you have access to virtual libraries?



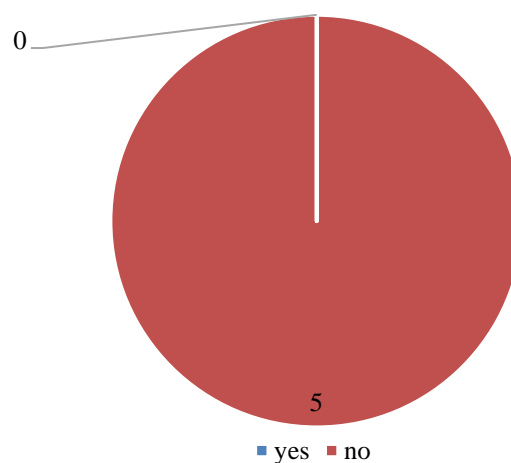
Graphic 50 Represents the answer to question 11 of checklist 3

In the answer to question number 11 of checklist 3 addressed to computer lab technicians, they state that they do have access to the 5 labs.

By analyzing the data obtained, it can be identified that, by having access to virtual libraries, students will have more sources of information and will be able to better develop their research work.

To which it can be inferred that in the future B-Learning education can be better developed at UTS.

12.- Do you have an institutional repository to host and consult research?



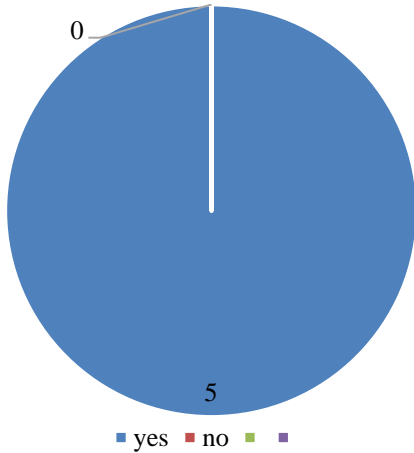
Graphic 51 Represents the answer to question 12 of checklist 3

In the answer to question number 12 of checklist 3 addressed to computer lab technicians, they state that there are no repositories for student access in any lab.

Analyzing the data obtained, it can be identified that the reference repository is in a library on CD, where the student can have access to it as if it were a physical book, which must be returned after three days of consultation.

To which it can be inferred that in the future there will be an internet portal where all the final works of Higher University Technician and Engineering can be hosted.

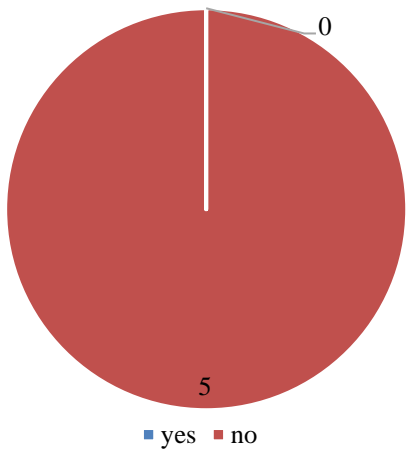
13.- Do you have institutional mail for teachers?



Graphic 52 Represents the answer to question 13 of checklist 3

In the answer to question number 13 of checklist 3 addressed to computer lab technicians, they state that in the 5 labs teachers can check institutional mail.

14.- Do you have institutional mail for students?



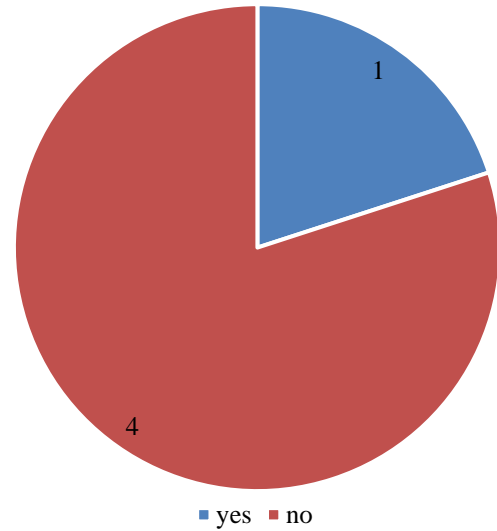
Graphic 53 Represents the answer to question 14 of checklist 3

In the answer to question number 14 of checklist 3 addressed to computer lab technicians, they state that the students do not have institutional mail.

When analyzing the data obtained, it can be identified that the students do not have institutional mail, but they do have personal mail, which can also be used to communicate with tutors, classmates and teachers.

When making an inference about the future of this questioning, the institutional mail, in his case, would be for group leaders or students who are in research groups with teachers.

15.- Are virtual forums or conferences held to share knowledge?



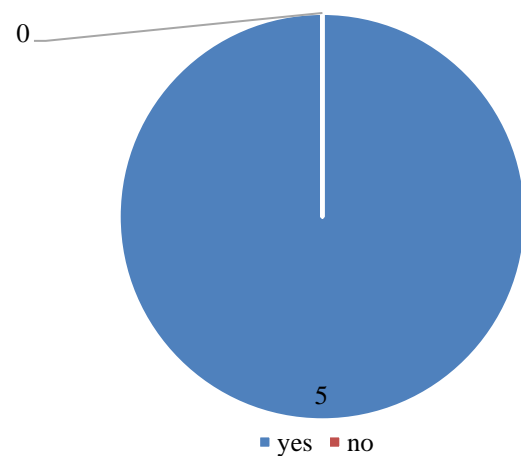
Graphic 54 Represents the answer to question 15 of checklist 3

In the answer to question number 15 of checklist 3 addressed to computer lab technicians, they state that virtual conferences are held and when they are held, it is done in a laboratory, because it is larger.

Analyzing the data obtained, it can be identified that virtual conferences can also be held in the rest of the laboratories, which are held on minimal occasions in groups divided in half.

From which it can be inferred that in the future a larger and more spacious audio visual laboratory or classroom can be designed for this type of event so that each user arrives with their laptop and connects if necessary.

16.- Do students have mobile technological resources?



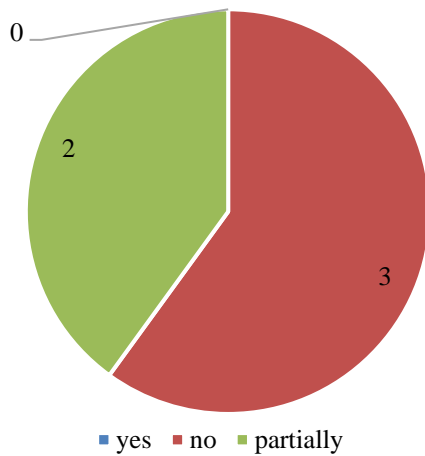
Graphic 55 Represents the answer to question 16 of checklist 3

In the answer to question number 16 of checklist 3 addressed to computer lab technicians, they state that students can use their devices in the 5 labs.

When analyzing the results obtained, it can be identified that the laboratories have the necessary technology for access and management of technological tools that students can use for their academic development.

To which it can be inferred that in the future their technology use skills will be more developed and they will not have obstacles to comply with what is requested in class.

17.- Is access to web communities (Facebook, WhatsApp, YouTube) free?



Graphic 56 Represents the answer to question 17 of checklist 3

In the answer to question number 17 of checklist 3 addressed to computer lab technicians, they state that access to web communities is partially free in 2 labs and definitely not in 3.

Analyzing the data obtained, it can be identified that this is due to the fact that the two laboratories where they are allowed to use it freely are research and homework centers that can be used outside of class, either in recess or free time.

To which it can be inferred that in the future students will have more technological skills for the use of social networks and technological tools to carry out their activities in addition to developing social skills through the network.

Discussion

Observing the results shown in graphs of the surveys applied to the students of the Engineering in Information and Communication Technologies career in the ninth semester, the following diagnosis of the problem studied is determined:

The students consider that the application of web resources is a necessity to support the development of the teaching-learning process. Since 27 of 30 students so declared in the survey (Graphic No. 1).

Between 24 and 27 students state that teachers plan activities for the subject in virtual learning environments, they do so with the Moodle Platform (Graphic No. 2, 3 and 4).

Almost all teachers include electronic bibliographic references in their Syllabus, which allows access to this information through electronic devices, in addition there is a balance between 20% physical bibliography and 80% electronic bibliography embodied and used in their lesson plans. (Graphics No. 5 and 6).

Only 21 ICT Engineering students use virtual library databases, although currently the UTS does not have this service, they consult external services (Graphic N° 7).

Between 15 and 28 students affirm that teachers plan and develop academic activities in web resources such as blogs, forums, wikis or chat, this being a significant advance in improving synchronous and asynchronous communication between teachers and students. The most used applications for communication and creation of web communities are Facebook and WhatsApp as well as several GoogleApp tools. (Graphics No. 8, 10 and 11).

Online exhibitions are a significant means to teach classes virtually, but unfortunately not one teacher has used this means to socialize content, this being an important resource to be exploited. (Graphic No. 9).

21 students affirm that teachers apply the M-Learning methodology (mobile learning) This type of methodology includes mobile resources such as: ipads, pocket computers, mobile phones, tablets, smartphones, in the student learning process. This being a paradigm that is gradually gaining strength among the more traditional teachers. (Graph No. 12).

Another strength found is that both teachers and students in most cases use the data cloud (Cloud Computing) as a support to store and share information and other electronic resources, 30 out of 30 students say so. (Graph No. 13)

An important source of consultation are the institutional repositories, which store the theses of Higher University Technician and Engineering graduates from the UTS, 27 out of 30 ICT engineering students say they consult them. (Graph No. 14).

Currently there are countless applications that facilitate the work of depositing information by applying representative techniques such as surveys in research work, these applications use the web as support, Google drive being the most used due to its free software feature. Between 15 and 21 students affirm that they use it, in addition to the research work carried out by the students, they are published in electronic format on web media such as Blogs or Wikis. (Graph No. 15 and 16).

According to the criteria of 15 students, the technological resources (lap top and tablets) that the UTS makes available for the development of activities are insufficient, which makes it difficult for students to access web resources within the university campus. (Graph No. 17).

The 30 students of the ICT engineering group consider that the Internet service that the University makes available to students is insufficient, which means that it is a criterion that must be improved for the sustainability of online educational processes. (Graph No. 18).

Regarding the methodology used by teachers of virtual subjects, 27 students consider their methodology to be good, this requires a review of the methodology applied by teachers to strengthen educational processes in virtual environments (Graph N° 19).

24 students out of 30 consider the process of accompanying teachers to be good, a fact that the students affirm (Graph N° 20). 21 out of 30 students mention that B-learning is a good practice within their academic training, while 9 consider it unsatisfactory. This indicates that the methodology should be reviewed and the details that the students consider unsatisfactory should be adjusted (Graph N° 21).

As the last indicator of this diagnostic descriptive study, it was asked if they consider that the b-Learning methodology improves their academic performance, a response was obtained that considers that their performance improved significantly, adding 27 students who consider it very significantly, evidencing that students who cross subjects Virtual students acquire certain abilities and skills that optimize their performance in academic activities. (Graph No. 22).

With respect to checklist 2 of students and checklist 3 with respect to laboratory technicians, they respond in almost all of the answers that they know and manage information and communication technologies, with respect to technicians they only mention one laboratory temporarily out of service for technical reasons where they report that it is the change of electrical wiring; which indicates that it is feasible to develop the mixed modality project because students, teachers and technicians have the skills to attend to it, apart from the need on the part of the students who declare it verbally that it would be interesting to start that project that would allow them to work and study in a mixed way.

Conclusions

Studying the results, several aspects to improve for the continuation of the Blended learning methodology are demonstrated, however, we think that all b-learning experiences first go through an adjustment process due to different aspects such as: Technological ignorance, the availability of technological resources Internet connectivity, planning and organization of virtual environments, teacher support, clear evaluation criteria, among others, but by strengthening the diagnosed weaknesses, significant progress can be made in the training of professionals using these new educational scenarios.

These new scenarios of education require us to urgently redefine the methodology, strategies, resources, bibliographic sources and contents of the university curriculum, evolving from traditional models to new models in which the teacher is a mediator in the construction of knowledge, a guide that guides you in the use of digital information and provides you with the appropriate tools in order to strengthen the process of teaching and learning.

The evolution of technologies has made Blended Learning a transversal methodology at the service of education, among the most valuable effects it is evident that they allow greater synchronous and asynchronous communication between students regardless of their culture and geographical location and by breaking space-time barriers brings the University closer to students who, due to personal difficulties, would be unable to stay in a traditional face-to-face modality, offering important possibilities for improvement.

Students who use the Blended Learning methodology achieve important skills such as: search, manipulation, editing, publication and distribution of digital resources in various formats and by different means Likewise, association skills are promoted for cooperative and collaborative work supported by web resources such as social networks, forums, wikis, among others, favoring an amazing dynamic in the generation of new knowledge.

The use of Blended Learning resources significantly improves the means of communication by transversally supporting all the academic and scientific areas of the Universidad Tecnológica del Sur de Sonora, allowing access and integrity of the information resource, as well as optimizing physical resources used in the traditional face-to-face training lastly, we are aware of the role of Higher Education institutions in the gearing of the development plan that requires Universities to see the same horizon in the training of professionals with high performance skills framed in quality; for which, the support in all usable technological resources is formed in an obligation that includes all the actors in this process, approving education as the main path towards competitive, social and human development.

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Fintech, the digital age of financial services

Fintech, la era digital de los servicios financieros

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Abstract

Coexistence with technology has become part of daily life, the advantages of its use have spread to different disciplines such as finance, this evolution is part of the emergence of companies called Fintech (Financial Technology), a term that unifies Finance with technology, and that promotes the development of services and products that includes technological innovation to provide financial services, in a practical way and with easy access to people, companies or government. Fintech companies follow a customer-focused methodology, developing technological solutions according to the needs of their users and the current trend of the digital market, their most common products are focused on: means of payment and transfer, infrastructure for financial services, credits digital, personal finance, business finance, crowdfunding, disruptive financial entities, cryptocurrencies, Blockchain, and InsurTech. The objective of this article is to analyze the products offered by Financial Technologies (Fintech) in the design of solutions for companies or independent users in their inclusion in the use of technology-based financial services, taking as a normative reference the antecedents of the Law for Regulate Financial Technology Institutions (LRITF) in Mexico.

Finance, Fintech, Technology, Customer focus, Financial services

Resumen

La convivencia con la tecnología se ha convertido en parte de la vida diaria, las ventajas de su uso se han extendido a diferentes disciplinas como las finanzas, esta evolución es parte del surgimiento de empresas denominadas Fintech (Tecnología Financiera), término que unifica las Finanzas con la tecnología, y que promueve el desarrollo de servicios y productos que incluye la innovación tecnológica para brindar servicios financieros, de forma práctica y de fácil acceso a personas, empresas o gobierno. Las Fintech siguen una metodología de enfoque al cliente, al desarrollar soluciones tecnológicas de acuerdo a las necesidades de sus usuarios y la tendencia actual del mercado digital, sus productos más comunes se centran en: medios de pago y transferencia, infraestructura para servicios financieros, créditos digitales, finanzas personales, finanzas empresariales, Crowdfunding, entidades financieras disruptivas, criptomonedas, Blockchain, e InsurTech. El presente artículo tiene como objetivo analizar los productos que ofrecen las Tecnologías Financieras (Fintech) en el diseño de soluciones para empresas o usuarios independientes en su inclusión en el uso de servicios financieros de base tecnológica, tomando como referencia normativa los antecedentes de la Ley para Regular las Instituciones de Tecnología Financiera (LRITF) en México.

Finanzas, Fintech, Tecnología, Enfoque al cliente, Servicios financieros

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† Researcher contributing as first author.

Introduction

The technological transformation of business processes had greater growth in the early 90's when the international financial crisis accelerated the creation of technologies focused on financial services, giving birth to the term Fintech, an English word composed of the words finance and technology (Gallo, 2018). This new financial and technological era allowed economic transactions to take place in less time, challenging traditional financial services to modify their internal processes according to the needs of users (customer focus). In this context, Fintechs came to strengthen the digital era of financial services, presenting solutions in products that disrupt the traditional to a model of technological innovation that is strengthening a more inclusive digital market. Mexico is one of the main countries in Latin America that has adopted Financial Technologies in its banking processes and services, this is manifested in its regulatory framework of the Law to Regulate Financial Technology Institutions (LRITF) published in 2018.

Justification

Technology is an indispensable resource in 21st century companies; its incursion into business processes is a decision that requires knowledge of the environment and general market trends. According to García et al. (2015) implementing technology is more than modern equipment or instruments, it represents the addition of resources that include knowledge, techniques, skills, processes and people that strengthen the economic and financial growth of a company. Technology then, has the capacity to function as a strategic resource in the transformation of products or services, towards the fulfillment of goals and objectives of the company (Hidalgo, 1999). Under this precept, the basis of this research is the Fintech or Financial Technologies model, which refers to the use of Information and Communication Technologies (ICT) in financial services. The conceptual and regulatory framework is supported by the Law to Regulate Financial Technology Institutions (L.R.I.T.F.) published on March 09, 2018 through the Official Gazette of the Federation and amended by Decree in the same media on May 20, 2021 of Mexico (L.R.I.T.F. 2021).

The products and/or services to be investigated are focused on ten main areas of the Fintech business model:

- Means of payment and transfer.
- Infrastructure for financial services.
- Digital credits.
- Personal finance.
- Corporate finance.
- Crowdfunding.
- Disruptive financial institutions.
- Cryptocurrencies.
- Blockchain.
- InsurTech.

Objectives

To analyze the regulatory framework shown by the Law to Regulate Financial Technology Institutions (LRITF) referring to financial services in Mexico provided by Financial Technology institutions.

To establish a theoretical framework regarding the term and characteristics of the main products and/or services of the Fintech model.

Method

A descriptive-exploratory type of study of documentary research method was used with emphasis on the contextualization and analysis of concepts (Tamayo, 2004). The literature review focused on the context of the Fintech methodology and the theoretical analysis of its ten main products described in the justification section. As a result of the theoretical analysis, a conceptual framework of the main Fintech financial solutions and products that are supported by the principles of the Law to Regulate Financial Technology Institutions in Mexico (L.R.I.T.F. 2021) is obtained.

Theoretical Framework

According to Avendaño (2018), Fintech refers to companies that provide financial products and/or services through the use of Information and Communication Technologies (ICT), these may include smartphones, applications, websites, social networks and technology-based platforms. Barrera et al. (2021) identify Fintechs as a business model that challenges the economy to a new digital era that adopts innovation and technology to the financial system, its purpose is to provide users with easily accessible services and products for the use and management of their financial operations. Similarly, Pinto and Montaudon (2021) argue that Fintechs are tools that improve traditional services, use technological innovation as a strategy, through faster and more flexible services, and also reduce costs and focus on the user's needs. Thus, the birth of this industry created tools that combine the use of Information and Communication Technologies with Finance. Its main objective is to automate financial services that are leveraged in newly created business sectors or that have been conditioned by traditional banking (Sanchez, 2016). The new financial and technological era, allowed economic transactions to occur in less time, transforming financial services to Financial Technologies (Pinto and Montaudon, 2021).

The characteristics of Fintech financial services include, giving agile and different solutions (Nicoletti, 2017), as described by Soto (2018) collaborative ways of working, with a focus on disruption (Loza and Reza, 2015), i.e., breaking with the traditional and radical renewal to the creation of new ways of working and services (Lavalleja, 2020); Fintechs are also identified by the inclusion of all audiences, companies, individuals and government that require innovative and technological financial products (Gallo, 2018); efficient and easy-to-use services (Barrera et al. , 2021) such characteristics consolidate what García and Castañón (2016) identify as, a customer-focused methodology, which develops products or services according to the needs of users and the current demands of the financial market.

In this sense, Fintech comprises multiple characteristics that make it a tool, a service, a product, a way of working, a methodology, a business model that combines a comprehensive approach to technological solutions in the area of personal, public or corporate finance.

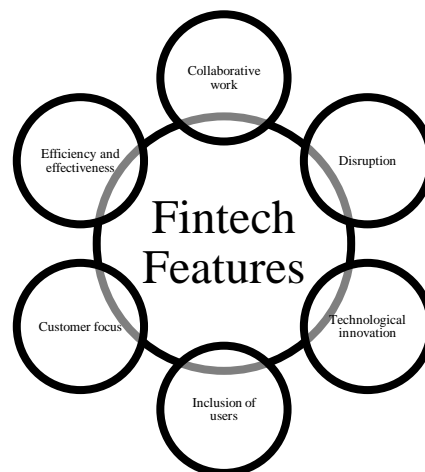


Figure 1 Fintech characteristics

Source: Own design based on Nicoletti (2017); Soto (2018); Loza (2015)

Studies such as those of Zhongqing et al. (2019) have proven the significant acceptance of Fintech services in the market, prioritizing their customer focus and strengthening trust among users who use electronic banking in their operations. In addition Keke et al. (2018) relate the improvement of productive quality and the impact on cost savings with the use of Information and Communication Technologies (ICT) in financial services. Martínez et al. (2021) confirm that recognizing the user as the central model of attention has increased the use and growth of Fintech companies worldwide; likewise, case studies such as Palomino et al. (2019) confirm a process of continuous growth by promoting innovation as a competitive strategy for positioning in the financial services market.

Fintech Law

The growth of Fintech companies in the global economy has created the need to establish a legal framework for protection against the degree of vulnerability, fraud or cyber-attacks that place the financial system at risk, given this possibility it is important to create normative regulations that promote the protection and lawful activity of financial operations (Lavalleja, 2020).

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In this way, a favorable environment for the development of Fintechs and the protection of the different users in the economic-financial market is regulated and promoted.

In Mexico, the Fintech financial model has the legal regularization established in the Law to Regulate Financial Technology Institutions (L.R.I.T.F.) published on March 09, 2018 through the Official Gazette of the Federation and amended by Decree in the same media on May 20, 2021 (L.R.I.T.F., 2021). The purpose of the L.R.I.T.F. is to regulate financial services in Mexico provided by Financial Technology institutions, which includes: organization, operation and functioning of financial services subject to special regulations that are offered or performed by innovative means (L.R.I.T.F. 2021). According to the aforementioned L.R.I.T.F. Law, Fintechs base their operations under a business model that offers innovative financial services to companies, government, or individuals, with the combination of technologies such as mobile payments, business loans, digital finance, etc., these services will allow users to share new forms of digital economic and financial interaction. In this way, the Fintech model allows not only the creation of opportunities, but impacts the reduction of costs, and an accelerated growth of information and secure financial transactions (LRITF, 2021).

In accordance with the provisions of the aforementioned L.R.I.T.F. (2021), the principles that regulate this type of institutions are companies of financial inclusion and innovation, that promote competition, and protect the consumer, while preserving the financial stability of the environment, and prevent illicit operations and technological neutrality. These principles must be monitored by the National Banking and Securities Commission (CNBV), the Bank of Mexico (BANXICO), the National Insurance and Bonding Commission (CNSF), the National Commission of the Retirement Savings System (CONSAR) and the National Commission for the Protection and Defense of Financial Services Users (CONDUSEF) (Gómez, 2022).

Authors such as Urdanivia et al. (2020) recognize that having a Fintech regulation law positions Mexico among the first countries with this type of regulation, offering opportunities to strengthen the financial system in areas such as: the prevention of cybercrime and fraud, transparent disclosure of financial information, operational solvency, detection of vulnerable money laundering activities, creation of trust between consumers and financial institutions, opportunities for domestic and foreign investment in the sector, as well as the inclusion of companies in the formal financial system.

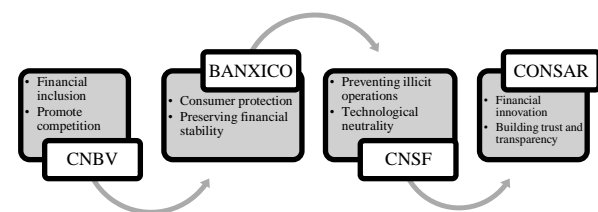


Figure 2 Oversight institutions in Mexico and Fintech principles

Source: Own design based on (L.R.I.T.F., 2021)

With the L.R.I.T.F. regulations, the aim is to provide legal certainty in the regulation of Technological Financial Institutions in the country, where innovation is promoted with emphasis on the transparency and security of the entire Mexican financial system, in addition to giving the possibility to different users to monitor, denounce and demand improvements in digital financial services in a legal manner in the country (Méndez and García, 2018).

The legal framework of the L.R.I.T.F. focuses on the regularization of two types of Financial Technology institutions: Collective Financing Institutions (IFC) and electronic Payment Fund Institutions (IFPE) (Martínez et al., 2021). The Institutions of Collective Financing (IFC) are companies that offer crowdfunding or collaborative, these refer to the creation of a network of people or companies that seek collective financing of projects through platforms such as technological ones (Jiménez and Acosta, 2018), the formation of capital is integrated by the different contributions collected, a financing alternative (Davara et al., 2019).

On the other hand, electronic Payment Fund Institutions (IFPE) comprise companies that develop technology, such as their own electronic payment systems, which include the issuance, administration, and transmission of electronic payment funds or by any other means of electronic communication (Galán and Venegas, 2016). Both types of Financial Technology Institutions, are distinguished in the L.R.I.T.F. specifying their regulatory framework on general provisions, conceptual delimitation, organization, functions, obligations, authorization requirements, supervision, suspension, sanctions, among other aspects of a legal and fiscal nature.

Table 1 details the legal structure of the Law to Regulate Financial Technology Institutions (L.R.I.T.F.).

| | |
|---|---|
| Title I. Preliminary provisions | |
| Title II. FTTs and their Operations | |
| | CHAPTER I. Collective Financing Institutions CHAPTER II. Of Electronic Payment Fund Institutions CHAPTER III. Operations with Virtual Assets |
| TITLE III. General Provisions | |
| | CHAPTER I. Authorization CHAPTER II. Operation of the ITFs CHAPTER III. Suspension and Revocation of the Authorization to Operate as a FTT. CHAPTER IV. Inspection, Surveillance and Exchange of Information. CHAPTER V. Trade Associations. |
| TITLE IV. Temporary Authorizations and Operation with Virtual Assets | |
| | CHAPTER I. Authorization of Novel Models CHAPTER II. On Novel Models in Regulated Entities. CHAPTER III. On the Operation of Financial Institutions with Virtual Assets. CHAPTER IV. Other Obligations and Revocation of Temporary Authorizations. |
| TITLE V. Financial Innovation Group | |
| TITLE VI. Penalties and Offenses | |
| | CHAPTER I. Administrative Penalties CHAPTER II. Offenses |
| | <i>Section One.</i> Procedural Requirement and Statute of Limitations. <i>Section Two.</i> Crimes for the Protection of the Patrimony of the Clients of the FTTs and of the Companies Authorized to operate with Novel Models. <i>Section Three.</i> Crimes against the adequate operation of the ITFs, or of the Companies Authorized to operate with Novel Models. <i>Section Four.</i> Crimes for the Protection of the Patrimony of the ITFs and of the Companies Authorized to operate with Novel Models. |
| TITLE VII. Notifications | |
| | Transitory Provisions Statement of Reasons |

Table 1 Legal Structure of the Law to Regulate Financial Technology Institutions (L.R.I.T.F.)
Source: Own elaboration based on (L.R.I.T.F., 2021)

Technological Financial Institutions in Mexico have had a substantial scale of growth; emerging enterprises find in the regulatory framework a protection and diffusion of new technologies in financial services (Martínez et al., 2021). According to data published by the National Institute of Statistics and Geography (INEGI), MSMEs represent more than 90% of the companies in the country, contributing 52% of the total GDP, where only 25% of them remain in operation for the first two years; these indicators show an opportunity to include this business sector in the margin of its representation for the economic and financial growth of Mexico. The Fintech business model is key to ensure that this population of emerging companies continues its development and strengthens its structure with technology-based financial services while at the same time boosting the strengthening of the financial system (Lavallega, 2020). In this regard, the Inter-American Development Bank (IDB), conducted a comparative Fintech regulation research in the countries of Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay, and the European Union, where it was shown that the different regulatory developments in these jurisdictions are usually controlled by the Central Bank of each country, keeping in common less demanding regulations to MSMEs with the aim of stimulating collaborative participation, and boosting their own competitiveness (Diehl and Lava, 2020).

Results

Within the objectives of this research, the following section presents the characteristics of the main products and/or services of the Fintech model.

Main Fintech products and services

According to Pinto and Montaudon (2021) the Fintech classification arises mainly around the growth of Information and Communication Technologies (ICT) as well as, the generation of opportunities in business and personal segments. It is also possible to classify Fintechs based on a series of questions, in this sense, Nicoletti (2017) analyzes Why was the Fintech created, for whom was it created, What service does it intend to provide, Who will be its users, Where and when will it be established, and How will it work?

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Likewise, Pinto and Montaudon (2021) identify the Fintech model according to the activities of corporate finance management, and personal finance, electronic means of payment, digital loans, crowdfunding, electronic money, and different mobile applications in the finance environment. Figure 3 shows the products offered by the Fintech business model according to ten main areas.

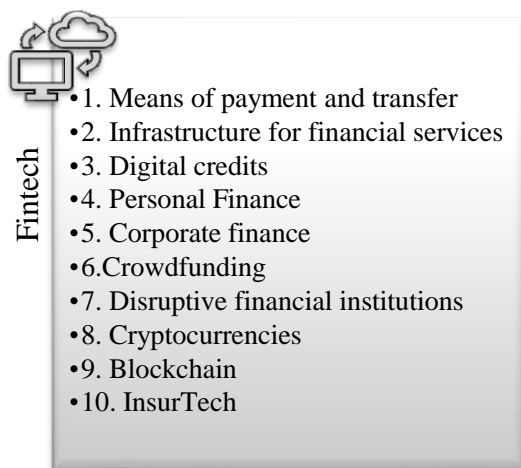


Figure 3 Main Fintech products

Source: Own design based on Nicoletti (2017) and Pinto and Montaudon (2021)

Means of payment and transfer

Means of payment are classified according to their importance in the economy as high value or low value, the Central Banks of each country are responsible for regulating this type of transmission mechanisms, the objective is to promote the stability of electronic means of payment and generate efficiency in the use of money (Galán and Venegas, 2016). In this regard, Soto and Botía (2020) argue that, means of payment and transfer are the most used Fintech services by seeking to reduce the use of cash with digital alternatives that preserve an environment of availability and communication between financial operations. The operating mechanism consists of services to make payments and transfer money, its mission is to generate instant and real-time cash flows (Nicoletti, 2017). The most common products include digital wallets, web platforms, interbank transfers and applications with smartphones. In addition, this type of product promotes market linkage with consumers who need to make secure payments, while offering opportunities for scale growth and cost reduction (Frost et al., 2021).

That is why means of payment and transfer represent the fastest growing Fintech in the global financial sector, the opportunities that technology brings to this sector drive emerging economies and their inclusion in the financial system (Soto and Botía, 2020).

Infrastructure for financial services

Facilitating the management of finances through the use of technology is one of the objectives of financial inclusion, in this sense, Fintech companies emerge, entities that create or strengthen new or existing technological infrastructures (García and Castañón, 2016). It is through arduous research of the financial market, knowledge of user needs and the establishment of regulatory frameworks, that a Fintech infrastructure ecosystem is formed that transforms the traditional physical market into a digital market. The objective of the infrastructure for financial services is to provide banking or other institutions with solutions to services that they cannot cover in a traditional way due to costs or physical barriers (Madrado et al., 2019).

Digital credits

Digital credits are another great solution of Fintech companies, it includes people or businesses in the granting of credits that have not been accepted in traditional banking. These Fintech have the vision of giving access to credit to users who have not had banking inclusion, the requirements or scores of credit bureaus have limited participation to a specific sector, through digital credits financial inclusion is promoted and financial inequality is reduced (Berg et al., 2020). Digital credits grant loans virtually and without intermediaries, the process works with a Fintech connection between the borrower and lender that uses technology and data in its favor to calculate the risk of the operation while charging a commission to users for its intervention (Madrado et al., 2019). In this regard, it is a means of credit opportunity for MSMEs and individuals who, due to their profile, could not access financing in a traditional financial institution (Lavallega, 2020).

Personal finance

Participation in Fintech personal finance, works in the development of digital tools that help the management of the use of money for savings and smart investment (Madrazo et al., 2019). In addition, it allows users to generate better decision criteria in the control of their finances, these tools are digital media that can be found in mobile applications, simple and easy to access, its mode of operation is that users set financial goals to control spending, savings, investment and debt (Finnovista and IDB, 2017). Similarly, having financial technology in personal segments, promotes basic and advanced knowledge of finance, therefore, accurate decision making sustains the financial system (Aggarwal, 2021).

Enterprise finance

Fintech companies continuously challenge the traditional financial system to generate new business segments, such is the case of technology services and/or products focused on corporate finance. According to Madrazo et al. (2019) Fintechs in the corporate finance segment aim to make it easier for SMEs to manage their financial resources, prioritizing financial growth goals and the fulfillment of commitments. In this sense, the management of business finances allows increasing productivity and efficiency of business methods through the automation and digitization of processes such as: information analysis, electronic invoicing, digital accounting, report generation, collection systems and solutions for the safeguarding and protection of information (Rodríguez and Morales Rodríguez, 2018). In this regard, Fintechs for corporate finance management have played an important role in the growth of companies that have not had access to traditional banking, by allowing greater formalization of their finances and the possibility of accessing means of financing (Finnovista and IDB, 2017).

Crowdfunding

The limitations in the traditional financial system to access financing mechanisms, has been an operating opportunity to offer collaborative tools that decrease or completely close the inequality in the financial sector.

In this context, Fintech crowdfunding companies promote collective financing by being a platform for generating funds rather than debt (Finnovista and IDB, 2017). This type of segment values the development of ideas and the creation of projects that have altruistic purposes or capital generation, through, alternative sources of financing (Madrazo et al., 2019). The crowdfunding model is then a collective financing mechanism of monetary funds, which is promoted through the internet and technological platforms in order to attract financial resources for the financing of a lucrative project or philanthropy, its mechanism of action is formed by three collaborators: the creator of the project, the investor and the Fintech platform (Ménez et al., 2017). This is why crowdfunding represents a specialized technological solution that is becoming increasingly accepted by individuals and especially by MSMEs by providing them with liaison relationships and financial collaboration.

Disruptive financial institutions

Given the need to offer more viable and accessible financial services, the development of technologies that transform banking services into more agile, efficient and less costly processes is stimulated. Automation contributes to productive efficiency (Nagao, 2021). In this sense, disruptive financial institutions are all those that have chosen to improve their internal processes to migrate to digital services that meet the current needs of users, with this change is intended to automate processes, strengthen the relationship with customers and improve productivity. According to Lavalleja (2020) a disruptive service uses technology as a means of opportunity to provide new or better services, at lower costs, this disruption forces traditional banks to update their products and remain competitive. Disruptive Fintech solutions incorporate digital services and virtual platforms that are perceived as more accessible and simple, this acceptance allows market growth (De Groot et al., 2020).

Cryptocurrencies

It is one of the most innovative segments of the Fintech Model, cryptocurrencies, is virtual money, which operates as a means of exchange of virtual assets (Avendaño, 2018). Its creator goes by the pseudonym of Satoshi Nakamoto, who introduced the first cryptocurrency called Bitcoin in 2009 (Fernández, 2021). Virtual money has spread throughout almost the entire global financial system, largely because it does not have a central body that intervenes in its control, which has allowed it to circulate as an alternative to traditional money (Lavalleya, 2020). According to Blanco (2021), their mode of operation meets the following characteristics: they have a global presence, they operate in a virtual market based on mathematical algorithms, there is no controlling body or bank, their algorithm preserves high levels of security that make them unforgeable, transactions do not require intermediaries, their exchange is possible with other cryptocurrencies or traditional money, it preserves the anonymity of users by employing blockchains. However, Pilacuán et al. (2021) argue that its low regulatory control implies a high investment risk, so its commercial operations do not have certain legal protection for its consumers.

Blockchain

With the creation of cryptocurrencies or virtual currency, Blockchain technology arises, which translated into Spanish is known as: cadena de bloques (Lavalleya, 2020). This type of technology is derived from a connection with virtual currency, essentially blockchain works as an internal database that records each of the transactions of the cryptocurrency, storing a kind of chained record containing information of all participants, through this kind of logbook substantially reduces time and costs, making it possible that there are no intermediaries of provision, nor modifications in its structure that make relatively safe its circulation (Nicoletti, 2017). Blockchain has a greater potential than virtual currency alone. According to Soto and Botía (2020), the blockchain mechanism can be applied to commercial activities, contract management, virtual assets, authentications, registration, validation and data transfer, generally, to any segment that can be referenced in digital format.

InsurTech

As another innovative segment of the Fintech methodology, InsurTech arises, the term is formed from the union of the English words: insurance and technology (Chavero, 2020). The InsurTech origin comes from the insurance industry and its fusion with the use of technology to offer solutions in innovative products or services focused on different sectors. The InsurTech advantages include increased productivity and reduced operating costs; the direct contact of traditional insurance disappears, since the physical presence of agents is not indispensable when working on virtual platforms (Vigil, 2020). The characteristics of virtual insurance focus on three strategies: always being available, i.e., its online mechanism allows you to contract and manage insurance through the use of virtual platforms or smart devices; the management of data volume or big data, which works as a tool for managing behavioral patterns based on the information of its consumers; and artificial intelligence (AI), a technological mechanism that manages online customer service (SafeLink, 2021).

Conclusions

The use of technology has been present in the daily life of human beings, becoming the fundamental element of their own evolution. Nowadays, the lack of technology in the business environment limits integral development, makes it difficult to achieve objectives in sales processes or production of goods and/or services, and also reduces market share. In this sense, the Fintech business model joins the digital era that incorporates Information and Communication Technologies to create new products or improve existing services of the traditional financial system. From this perspective, Fintech or Financial Technologies seek to automate processes and make resources more efficient in the creation of goods and services that meet the needs of individuals, as well as those of companies and the Government. This exchange of benefits generates more efficient value chains that are reflected in more productive and innovative financial markets. The Fintech business model is identified as a tool, a service, a product, a platform, a customer-focused methodology that prioritizes the satisfaction of user needs in the financial market.

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The main Fintech products have increased their demand in users who prefer agile, flexible and lower cost services, among the options available in the market are, payment and transfer means, infrastructure for financial services, digital credits, personal finance, corporate finance, Crowdfunding, Disruptive financial entities, cryptocurrencies, Blockchain, and InsurTech. As a result of disruptive innovation Fintech has not only caused traditional banking to be transformed in its operational forms, but has opened up the participation of more sectors that had been excluded or conditioned in the financial market. Faced with this continuous growth, the need arose to create regulatory frameworks that support the general provisions of conceptualization, organization, function, obligation, authorization requirements, supervision, suspension, sanctions, among other legal aspects that protect consumers and the market. Mexico is one of the countries that have had greater initiative in creating legal regularization rules, such is the case of the Law to Regulate Financial Technology Institutions (L.R.I.T.F.) published in 2018 and reformed in 2021 in the Official Gazette of the Federation. These regulatory initiatives have maintained the margin of protection and vulnerability generated by operating in a technological financial market.

The current market trends and the continuous needs of users will continue to be the main reasons for the growth of the Fintech model, the next generation of Financial Technologies has at the door a framework of opportunities to continue strengthening a means of knowledge exchange in the creation of attractive, innovative, more powerful and lower cost technological solutions that unify the traditional financial system with the digital era. Undoubtedly, financial technologies will continue to be a sector in constant growth in the next generations of users who use technology as a means of communication and exchange of information in real time.

Companies and government entities have within their reach these new technologies as a competitive advantage to boost their own growth and also contribute to the economy and development of the country.

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Analysis of the use of the cell phone in the learning process of the students of the superior technique logistics and the superior technique marketing of the UTNA

Análisis del uso del celular en el proceso de aprendizaje de los estudiantes de Técnico Superior Logística y Técnico Superior de Mercadotecnia de la UTNA

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Abstract

The present study is an analysis of the uses that the cell phone has for the support of the students of the Logistics and Marketing careers of the Universidad Tecnológica del Norte de Aguascalientes that seeks to show an overview of the situation of the students in this area. This analysis allows us to observe what are the resources that students take as support to improve their learning in the different subjects they take. The sections that are analyzed in the following pages offer teachers and students a topic for reflection on the significant progress that the use of cell phones has had in the educational field with the students of these careers.

Education, Technology, UTNA, Quality, Cellphone

Resumen

El presente estudio es un análisis de los usos que tiene el celular para el apoyo de los alumnos de las carreras de Logística y Mercadotecnia de la Universidad Tecnológica del Norte de Aguascalientes que busca mostrar un panorama de la situación de los alumnos en este rubro. Este análisis permite observar cuales son los recursos que los alumnos toman como apoyo para mejorar su aprendizaje en las diferentes materias que cursan. Los apartados que se analizan en las siguientes páginas ofrecen a los profesores y alumnos un tema de reflexión, sobre el avance significativo que ha tenido el uso del celular en el ámbito educativo con los alumnos de estas carreras.

Educación, Tecnología, UTNA, Calidad, Celular

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Introduction

This report presents an Analysis of the use of the cell phone in the learning process of the students of the Superior Technique in Industrial Processes of the Universidad Tecnológica del Norte de Aguascalientes.

A survey was conducted to determine the most important parameters to measure on the information of students of the Superior Technique in Industrial Processes.

The results of the survey applied to a sample of 45 students from the generation 2020-2022 are shown below.

This project benefits the Universidad Tecnológica del Norte de Aguascalientes since it allows it to know the most important information about its students in this entry.

Methodology

According to Hernández Sampieri (2010), the study that was applied was a “Quantitative Exploratory” study where a survey-type data recovery tool was used where a series of questions about Superior Technique in Industrial Processes in the use of cellphone, this question were specified and the survey was applied to a large number of our alumni in order to gather data or to detect public opinion on a given matter.

The objective is to evaluate the impact of cell phone use on the learning conditions that students had during the transition from the pandemic, hybrid classes and later face-to-face classes.

Sampling

The type of sampling that was carried out was stratified.

The advantage of this type of sampling is that it tends to ensure that the sample adequately represents the population based on selected variables. It also allows more precise estimates to be obtained and its objective is to obtain a sample as similar as possible to the population in terms of the stratified variable (s).

The results of the survey applied to a sample of 45 students from the generation 2020-2022. The survey was applied from June to September 2021.

Background

The human being can be considered as a permanent learner, considering that even in the activities of less intellectual demand, he requires training, or training, that he had to acquire and develop. It must be considered that in this elementary type of learning, it is carried out almost always unconsciously by the subject who performs it. Intellectual learning in human beings previously requires adequate psychobiological and neurophysiological maturation on the part of the student or scholar. It can be stated that if the individual is not prepared to learn, that is, they do not have the necessary maturity, they will have difficulties during learning.

Once the individual meets the conditions for the development of intellectual work, their ability to learn should no longer have any type of intellectual limitation. Moreover, it is in a position to demand the right to access the goods of education and culture. UNESCO has been advocating for years for continuous learning throughout life, with no limitations other than personal interest or motivation. In a society that is constantly changing, it no longer makes sense to speak of an age of learning that ended with university graduation. Permanent learning is essential, either to acquire the training and learning of the times that you demand, or to satisfy the innate desire to learn, even if it is a compensatory way in adulthood.

Applied learning

There is a clear relationship between learning and application or realization, considering that it is as compliance and verification of what has been learned, rather than as a personal achievement of a series of attitudes and values that the subject develops. The application or realization is considered here as an evaluation of the learning achieved before a specific proposal. Precisely the implementation of a change of attitude is, in some way, the evaluation of it, although without considering the conditions that affect learning: forgetfulness, fatigue, etc., or aspects such as attitudes, ideals or interests.

Another consideration to be made is the relationship between learning and the context in which it takes place; it is the undeniable social condition of the individual that involves a series of conditions of all kinds with the environment in which they are immersed.

From childhood, the citizen has to accommodate their behaviors to various conventional forms that are, more or less, dictated by the family and social environment that have to do with the personal or the subjective. Society, in short, will evaluate them and the result of this evaluation will result in the qualification of accepted or rejected, the consequence of this last qualification being the marginalization of the individual, from which they will be given the opportunity to change, but always having taken into account the objectives set by the company. It is about the permanent interaction between the individual and the community, or between the person and society: we are, in part, what our circumstances are.

Purposes of human learning

The great purposes of education can be explained around three fundamental areas of every human being: personal environment, cultural environment, and social environment.

1. Personal sphere: knowing oneself, one's own capacities, the way of adapting and fitting into society, the way of satisfying one's own needs within the socially established framework, the development of one's potentialities and aspirations, etc.
2. Cultural field: learning to function, not only in the physical environment, but especially in the part of the environment made by him through knowledge of language, numbers, technology, customs and traditions.
3. Social sphere: know how society works in its great manifestations of economy, politics, governments, religion, coexistence and tolerance, democracies and human rights, constitutional values of citizenship, etc.

These fundamental objectives can be explained with the acquisition of knowledge, skills and attitudes in relation to all branches of knowledge.

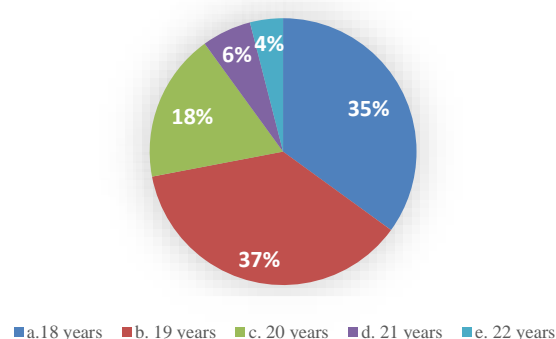
Results

The results of the survey applied to a sample of 68 students of the 2020-2022 generation on the use of cell phones in the educational process during the pandemic and the hybrid classes and later the face-to-face classes are shown below.

Results and discussion

1. Age

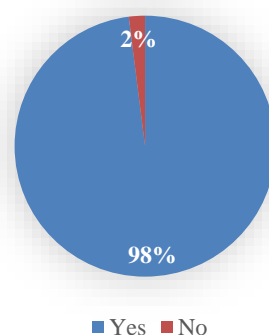
The age of the surveyed students ranges between 18 and 22 years.



Graphic 1 Age of the surveyed students

2. Do you use the cell phone as a support in your studies?

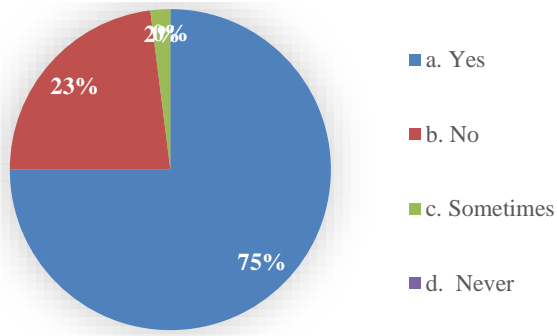
In the survey of students of business careers, 98% of those surveyed answered that they use the cell phone as support in their studies, while 2% commented that they do not use it.



Graphic 2 Use the cell phone as a support in your studies

3. Do you consider that the cell phone facilitates your study?

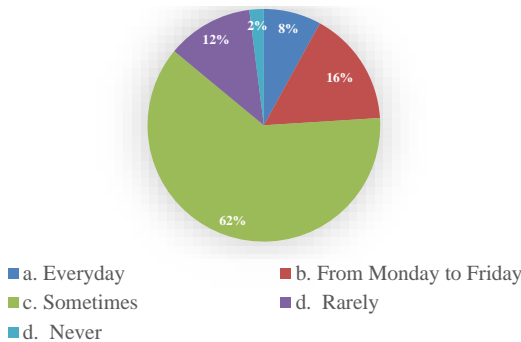
Regarding the question of whether the student considers that the cell phone facilitates their studies, 75% of the students surveyed answered that it does facilitate their studies, 23% answered no and 2% said that sometimes.



Graphic 3 Percentage of students consider that the cell phone makes their studies easier

4. *Do you use the cell phone for "Comprehension reading of some of your classes"?*

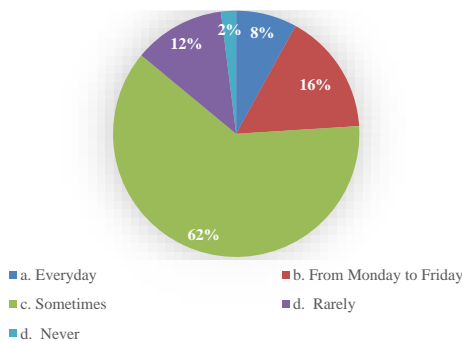
During the survey, students reported that 62% sometimes use the cell phone for reading comprehension in some of their classes. 16% say that if they use it from Monday to Friday, 12% reported rarely, 8% said daily, and 2% reported never.



Graphic 4 Use of cell phone for Comprehension reading of some of the classes

5. *Do you use the cell phone to "process any of your work in class"?*

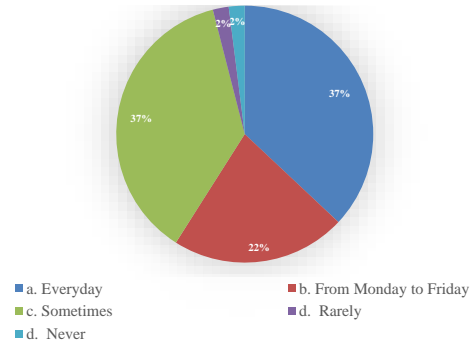
62% of the students answered that they sometimes use the cell phone to process some work in class. While 12% of the students answered that they rarely used it.



Graphic 5 Use of cell phone for process any work in class

6. *Do you use the cell phone for the "investigation of a specific topic that one of your teachers left you"?*

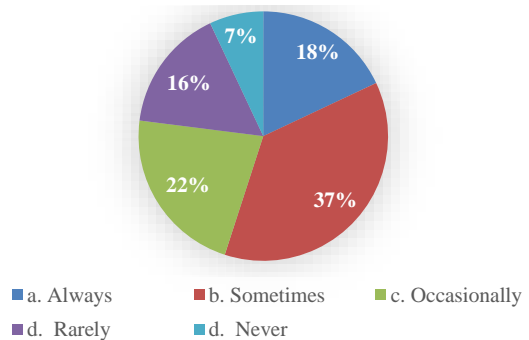
In this question, 37% of the students surveyed commented that they use the cell phone daily for research on a specific topic. In contrast to 37% who said that they sometimes use it, while 22% mention that they only rely on the cell phone to investigate from Monday to Friday.



Graphic 6 Use of cell phone for investigation of a specific topic that one of the teachers left them

7. *Do you use the cell phone for "support in any of your school presentations"?*

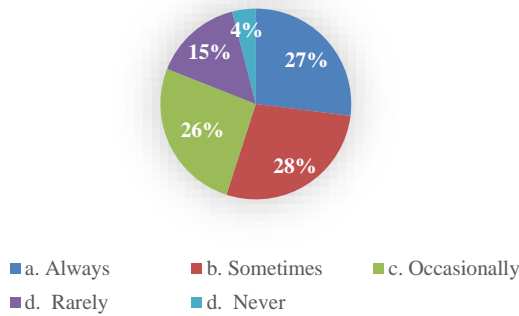
A very common case today is that students make their presentations with the support of the cell phone, reading the key information of the cell phone presentation. For this answer, the students answered that 18% always use the support cell phone during their presentations, 37% answered that sometimes, 16% answered that rarely, 22% answered that occasionally, while only 7% answered that they are never.



Graphic 7 Use of cell phone in support in some school presentations

8. Do you use the cell phone to "perform some mathematical calculations on a specific problem."?

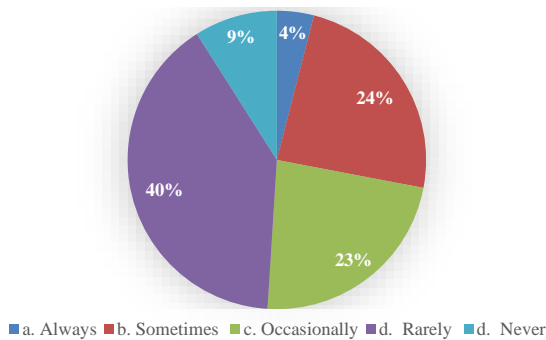
Another use that student give to the cell phone for support during their classes is to perform mathematical calculations for the subjects that require it. To this question, the students responded that 27% always use their cell phones for this operation, while 28% said rarely, 26% said occasionally, 15% rarely and 4% said they never use it. to do mathematical calculations.



Graphic 8 Use of cell phone for perform some mathematical calculations on a specific problem

9. Do you use the cell phone for the "see classes that have already passed"?

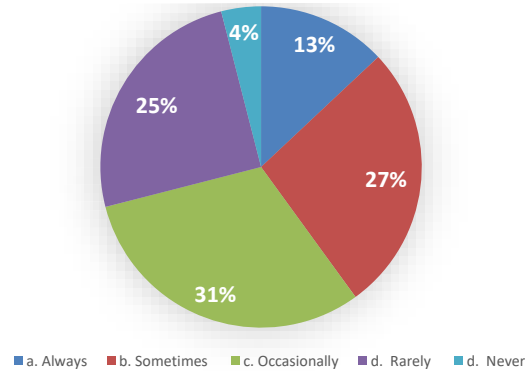
The students surveyed mentioned that only 4% use the cell phone to see classes that have already passed, while 40% answered that they rarely carried out this activity, 24% mentioned that sometimes, 23% said that occasionally, while 9% of the students surveyed mentioned never.



Graphic 9 Use the cell phone for the "see classes that have already passed"

10. Do you use the cell phone for the "Watch videos to study for your classes"?

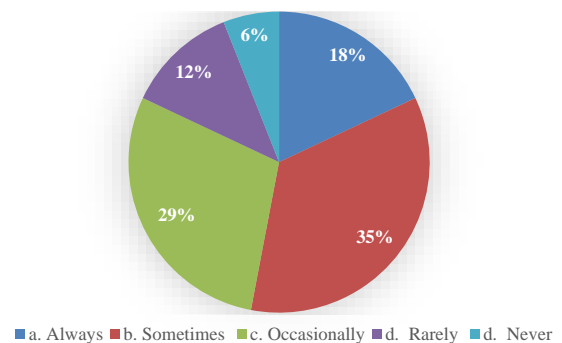
Another use of the cell phone that the students surveyed were asked is that, if they used this device to watch study videos for their classes, to which the students answered that 13% always do it, 27% answered that sometimes, 31% answered occasionally, while 25% answered rarely and 4% said never.



Graphic 10 Use the cell phone for the "Watch videos to study for the classes"

11. Do you use the cell phone for the "Participate in conferences"?

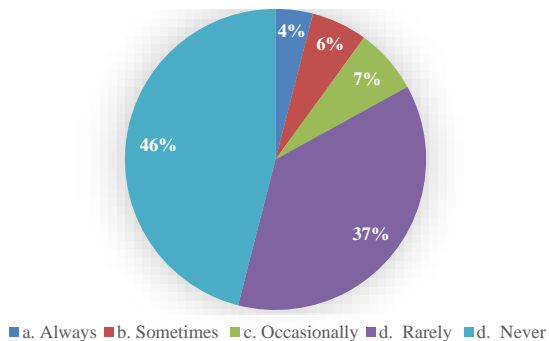
The students responded to the question of the use of the cell phone to participate in conferences that 18% always do it, while 35% sometimes do it, 29% do it occasionally, 12% rarely, and 6% never.



Graphic 11 Use the cell phone for the Participate in conferences

12. Do you use the cell phone for "Support during exams"?

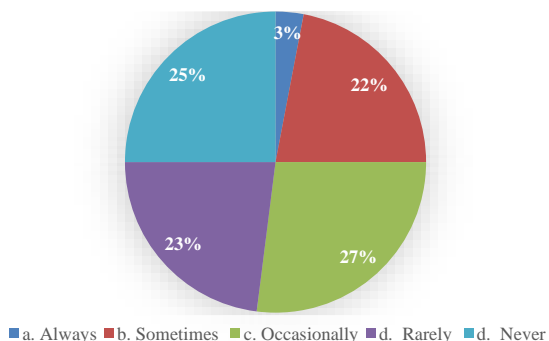
Another question that was also asked of the students surveyed is if they used the cell phone as a support during the exams, to which the students responded by 4% always, 6% sometimes, 7% occasionally, 37% rarely, and 4% never.



Graphic 12 Use the cell phone for Support during exams

13. *Do you use the cell phone to study with educational games?*

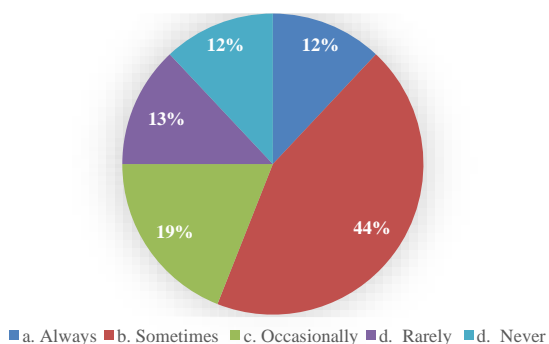
The students responded to the question of using the cell phone to study with educational games that 25% always do it, 22% sometimes, 27% occasionally, 23% rarely and 3% never.



Graphic 13 Use the cell phone to study with educational games

14. *Do you use the cell phone to take quizzes or some other type of exam?*

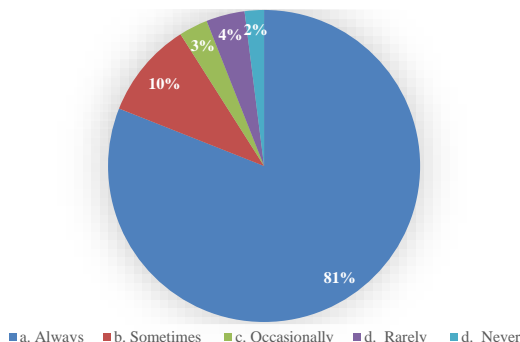
In this question, the students surveyed answered that they use the cell phone in 12% to take quizzes or some other type of exam, while 44% answered that sometimes, 19% answered that occasionally, 13% said that rarely, and 12% mention never.



Graphic 14 Use the cell phone to take quizzes or some other type of exam

15. *Do you use your cell phone to communicate with your classmates?*

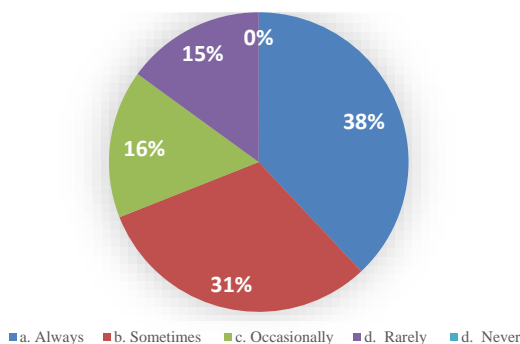
Another use that students are asked about the use of the cell phone was if they use this device to communicate with their classmates, for which they answered, 81% always do it, 10% sometimes, in a 3% occasionally, 4% rarely, 2% never.



Graphic 15 Use of cell phone to communicate with the classmates

16. *Do you use your cell phone to communicate with your class teachers?*

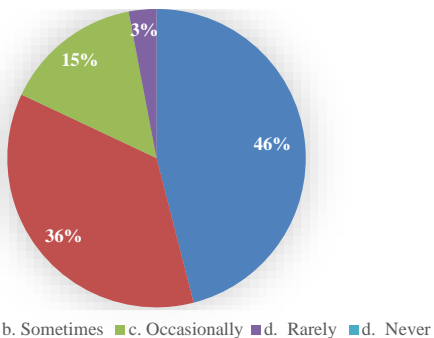
The students were also asked about the use of cell phones to communicate with their teachers, for which 38% responded that they always do so, 31% sometimes, 16% occasionally, 15% rarely, the 0% never.



Graphic 16 Use of cell phone to communicate with class teachers

17. *Do you use your cell phone to share class material "?*

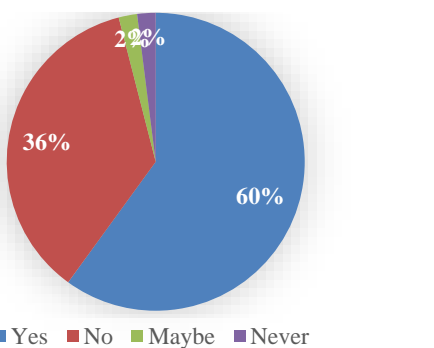
Another use that the students were asked was if they used the cell phone to share class material, for which the students answered that 46% always, 36% sometimes, 15% occasionally and 3% rarely.



Graphic 17 Use of cell phone to share class material

18. *Do you think you learn by using your cell phone?*

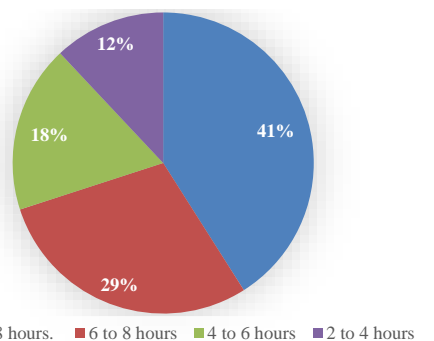
The students responded to the question of whether they learned using the cell phone, 60% yes, 36% no, 2% maybe, and 2% never.



Graphic 18 Learning by using your cell phone

19. *How many hours a day do you estimate that you use the cell phone?*

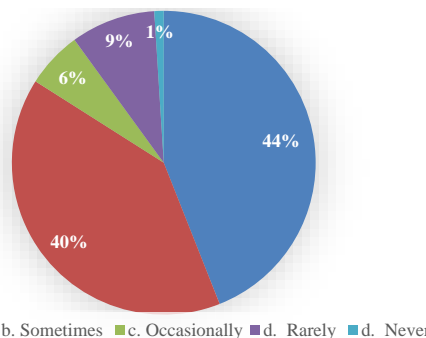
In students regarding the use that is given to the cell phone daily for hours, the respondents answered in 41% that they use it more than 8 hours a day, 29% answered that they use it from 6 to 8 hours, 18% said that they use it used 4 to 6 hours and 12% of the contest that between 2 and 4 hours.



Graphic 19 Estimated hours per day of cell phone use

20. *During your stay in the Pandemic while you were at home, do you use your cell phone to take your classes?*

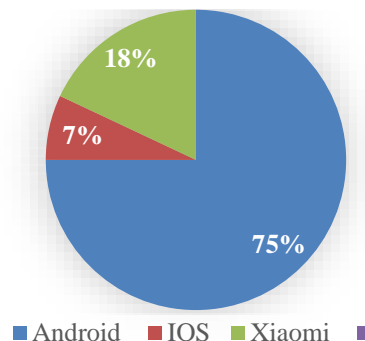
When asked if you used your cell phone to take classes during the pandemic, the students answered that 44% always, 40% sometimes, 6% occasionally, 9% rarely and 1% never.



Graphic 20 Use the cell phone to take the classes during the Pandemic

21. *What operating system does your cell phone use?*

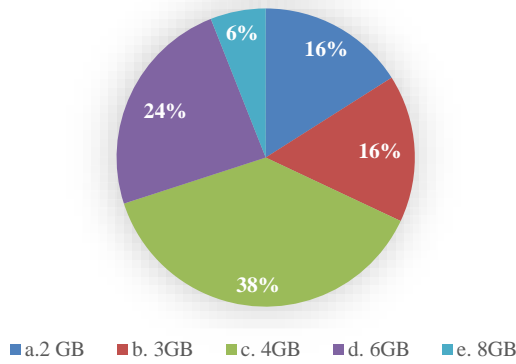
The students responded to the question operating system does your cell phone use that 75% have Android, while 18% Xiaomi, and IOS 7%.



Graphic 21 Operating system's cell phone

22. *What RAM memory does your cell phone have?*

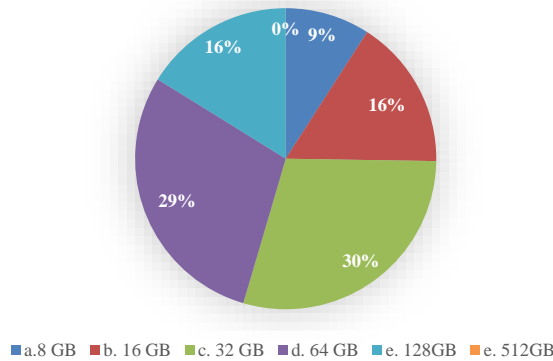
The capacities of cell phones in RAM memory were: 2GB with 16%, 3GB with 16%, 4GB with 38%, 6GB with 24% and 8GB with 6%.



Graphic 22 Capacities of cell phones in RAM

23. *What capacity does your cell phone have?*

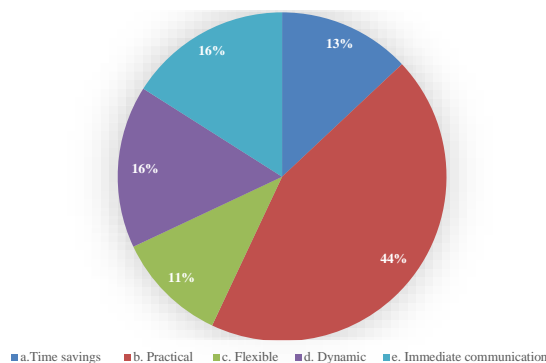
The capacities of cell phones in GB memory were: 2GB with 16%, 3GB with 16%, 4GB with 38%, 6GB with 24% and 8GB with 6%.



Graphic 23 Work satisfaction

24. *What is the main benefit that you consider your cell phone brings you in your studies?*

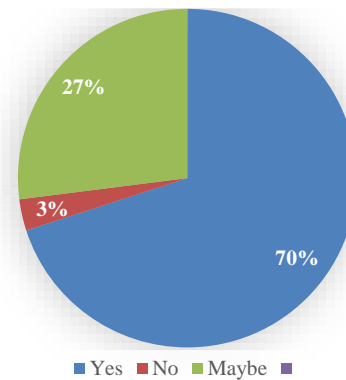
The students responded that the main benefit of the cell phone in their studies was 13%-time savings, 44% practical, 11% flexible, 16% dynamic, 16% immediate communication.



Graphic 24 Benefit cell phone

25. *Do you consider that it is necessary to carry out a practice after leaning on the cell phone to reinforce your knowledge?*

The students responded to the question that if they consider it necessary to carry out a practice after relying on the cell phone to reinforce their knowledge, 70% said yes, 27% maybe, and 3% no.



Graphic 25 Practice after leaning on the cell phone

Conclusions

The benefits of cell phone use are multiple in the student since it allows them to acquire the necessary knowledge for their subjects through access to multiple resources on the internet.

99% of the students surveyed use the cell phone for support in their classes, they mentioned that the cell phone helps them save time, it is practical, flexible, dynamic and facilitates communication both with the teachers, as well as with their classmates.

Also, the cell phone was a very important tool during the pandemic as it allowed students to take their classes from home when one of their siblings used the computer.

In general, this research helps us to see the usefulness and the way in which our students use the cell phone in the subjects of the UTNA business careers.

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Processor and memory performance with design patterns in a native Android application

Rendimiento del procesador y memoria con patrones de diseño en una aplicación nativa de Android

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Abstract

The main objective of this article was to develop a native Android mobile application focused on local file storage, following different design patterns to compare the performance they had in processor and RAM memory consumption. To achieve this, the design patterns MVC, MVP and MVVM were taken as a sample, and for each one a native Android mobile application was developed to compare the performance they had when executed on the same device, thus concluding which design pattern consumed less processing resources and RAM memory. It was contributed to the area of software architecture and it was possible to test the hypothesis that the use of a software architecture design pattern applied in a native Android mobile application is a factor that influences the performance of use in CPU consumption and RAM memory. The pattern that least affects the device performance between MVC Pattern, MVP Pattern and MVVM Pattern is the MVVM with just a 3.5% increase in processor work and a record of a 17.5% increase in RAM consumption.

Resumen

El objetivo principal del presente artículo fue desarrollar una aplicación móvil nativa de Android con enfoque en almacenamiento de archivos de manera local, siguiendo diferentes patrones de diseño para comparar el rendimiento que tuvieron en el consumo de procesador y memoria RAM. Para lograrlo se tomaron como muestra los patrones de diseño MVC, MVP y MVVM, y por cada uno se elaboró una aplicación móvil nativa de Android con lo que se comparó el rendimiento que tuvieron al momento de ejecutarse sobre el mismo dispositivo, con ello se logró concluir cuál fue el patrón de diseño que consumió menos recursos de procesamiento y memoria RAM. Se aportó al área de la arquitectura de software y se pudo comprobar la hipótesis de que el uso de un patrón de diseño de arquitectura de software aplicada en una aplicación móvil nativa de Android es un factor que influye en el rendimiento de uso en el consumo de CPU y la memoria RAM. El patrón que menos afecta el rendimiento del dispositivo entre Patrón MVC, Patrón MVP y el Patrón MVVM es el MVVM con apenas un aumento del 3.5% en el trabajo del procesador y un registro de un aumento del 17.5% en consumo de RAM.

Patterns, Processing, Mobile, Application

Patrones, Procesamiento, Móvil, Aplicación

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Introduction

Software development has been characterized by improving more and more in shorter periods of time. Since the software crisis until today, an exponential growth has been achieved that allows having everything we know today as software.

This enormous evolution for software development has managed to create a process engineering, which defines moments and characteristic points that are vital for the correct operation of a system, however, when it comes to a more specific product such as a mobile application, there are factors to take into account ranging from the language to be used to the type of application to be made (native or hybrid) and when using generic resources, an optimal expected result is not obtained. (Pizón Bayona & Sanabria Orjuela, 2022)

There is a wide range of software architecture patterns that can be used arbitrarily in the development of any system.

Notoriously a software architecture pattern may be more efficient in the development of systems with specific features, however, there is no accurate information on when a software architecture pattern will be more efficient for the specific development of a mobile application even though the Android operating system is the most widely used by users. (Arbulu Peralta, 2022).

When it comes to mobile development there is an extensive list of ways to develop an application, from hybrid applications to native applications, and when it comes to the development phase of the application, the way to structure the code will depend a lot on whether it is a native application or not.

At the present time, knowledge about the implementation of design patterns in native mobile development on Android is scarce. Research exists, but it is mostly for desktop applications and web development.

Software development is the process of describing a sequence of activities that must be followed by a team of workers to generate a coherent set of products (Abanto Cruz & González Ramírez, 2019) which means that it is not only about complying with the functionality of the software, but to generate a quality product and/or service that meets high level standards and for this it is necessary to know more than just the methodology of the development itself, it is necessary to be able to evaluate which architecture will be implemented since this has an influence on the quality characteristics of the system. (Orellana Chicaiza & Velastegui Mejía, 2007)

Based on studies, it has been proven that design patterns have shown a greater impact on classic software development, of them, the main software design patterns for quality mobile development are: MVC, MVVM, MVP, BLOC and VIPER and with them, there are criteria for their analysis that allow you to decide which pattern fits best according to your needs. (Abanto Cruz, *op. cit.*)

In the field of mobile development there is not enough information on studies conducted in this specific area, however, in other areas of software development it was found that the microservices architecture pattern meets the notion of "separately deployed units" which refers to the fact that each component of the architecture is implemented separately, thus making the architecture pattern understandable to other domains that require the application of new techniques that allow to face continuous software deliveries in accelerated development contexts (Mamani Rodríguez, Del Pino, Rodríguez, & Gonzales Suarez, 2020), which consequently allows overcoming problems that were previously very marked, such as maintenance or change in the functionalities of the applications, which represented a problem due to its monolithic nature. (López & Maya, 2017)

Nowadays the software architecture of a system is important to achieve a high level of quality in many project requirements and thus be able to implement evaluation models of software architectures to prevent disasters of an architectural design that does not meet the quality requirements. (Orellana Chicaiza, *op. cit.*)

It has also been found that the most focused works in software development address issues that increase usability, which are called "usability mechanisms" and should be taken into account from the beginning of the project, the functionality of each usability mechanism is represented by application scenarios. (Rodríguez Tibocho, 2014)

Consequently, we can say, that the idea of architectural patterns can also be used independently of architecture, since design solutions are provided, this only considering that the usability requirements are given at the first moment of development and evaluated by means of architectural patterns so that usability improvements are provided in the final problem. (Idem)

Design patterns

Design patterns have a wide variety of uses that have been employed and tested in practice. They have been shown to be effective in software development to simplify the overall design of applications. Design patterns make software more reusable, which can reduce production cost and development time. Design patterns are very useful for developers and designers as they encapsulate expertise, provide a common vocabulary, and improve the documentation of software designs.

Types of design patterns:

- Delegated.
- Compound.
- Decorator.
- Mediator.
- Iterator.
- Observer.

Design patterns have had massive influence on software development. Like web applications, mobile application implementation also established some proven patterns and standards to overcome the challenges and limitations of mobile development. Most of the mobile applications were developed with low quality code and are not based on architectural design patterns.

Developments of a mobile application with the right design pattern can effectively synchronize the user interface with data models and business logic, this will influence how your source code should look like. There are several architecture design patterns for mobile development. In the table below we show the following design patterns for mobile applications. (Abanto Cruz, op. cit.)

| Platform | Design patterns |
|----------|---|
| iOS | Abstract Factory, Adapter, Factory Method, Template, Singleton, MVC |
| Android | MVC, Model View View-Model, Model View Presenter, BLOC Viper |

Table 1 Design patterns and platforms

Source: Own elaboration

Usability pattern

The aspects that these patterns deal with basically refer to user interfaces, so they are also called interface patterns or interaction design patterns. The most widely used pattern concept in software development is the design pattern used particularly in the object-oriented paradigm, which in this context refers to a description of classes and objects working together to solve a particular problem.

According to the degree of abstraction, there are several possible classifications of patterns, some proposed categories are:

- Design patterns.
- Architecture patterns.
- Analysis patterns.
- Creation patterns.
- Behavioral patterns.
- Requirements modeling patterns.
- Organizational patterns.
- Programming patterns.

Software architecture

In the book "Software Engineering. A Practical Approach", by author Roger S. Pressman, an internationally recognized authority and PhD in Engineering Physics from the University of Connecticut, USA, the following definition of software architecture is given: "The software architecture of a program or computer system is the structure of the system structures, which comprises the software components, the properties of those externally visible components, and the relationships between them".

Design patterns

They provide a proven and documented solution to software development problems that are subject to similar contexts. Design patterns facilitate the reuse of successful software architectures and designs; they are oriented to how to organize the source code and how the different parts of the software interact. (Melgar Sasieta, 2020)

Design patterns and their relationship in software architecture

Since design patterns are applied to different solutions and can be implemented in different architectures, the best features of each pattern can be extracted and applied to the best points of an architecture to achieve a model that completely fits our needs.

MVC

- Its foundation is the separation of the code into three different layers, bounded by their responsibility, in what are called Models, Views and Controllers, or what is the same, Model, Views & Controllers. It is a design pattern used in all modern web applications (Toapanta, Palacios, Chito & De la Torre, 2022).

MVVM

- MVVM, Model View ViewModel, is a design pattern that aims to separate the user interface part (hence the V for View) from the business logic part (hence the M for Model), thus making the visual part totally independent. The other component is the ViewModel, which is the part that will interact as a bridge between the View and the Model.

MVP

- MVP (Model View Presenter View) is another design pattern that aims to separate the view layer from the logic, perform unit tests, and write cleaner code, etc.

BLOC

- BLoC stands for Business Logic Component.
- The Google team's goal in designing this pattern was code reuse between their mobile applications, using Flutter with Dart, and web, using Angular Dart.

VIPER

- In VIPER we find more subdivisions than in other architecture patterns, since each of its components must be responsible for a single task.
- VIPER stands for: View, Interactor, Presenter, Entity and Router.

Separately Deployed Units

Usability requirement

- The main factors to be considered when talking about usability are the ease of learning, the effectiveness of use and the satisfaction with which people are able to perform their tasks when using the product, all of which rest on the foundations of user-centered design.

Types of design patterns

- Delegated: uses inheritance to delegate operations on dependencies with static characteristics.
- Composite: uses hierarchies to handle primary and composite objects in a uniform way.
- Decorator: allows combining features in a dynamic way.
- Mediator: coordinates communication between objects of different classes.
- Iterator: performs traversals on composite objects independently of their implementation.
- Observer: creates a one-to-many dependency between objects so that all objects involved can be automatically updated.

Monolithic application

A monolithic application refers to a software application in which the user interface layer, business logic and data access layer are combined in the same program and on the same platform.

The research contributes to the area of software architecture, shows the results of the comparison of applying design patterns in software development, measuring memory and processor performance parameters of a native Android mobile application, focused on storing files locally.

In addition to referring to design patterns, where it is explained what they are and how they are implemented, along with what a usability pattern is, how it relates to software architecture and how it involves design patterns. The methodology used to carry out the analysis is presented along with tables and graphs. Subsequently, the analysis of the results obtained and the conclusions are presented.

Methodology to be developed

The classical research methodology (Hernández Sampieri, Fernández Collado, & Baptista, 2014) was employed, consisting of the following steps:

- Scope and focus of the research.
- Hypothesis.
- Research design.
- Sample selection.
- Data collection.
- Data preparation.

Scope and focus of the investigation

A descriptive type of research with a quantitative approach was carried out.

Definition of the Research Hypothesis

H₀: The use of a software architecture design pattern applied in a native Android mobile application is a factor influencing usage performance in CPU and RAM consumption.

H₁: The use of design patterns is not a factor when measuring the performance in CPU and RAM consumption of a native mobile application on Android.

Research Design

The research was designed with a quantitative and experimental approach.

- Develop 3 test applications focused on local file storage, with the same functionality applying a different design pattern.
- Measure the processor and RAM performance when running the application on a mobile device with the following characteristics.

| Feature | Description |
|-----------------------------|---------------------------|
| Type (Physical / Emulators) | Physical |
| Brand | Xiaomi |
| Model | Redmi 9 - M2004J19G |
| Range (high, medium, low) | Medium |
| OS Type and Version | Android 10 MIUI 12.0.2 |
| CPU (Model and Capacity) | Helium G60 |
| RAM Memory | 4 GB |
| Storage (Capacity) | 64 GB |
| Battery Type | 5020 mAh Fast loading 18W |

Table 2 Characteristics of the device to be evaluated
Source: Own elaboration

Sample selection

The three types of design patterns most frequently encountered in application development were chosen:

- MVC Model View Controller.
- MVP Model ViewPresenter Model.
- MVVM Model ViewModel.

Data Collection

The freely downloadable AIDA64 mobile application was used to obtain the processor and RAM performance data of the device at the time of execution of the native mobile test application.

Data preparation

A table with the data obtained and graphs showing the comparison between processing performance and RAM and the three design patterns are presented.

Results

Pilot Test - Local Storage Application.

- Data collection and processing.

| Device | Pattern | | |
|----------------|---------|-------|-------|
| | MVC | MVP | MVVM |
| Xiaomi Redmi 9 | TR1.1 | TR1.2 | TR1.3 |

Table 3 Comparison of data
Source: Own elaboration

| Type of monitoring on the device | | |
|------------------------------------|------------|---|
| Before, during and after execution | Element | Result |
| | CPU | In the CPU element, logging was started taking as 100% the value of 2000MHz. The logging was started with an original consumption of 25% and an increase to 57.9% was recorded and when the application was closed it reached a consumption of 25%. |
| | RAM memory | In the RAM memory element, logging started with a value of 42.5% as 100% and when the application was closed it reached a consumption of 25% 3754MB. The log started with an original consumption of 65.13% and increased to 69.36% and when the application was closed it reached a consumption of 69.09%. |
| | Battery | Battery usage was not affected |
| | Data Use | The application does not consume data |

Table 4 Table of results 1.1 - TR1
Source: Own elaboration

| Type of monitoring on the device | | |
|------------------------------------|------------|--|
| Before, during and after execution | Element | Result |
| | CPU | In the CPU element, logging was started taking as 100% the value of 2000MHz. The logging was started with an original consumption of 25% and an increase to 46.85% was recorded and when the application was closed it reached a consumption of 25%. |
| | RAM memory | In the RAM memory element, logging was started taking as 100% the value 3754MB. Logging started with an original consumption of 66.43% and increased to 73.36% and when the application was closed it reached a consumption of 69.97%. |
| | Battery | Battery usage was not affected. |
| | Data Use | The application does not consume data |

Table 5 Table of results 1.2 - TR1.2
Source: Own elaboration

| Type of monitoring on the device | | |
|------------------------------------|------------|---|
| Before, during and after execution | Element | Result |
| | CPU | In the CPU element, logging was started taking as 100% the value of 2000 MHz. The logging was started with an original consumption of 25% and an increase to 42.5% was recorded and when the application was closed, the consumption reached 25%. |
| | RAM memory | In the RAM memory element, logging was started taking as 100% the value 3754MB. The log was started with an original consumption of 65.37% and an increase to 68.56% was recorded and when the application was closed it reached a consumption of 65.30%. |
| | Battery | Battery usage unaffected |
| | Data Use | The application does not consume data |

Table 6 Table of results 1.3 - TR1.3

Source: Own elaboration

Analysis of results

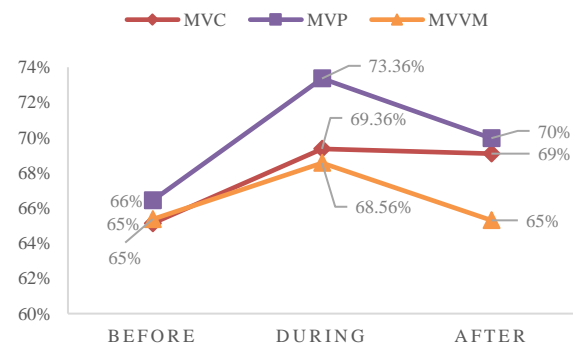
For the realization of this research, the development of a native Android mobile application in the Java programming language was carried out. This application was planned applying functionalities that are directly related to data storage and persistence, which would be a relatively significant and completely valid level of stress to analyze. The application was built from scratch three times varying one specific element, the architecture pattern. In the following tables you can see the analysis of the resource consumption of both RAM and CPU, information that will serve as a parameter to measure the performance of the application on the device in general.

| Analysis of RAM consumption RAM memory | | | |
|---|--------|--------|-------|
| Monitoring in execution | Before | During | After |
| MVC | 65% | 69.36% | 69% |
| MVP | 66% | 73.36% | 70% |
| MVVM | 65% | 68.56% | 65% |

Table 7 Analysis of RAM memory consumption

Source: Own elaboration

RAM consumption according to architecture patterns



Graphic 1 RAM consumption according to architecture patterns

Source: Own elaboration

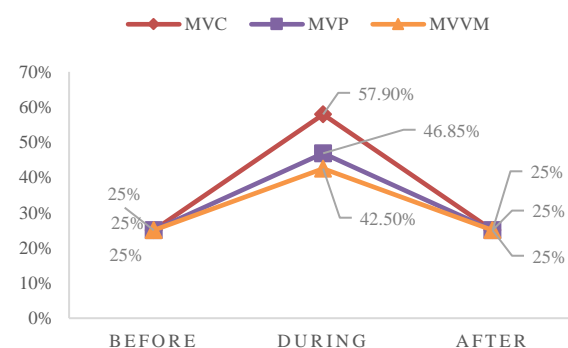
In the same way as the previous graphs, CPU resource consumption was measured with the same application on three different occasions, varying the architecture pattern at the time of development. As we can observe in Table 2 CPU consumption analysis, and confirm in Graph 2: CPU consumption according to architecture patterns, it was clearly noticed that the pattern that offers a lower performance is the MVC, since it is the one that increased the most with respect to the other two. However, we can also notice that, at runtime, the pattern that offers a more optimal performance and without consuming so many resources is the same as in the previous results, the MVVM pattern.

| Analysis of CPU consumption | | | |
|-----------------------------|--------|--------|-------|
| Monitoring in execution | Before | During | After |
| MVC | 25% | 57.90% | 25% |
| MVP | 25% | 46.85% | 25% |
| MVVM | 25% | 42.50% | 25% |

Table 8 Analysis of CPU consumption

Source: Own elaboration

CPU consumption according to architecture patterns



Graphic 2 CPU consumption according to architecture patterns

Source: Own elaboration

Acknowledgment

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Conclusions

In conclusion, the results obtained from the pilot tests validate the hypothesis, and confirm that choosing a specific software architecture pattern, such as the MVVM, when developing a mobile application will have an impact that will be directly related to both the performance of the software when consuming resources on the mobile device and its scalability when developing and building it.

In the performance tests, it was found that the pattern that most affected the performance of the device at the time of application execution was the MVC, since it increased the processor work by 32% together with a 4.3% increase in RAM consumption, while the pattern that least affected the performance of the device was the MVVM with only a 3.5% increase in processor work and a 17.5% increase in RAM consumption.

However, it is important to highlight that the MVP pattern has an interesting resource consumption, since it registers a 21.8% increase in processor work, which shows that it increases in less quantity than the MVC, but with a 7.36% RAM consumption, that is, more than the MVC. This situation is decisive at the time of development, because, in addition to the functional and non-functional requirements, it must be taken into account whether the type of application to be developed needs to be optimized to process a large amount of information or to be optimized for the exhaustive use of RAM memory.

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Institutional Affiliation of Author including Dependency (No.10 Times New Roman and Italic)

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Introduction

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General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features

Clearly explain the problem to be solved and the central hypothesis.

Explanation of sections Article.

Development of headings and subheadings of the article with subsequent numbers

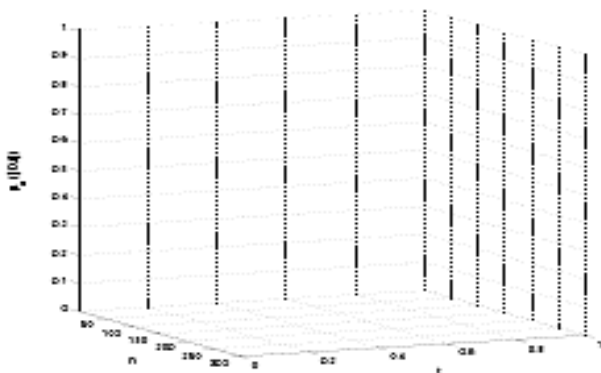
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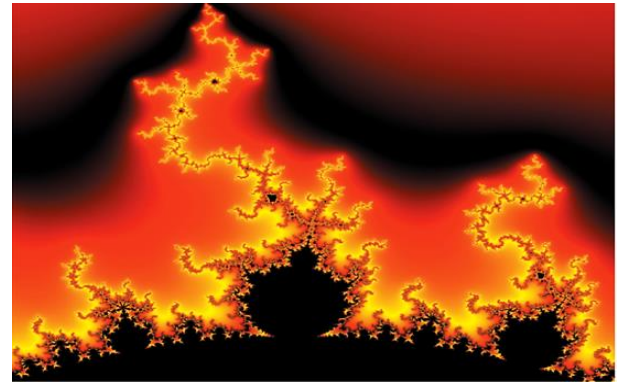


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