

Youth science

Research like professionals
without dying in the attempt

Galileo International Chair

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By way of
introduction

Andrea García Valerio

“Connect with a scientist and
you will be connecting with a
child”

Ray Bradbury

As long as the goals are met, the final objective is also achieved, however, how many times does a project start without having clear goals or a time parameter to achieve them? This work does not pretend to be just another methodology book, but an agile guide that guides us and helps us to reach the goal.

As a general guide, it seeks to inspire and provide guidance on what researchers are expected to develop in each of the points presented in outline one of chapter I.

In this order of ideas, it is important to mention some preliminary considerations:

- a) This book is written in a language that wants to be friendly and agile for you, kind reader, however, it is important to remind you that, when you write your research, it must be in the third person;
- b) The term research will be used, which can be substituted for thesis if you use this book to carry it out, as well as for a thesis or research project;
- c) Although the topics covered are very useful in general, this book presents an inclination for the economic and administrative sciences.



Image 1. Own elaboration.

First experiences in state events.

Now, it will be very useful to have a visual aid, for this, we suggest using a very simple tool that allows you to control the activities in graphic form and we refer to the schedule of activities (see diagram two of the first chapter). Once it has been done, it is recommended that we print it and stick it on the refrigerator or in a visible place and mark both achievements and delays in order to keep a real control of the project. It is important to remember that speaking is compromising, therefore, by placing the schedule in a visible place for everyone, it will become an incentive to meet the goals and, perhaps, receive support from the people with whom you live and, who knows, perhaps also help from someone who was not originally thought.

Before beginning the research work, it is particularly important to comment that when choosing the topic to develop the thesis, three criteria should be considered:

1.- The one who truly feels an attraction for the selected topic. It is feasible to refer to it in terms of loving the subject since the author will "marry" it, at least for the duration of the adventure of its development;

2.- That it is possible for him to obtain the necessary information for the development of the investigation, as well as having the financial, logistical, permits and other necessary resources, and;

3.- That it is possible to contribute something to the body of knowledge of the discipline in which the research is carried out.



Image 2. Own elaboration.

Demonstrating that the experiment is reproducible and its repeatability.

Once the above aspects have been assessed, work should start as soon as possible, avoiding excuses. Starting with an attitude of openness to new ideas and that they are perfected throughout the investigation will help the work to take shape little by little until it is a product of good manufacture, achieving, of course, contributing something to the body knowledge (and in addition, to achieve the degree of the corresponding degree, if applicable).

Remember: As long as your own goals are met, the final goal is also achieved.

Sir Isaac Newton said: I could see far because I climbed on the shoulders of giants. The above is a fundamental thought when starting a research project, since it

always begins by investigating the antecedents that exist on the topic of interest both to find out about existing advances and to rule out the possibility of writing on a redundant topic.

8 | VIERNES 28 DE JUNIO DE 2013

Diario de Yucatán

EDUCACIÓN



Vivi Aldebarán Martínez, de la primaria "Aida Mejía Salazar", explica su experimento con el zodiaco

Desde pequeños ya hacen ciencia

Image 3. (Diario de Yucatán, 2013).

Explaining the findings.

At this point it is essential to mention that if at the end of the work it is found that the hypothesis is true or false in both senses, the research is valid and provides knowledge to the body of the discipline that the study belongs to.

Therefore, it is essential to adhere to the selected scientific method and treat the data obtained with great impartiality and neutrality so that the results obtained are a reflection of reality.

The importance of this concept is such that it is necessary to delve into it, mentioning that the findings, whether they confirm or deny our hypothesis, are valuable and contribute to the body of knowledge, since, both by indicating that we are on the right path or, on the contrary, by showing us that the selected path is not the correct one, if the investigation has been carried out with the appropriate rigor, it provides valuable information that, when shared, can prevent someone else from taking that path in future investigations.



Image 4. Own elaboration.

Obtaining samples in cenotes.

1

Conceive the idea to
investigate

Vili Aldebarán Martínez García

“Research is what I do when I don't
know what I'm doing”

Wernher von Braun

Why? A question that is the beginning of everything

To start this intellectual adventure, we invite the kind reader to join us for a moment with their imagination and, to place themselves for a moment in the company of a small two-year-old, at this time surely their mind is filled with memories of how these little ones are synonymous of games, races and, above all, of limitless curiosity. In this sense, the little ones investigate everything, review everything, try to understand the world around them and, in a few years (around three years), when they begin to articulate words, a question arises that will accompany them constantly to From there, why? Why is the sky blue? Why is the grass green? Why are the clouds white? And from there to infinity. The above allows us to visualize that each child is a budding researcher, that each child is born with a natural disposition for research, however, what happens during their growth? Why is the desire to investigate and learn suffocated?



Image 5. Own elaboration.

First accompanied experiments.

The answer to the last question is multifactorial, however, it is possible to identify two of the main factors that end curiosity and the desire to learn, these being indolence and unacknowledged ignorance (that is, we do not know the answers and therefore we disqualify them automatically). In such a way that, many of the budding scientists find that many of their questions collide with answers such as "I don't know and I'm not interested", or with answers like "that does not feed", "you have other things of what to worry about right now "or" not important ". Certainly, it cannot be forgotten that there are basic conditions for life such as food or fulfilling the tasks entrusted, however, we must not

leave aside the possibility of investigating those things that cause curiosity.



Image 6. Own elaboration.

Demonstration of experiments to children in the first year of primary school.

In this order of ideas, the question arises. How to encourage research in children? In the first place, we suggest accepting that we do not know everything and that the simplest questions can have great potential, so that when we are asked a question for which we do not know the answer, we can authentically say “I don't know, but we can investigate it”, immediately afterwards, it is important that, as far as possible, time is dedicated to trying to resolve the issue, either with a small search on the internet (it is essential to consult reliable sources), to ask people who know about the topic (what they really know and are informed about), or, if feasible, visit a museum, laboratory or

organization where you can learn more about your question.



Image 7. Own elaboration.

Taken during the visit to the Institute of Biotechnology of UNAM, received by Dr. Enrique Galindo Fentanes (on the right). Mexico.

These last suggestions may seem difficult and far away, however, with a little research, you will see that in many localities it is feasible, with a little planning, to visit these places and even some of the highly prestigious institutes organize events called "Open doors" where they not only show their visitors their facilities, but also, they can interact with their scientists and learn about their research, in the case of companies, some consider guided tours and, naturally, museums, zoos, vivariums, aviaries, etc., have mechanisms to visit them.



Image 8. (National Institute of Nuclear Research, 2016)

What happens over time? Later on, a large part of the children are incorporated into a formal education system where we would presume that they would be in charge of promoting and guiding their desire to learn and research, however, with honorable exceptions, it is precisely in school where they are asphyxiated in form. Systematic research spirit in the little ones since it seeks to "fill in" them with "authorized" knowledge, rewarding their ability to memorize instead of fostering skills that allow them to learn how to use the acquired knowledge.



Image 9. Own elaboration.

Taken during the rescue of a baby possum (you can see the natural curiosity in every child).

In this sense, we can say that "the vehicle travels faster than its occupants", since we live in a paradox where people have access to advanced technology but do not have the slightest idea of how it works, they have the possibility of accessing to an enormous amount of information, but you choose to visit sites with information that, in the best of cases, is biased and of dubious origin. It is possible to say that we live in a time of scientific illiteracy, a time where positions such as the anti-vaccine movement or those who say that the earth is flat are gaining space at a speed that defies all logic, we find ourselves in a world that has recently returned to being shaken by the appearance of a disease related to the virus identified as

SARS-CoV-2, which has placed a large part of humanity against the wall and shows us:

1.- **The great capacity that we have as a species to forget the lessons learned.** In 1918 (just over 100 years ago) we had already faced a similar condition with the so-called Spanish flu;

2.- **The inability we have to focus and devote attention to relevant issues.** The importance of investing in research and education issues, which are lagging behind in much of the world, was uncovered, without diminishing the importance of leisure, huge soccer stadiums have been built and training centers have been relegated. investigation;

3.- **The inability we have to focus attention on conditions related to science.** It should be remembered that the Cosmos series with Carl Sagan had one season (which, fortunately, was recently resumed with Neil deGrasse Tyson), while The Kardashian has a total of 18 seasons (at the end of this book);

4.- **The impossibility of allocating resources strategically.** Without the desire to criticize the millionaire sums paid to a few people (for example, from entertainment or sports), but yes, with the aim of focusing attention on scientists and personnel whose substantive tasks are to contribute to the advancement and maintenance of the society;

5.- **The great existence of pseudo sciences and simulations.** In such a way that unsupported publications are abused, resources are obtained for projects that lack bases, techniques known as "carousel" are used (they use the same research with small changes, presenting it again and again in different forums as if it were original in each case), the omission of data presenting only partially the results obtained during the experiment, the fragmentation of the research to present in small parts and publish many times in this way, or the inclusion of people who did not participate in the work.

6.- **The existing corruption.** Not only in the professional spheres of science, but in places where young researchers are hurt indescribably like at science fairs where you can see a work outside of any scientific context (such as an incubator that uses fluorescent lamps, which do not generate heat), projects that are not present (they went shopping), they do not have the documents to support their research, they do not have a presentation and, in some cases, they were not even presented but are awarded.

With all of the above, we could say that it makes no sense to participate in science issues, however, instead of giving up, we want to invite them to make up efforts, with the own enthusiasm that characterizes those who do what they love and with the conviction of their effort, it bears fruit. by inspiring and possibly being the starting point for young researchers to decide to be part of the human effort to understand the universe around us, to be able to provide a word of encouragement when the desired results are not achieved or become victim of obscure characters who put their interests before science.



Image 10. Own elaboration.

Collection of samples in search of tardigrades in cenotes.

A short tour from fire to space

The previous lines serve to understand that the path of science is by no means simple or fair, however, the fascinating path of science is in itself, a powerful incentive to continue advancing, this is similar to when we observe a small child who is making preparations for some “mischief”, we can see that they drag the bucket, the broom, or the materials that he considers to be part of his little project with great enthusiasm, we can see the sparkle in his eyes as he prepares everything to do what that you want, that transforms a box into a car, an airplane or a spaceship, in this sense, researchers from all disciplines should enjoy the journey and that the findings obtained are only the logical result of the process carried out, in this sense , being able to encourage the little ones to exercise their skills to know the world around us is a great start for them to ask the basic questions that no one asks and have happened previously.



Image 11. Own elaboration.

A meteorite at the Ontario Science Center. Canada.

We can imagine that, at the beginning of the times of the human race, there must have been multiple encounters between humans and fire (caused by various causes such as lightning), however, it is likely that some encounters happened until "someone" was "encouraged" to approach the fire and discover that the temperature was pleasant and, annexed to it, allowed to see in the dark (something that surely changed in an important way the places they could inhabit such as caves or cavities), we can imagine how with the passage Over time (either by serendipity or by a structured search process), mankind was discovering different uses for fire. Certainly the use of tools is not

exclusive to the human race, however, due to the ability to think, transmit information and work as a team more efficiently than other species, we begin to prevail and dominate environments that would otherwise result. extremely hostile. It is precisely through the use of ingenuity and technology that we stop looking at the night with fear and begin to look up at the sky until someone wondered why not go to the moon? Why not continue our journey to the stars? Why only birds fly? Can we fly?



Image 12. Own elaboration.

Taken at the Museum of Tomorrow. Brazil.

In a certain way, we can visualize the stages of human history depending on the technological developments achieved, in

such a way that considering the oldest findings of the existence of the first human groups to date it is feasible to observe that for more than two thirds of our existence on the planet our life developed in a relative state of tranquility, without having the ability to significantly alter our environment, however, it is in recent centuries (an extremely short period of time considering that some researchers date the appearance of homo sapiens around 200,000 years before the common era), when the human race has seen the greatest advances in our history in such a way that we went from traveling on horses to having means of transport such as airplanes, ships, trains and vehicles of all type, we went from having to eat what was possible when we had the opportunity to having food of all kinds in which Any season of the year and with the possibility of keeping them fresh or preserved for long periods of time, we went from seeing our communication limited by the force of our lungs (having to shout to communicate), to being able to be connected almost instantly to any part of the world. world not only with voice but with video. These brief lines serve to give a fleeting glimpse of how man went from fear

of the dark to becoming a traveler to the stars.

As we mentioned in previous lines, discoveries can occur both by serendipity (findings by chance), and by structured processes that focus on achieving a result, but in both cases, you must be alert to identify the opportunities that have arisen and how to apply them to improve our environment. Let us briefly return to the example of fire, if no one had dared to approach it, they would not have known its benefits, if they had not learned how to maintain it, its benefits would have been fleeting, if they had not learned to create it their possession would have been limited, if they had not learned to control it, its uses would have been minimal. In summary, we must foster the spirit of investigation with which we are born in such a way that it is a common practice to ask the why of things,

to be certain that no one knows everything, that we can learn from everyone and, that science is not a perfect state of things, they are only successive approximations to a deeper knowledge and that each theory is only as good as its ability to explain the phenomena that surround us, until a new theory appears that explains them better.



Image 13. Provided by Andrea Solano from CeNAT, during the stay at CENIBiot. Costa Rica.

Conceive the idea to investigate

Where can ideas for research come from?

Great research ideas come from anywhere. It's about seeing what everyone sees on a daily basis, but no one has thought of it before. Imagine for a moment that a falling apple inspired Newton to understand gravity. It is obvious that the process that led to the writer of Principia Mathematica was surely different from contemplating the fall of a fruit, however, we seek to exemplify that ideas can arise in unexpected places, in this order of ideas, many scientists were inspired by seeing science fiction films and began to create devices that until then seemed impossible, therefore, the questions of children, who do not know the processes (and therefore do not understand their limitations) must be considered and learning to think in new directions can pave the way for revolutionary ideas and inventions.



Image 14. Own elaboration.

Collection of samples in cenotes.

In this sense, it is not important if the idea arises from reading a high-level magazine, from a conversation with researchers or with a lady from whom we buy herbs for tea in a market, the ideas can arise at any time, so we just have to be vigilant to discover its potential.

Now, suppose a question arises, Why is the grass green? We immediately ask those

around us, however, apparently it is a mystery that no one has clues about and we think, "Wow, we have an excellent problem to research". The next step is to search for information from reliable sources. It is not long before it is possible to locate a biology book where it is mentioned that the green color of grass is due to chlorophyll. At this point we must have the maturity to recognize that our first proposal that seemed great has already been answered before and we must focus our efforts on another topic. This is fundamental since we must remember that the researcher seeks to add to the body of knowledge in such a way that he must be able to recognize the achievements of other researchers who preceded him and be able to undo the path that he has already taken to seek new paths. In this sense, it is essential to be constantly self-critical in such a way that our ideas are certainly embraced with love and passion, but not with self-indulgence, in such a way that, from time to time, we must dress in the robes of an inquisitor (sounds intense this word, however, means the one who seeks or inquires), to see if we are going in the right direction and, this exercise will be even more enriching if it is done using pairs. In this sense, it is essential that peers are people

with a love for research and not self-centered who only seek to assert themselves in their own beliefs or positions. Annexed to this, if we consider the current state of all the sciences, it is feasible to mention that there are no exhausted topics, only people unable to see beyond.



Image 15. Own elaboration.

By analyzing samples with minimal resources, contributions can be made.

In this vein, let's go back to the grass question. Why is it green? We have already discovered that it is due to chlorophyll, now, why does chlorophyll have that green tone? How did it take that color? Are there variations of green in grasses? And if so, do their characteristics or properties vary? In this sense, having an approach with specialized personnel in the field we can focus our initial question in such a way that

we finally reach the frontier of knowledge today and, with this, we can contribute new knowledge.

Before finishing this section, just reaffirm one consideration. If in the advance of our investigation we suddenly find material that indicates that previously someone has already solved it or found what we are looking for, we must be able to recognize the work of others and look for new horizons.



Image 16. Own elaboration.

Participation in youth science programs.



Image 17. Own elaboration.

Practice Trip to Find Extremophiles.



Image 18. Own elaboration.

Practice Trip to Find Extremophiles.

Preliminary considerations

It must be remembered that science has a great division which is in the formal sciences (such as mathematics and logic) and factual (physics, biology, chemistry, sociology); It is important to remember this since, they differ from each other by the objective pursued and their validation method; While the formal sciences through axioms check their theorems, using logic, the factual sciences use observation and / or experimentation to check the results with their hypotheses.

We must not lose sight of the fact that scientific research must be objective and systematic, and must be carried out using a method to be effective and valid. It is important to consider that each institution has its own scheme that may have variations, however, we present a summarized scheme with the minimum that it must contain:



Image 19. Own elaboration.

Meeting Dr. John C. Mather. Nobel Prize in Physics.

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Formas de obtener los datos.

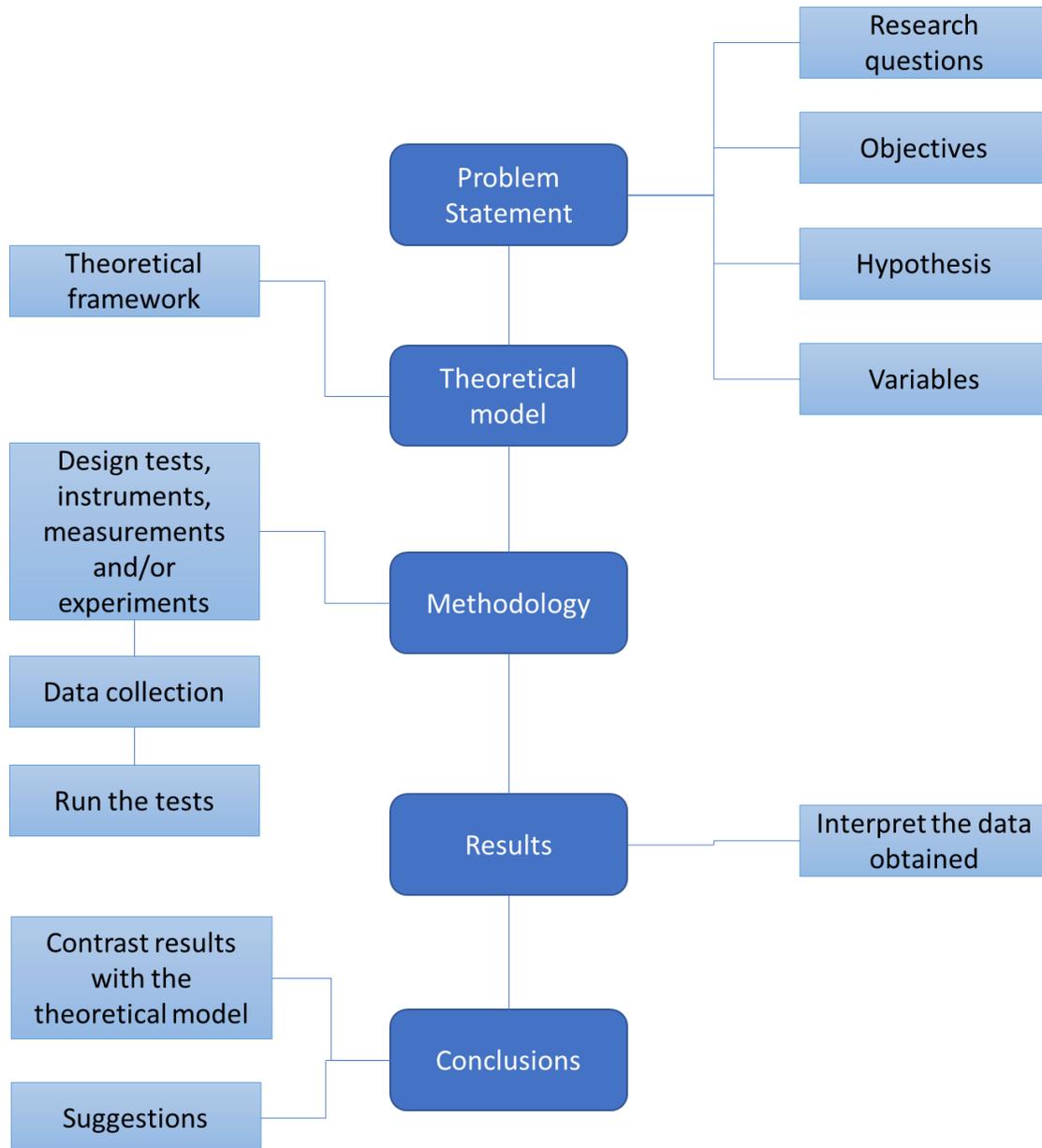
- Observación;
- Informes especiales;
- Cuestionarios.
- Entrevistas;
- Reuniones;
- Estudios de actitudes de los empleados;
- Estimaciones.

La validez del constructo se suele determinar mediante el procedimiento denominado análisis de factores. Su aplicación requiere de sólidos conocimientos estadísticos y del uso de un programa estadístico apropiado en la PC.

Image 20. Own elaboration.

Participation in the International Galileo Chair.

Scheme 1. Stages of the investigation



Own elaboration.

Research like professionals without dying trying.

Once you have decided on the research project to be carried out, the work schedule will have to be carried out in which the estimated times for each activity will be scheduled in order to keep a real control on the progress, it must be established with

time units either weeks or months depending on the time that is planned; The activities must be in chronological order, the format that best suits our needs must be chosen.

Scheme 2. Work Schedule

Activity / date		July	August	September	October	November	December
Problem Statement	P						
	R						
Construction of the theoretical framework	P						
	R						
Methodology	P						
	R						
Results	P						
	R						
Conclusions	P						
	R						
Drafting of the final report	P						
	R						
Job presentation	P						
	R						

Own elaboration.

Before starting our work, let's meditate a little and we invite you to do this first exercise:

Exercise one:

- 1.- Write the 3 main “causes” (excuses) that you know for not doing an investigation.



Image 21. Own elaboration.

Sample obtained on site.

2.- Which of the above applies to you?

3.- Realistically, how many hours a week do you dedicate (or will you dedicate) to your research?

4.- Considering the time spent, obtain a realistic date for the end of the investigation.

5.- Making an estimate of time to dedicate in the investigation, write down the deadlines to achieve each of the stages; It is essential to remember that we do not speak of absolutes but of dates that must be remembered and fulfilled as faithfully as possible.



Image 22. Own elaboration.

Presentation of results in international events.

Raise the research problem

Certainly, all parts of the investigation are important, however, this part is critical since the rest of them will emerge from it and will naturally be the guiding principle.

In essence, it is in this part where the problem we identify or the question we want to solve is reflected. Therefore, it is very likely that our doubt or problem to be solved is very large or requires a quantity of resources that we do not have the possibility of obtaining, therefore, it is precisely at this moment that we delimit the scope of the same and we have the possibility to segment the way in which the investigation is going to be carried out. A sensational example of how an investigation is developed in stages can be seen in the space program. As you can recall in his speech on September 12, 1962, President John F. Kennedy made it his goal to put a man on the moon and bring him back safely. To achieve such titanic work, three stages were conceived which had very clear objectives, the missions, the Mercury program, had to take a person to Earth orbit, the Gemini program, I seek to extend the duration of the people in space and achieve successful re-entries, finally the Apollo

program, managed to achieve the set goal of reaching the moon and returning safely to earth. This example is particularly valuable not only because of the implications related to becoming star travelers, but also is a perfect example of how countless problems had to be solved in order to achieve the desired goal, it required an Immense budget to achieve it and, incredible as it may seem, despite all the evidence, all the progress, today it is possible to find people who claim that the goal of reaching the moon was not achieved. Therefore, do not be surprised if at some point you find detractors whose motivations are not only unfounded, but also react in ways that border on fanaticism.

Returning to the previous lines, it is of great importance that when writing the research problem, you consider:

- 1.- Write it in a concrete way;
- 2.- Make sure that the selected variables are included;
- 3.- Consider a first balance where you have the possibility of access to the necessary resources (information, permits, monetary aspects, equipment, etc.).

One suggestion is to write the research problem in the form of a question, this facilitates its connection, remembering that its objective is to formulate the core question of the research (to give structure to the research idea); the statement of the problem must have scientific and / or social relevance; relate two or more variables. It is written in such a way as to provide references that describe the situation, highlighting the gaps in existing knowledge about the problem, or the questioning of these antecedents that are intended to be verified. It is at this point when the problem is posed in the form of a question which must be very specific, be located in a specific place and time. That is, the subject must be delimited.

The formulation of hypotheses and objectives will depend on the correct approach to the problem; Therefore, the success or failure of the entire investigation depends largely on this step.

There are elements that are going to be related to each other and, they are the ones that together will form the statement of our problem, these elements are: research

questions, objectives, hypotheses, justification and feasibility of the study. Take into account that these elements seek to answer the questions:

What ?, Who ?, How ?, Where ?, When ?, Why ?, and For what?



Image 23. Own elaboration.

Participation as an evaluator in international events.

Certainly, the example of the space project is great, but, it could be a bit far for our first approach to science, perhaps a more everyday example will give us a closer vision. Let's take a few steps forward and imagine for a moment that we want to keep our food cold without relying on electricity. In this order of ideas, the research question arises. How can we keep our food cold without electricity?

The available bibliography is consulted and an alternative is found, which is the use of clay pots with sand to achieve a heat exchange. Once the design is consolidated, the feasibility of obtaining the necessary materials is seen and they are developed.



Image 24. Own elaboration.

It seeks to improve the evaporation design (which is what keeps food cold) by using recycled materials.



Image 25. Own elaboration.

The prototype is assembled.



Image 26. Own elaboration.

The experiment is carried out recording the results observed during 12 days.

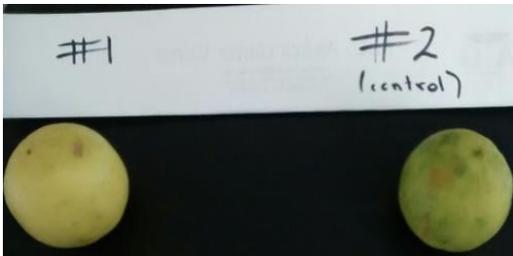


Image 27. Own elaboration. Control lemons placed near the refrigerator.

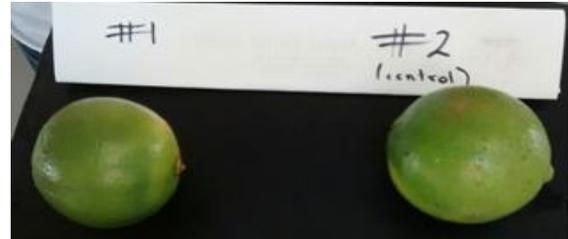


Image 28. Own elaboration. Control lemons placed inside the refrigerator.

The results are compared.

Are graphed.

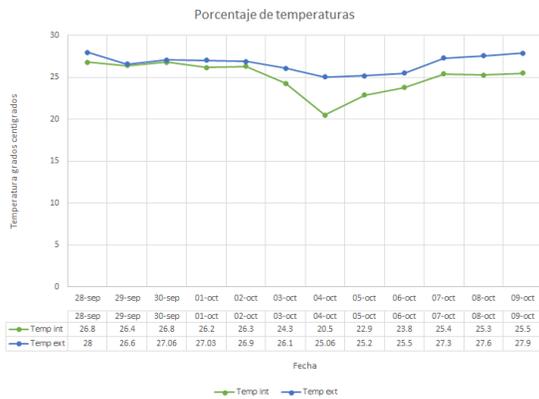


Image 29. Own elaboration.

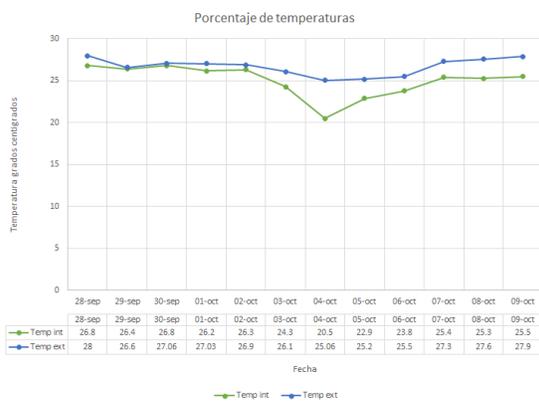


Image 30. Own elaboration.

The conclusions and the report are prepared to present.

As we can see, the process is extremely simple if the proper process is followed, carefully recording all observations to achieve the desired robustness.



Image 31. Own elaboration.

Participation in the International Galileo Chair.

Develop the research questions

Once we have managed to write the objectives, it will be very useful to develop one or two questions related to each objective in such a way that our mind can focus on what we need to obtain in each case. In a way, putting the research problem in the form of a question allows the mind to focus on how to arrive at the answer we need, a condition similar to the questions that are developed from the objectives.

Let us remember that, once the questions are asked, it is important that the answer is not known, since answering it is the objective of the study, they must be clear and contribute something new to the field of study

When asking your questions, consider the What?, Who?, How?, Where?, When?, Why?, and, For what?

Write the possible problems of your investigation and see if you have the elements to solve the questions:

Is there a link between the problem we want to solve and the investigation?

2.- If necessary, the questions that complement the problem should be attached to answer the elements that make it up.



Image 32. Own elaboration.

Sharing and learning at science events.

It is feasible that at this stage it is not possible to satisfy all the elements, however, the more we manage to gather, the more feasible it will be that we achieve success in the investigation.

Establish research objectives

Once we have managed to discern the research problem we are ready to develop the objectives of the research work. These emanate directly from the guiding axis (research problem) and must be focused on solving the question it represents (this is one of the reasons why we suggest developing the problem in the form of a question). It is suggested to use the acronym **SMART** (intelligent in English) since it allows to visualize the objectives as:

specific

Measurable

Achievable

Realistic

in a given **t**ime.

It should always be written using an infinitive verb.

Another recommendation is to limit the number of objectives as much as possible in such a way that they do not exceed more than three. In the event that the research problem requires a greater quantity, it is likely that it is necessary to integrate a research group that allows the objectives to be covered efficiently or, to sub-divide them

into stages in such a way that they are fulfilled according to the times and resources that are scheduled.



Image 33. Own elaboration.

Sharing points of view and setting goals at science events.

At this point, it is important to remember to always be able to “re-calibrate” the objectives as data emerge during the investigation, in such a way that the idea that an investigation is only valid when the objectives that were set are achieved are abandoned. at the beginning (the importance of rejecting a proposed hypothesis will be mentioned later). In case we find that the findings show a trend contrary to what would be expected, we must have the ability to see if we are making correct observations and obtaining correct results and, if so, we are probably in a position to raise the

research problem again and with this, adapt the objectives to continue advancing, reporting the findings and explaining the reason for the change. Obtaining a confirmation of the hypothesis is just as valuable as proving that it was wrong, since both positions contribute to the body of knowledge.

Before continuing, it is time to stop for an ethics note. The findings found must be reported accurately and completely, avoiding any type of manipulation or omission. The reader may have heard of some cases where those who call themselves researchers even omit data that does not favor the result they seek and limit themselves to reporting only those that support their work. These pseudo researchers have no place in the scientific, academic or consulting community and, the damage they can cause is difficult to quantify, therefore, it is important to always be alert and avoid falling into involuntary omissions that could lead to reporting unsupported findings.

Let us remember that posing our problem in the form of a question will help to present it directly and, since it is difficult to

encompass all aspects of the problem in a single research question, two or more questions can be asked; They must be specific because if they are very general they will not lead to a specific investigation.



Image 34. Own elaboration.

Giving the keynote address at an international event.

The objectives are what the research intends, while the problem is the "what" to investigate, the objective includes the "why". They are the contributions that the researcher intends to originate from his study, for this it is necessary to know in detail what is possible to achieve through research.

The objectives must be congruent with the justification and the problem; measurable, realistic, are the guidelines and should be taken into account throughout the investigation; They must be described by

means of a verb for which you can help yourself with the Bloom scale which you can consult in (Eduteka, 2017).

Also, you can set a general objective, followed by one or more specific objectives. It is important to mention that during the investigation additional objectives may arise, the initial objectives may be modified and even be replaced by new objectives, depending on the direction the investigation takes.



Image 35. Own elaboration.

Winning the absolute in an international event.

Exercise three:

1.- Write the objective (s) of the investigation.

2.- Are they congruent with the problem statement?

3.- Are they achievable?

4.- Do they need to be adapted?

5.- Are they real?

6.- If you have answered yes to questions two to five. Congratulations, you are on the right track. Observe your schedule and check if you are in accordance with the time you have set, otherwise make the necessary adjustments.

Justify the research and its feasibility

At this point is when we must place ourselves alternately on the two sides of the table, what do we mean by this? It is a way of saying that we must take two positions from time to time when reviewing our work considering:

a) In the first, we must see the benefits that will be obtained, the needs that will be covered and the contributions that will be provided with the expected results of the investigation, in return;

b) In the second position, we must be able to glimpse and evaluate all the possible problems that we will face, the possibility that the findings may be irrelevant or, even more, ask ourselves who could be threatened by our investigations.

This last point is not about frightening ourselves and abandoning the investigation, but about being prepared and aware that there could be unintended consequences. For example, when James Patterson discovered that lead contained in gasoline and many other supplies widely used in the leather, paint and many other industries had serious implications for people's health, he

decided that he would make his findings public, however. , one of his main sponsors (the oil industry) was involved in this situation, at first, they tried to convince him not to publish and, not achieving their goal, they not only stopped subsidizing him, but began to block his work . Patterson required a lot of courage and dedication not only to avoid that his work was sunk by the interests of those industrialists, but to get the knowledge to reach people and, thanks to his efforts, lead was removed from a large number of products.

It should be noted that during the path that Patterson had to walk to get the information to come to light, not only did he have to fight with bureaucracy and economic interests, but even more, he had to fight with such obscure characters as Robert A. Kehoe, a toxicologist who served the interests of large corporations and "sold his knowledge" to seek to justify the use of hazardous materials by making them appear innocuous. This item deserves special attention since, although it might be thought that people involved in science have high ethical standards, this does not always happen and it is possible to see people who use science to sell "favorable" results to the

highest bidder. Therefore, remember, when having a great discovery on the doorstep, always think not only about the good you do, but also, you must consider what interests you may be affecting and be prepared to face the consequences.

The justification must offer a convincing argument describing the knowledge to be obtained and the purpose of the research findings. Some criteria that must be taken into account for the justification can be:

How is the research related to the priorities of the region and the country? What knowledge and information will be obtained? What is the intended purpose? How will the results be disseminated? How will the results be used and who will be the beneficiaries? And what is the potential importance of the research? (Pan American Health Organization, 2002).

Here you must justify the reason why you have to study the problem, but do not justify the results; in some cases, you can only meet one criterion which is sufficient.



Image 36. Own elaboration.

Participation in the International Galileo Chair.

||

Develop the
theoretical framework

Beicy Viviana Acosta González

“Science is made of data, like a
house of stones. But a pile of data is
not science any more than a pile of
stones is a house”

Henri Poincaré

Develop the theoretical framework.

How to base the investigation?

Access to information has become a tool for the development of new ideas and knowledge, however, this has also conditioned that much of it is not accurate and true, for which the researcher must be cautious in obtaining the information. Information that supports and argues its possibilities. It is necessary that in all phases of the investigation, the documents that relate to the subject to be investigated be taken into account, because as progress is made, it can take certain turns of what we had not initially considered as relevant.

Literature review

When reviewing the literature for the subject to be investigated, the means to obtain information play a crucial role, in the world in which it is bombarded by a number of sources of information such as articles, books, magazines and access to the internet this that since the 60s came as the interaction of teams and that today has

revolutionized the way the world is seen to invade the head of anyone who wants to know something specific, not only as a communication channel, however with this also came the misinformation that cannot be verified and of which there is no reliability.



mage 37. Own elaboration.

Participation in events.

Initially, you can refer to an expert on the subject, who for that matter may be a teacher or tutor who guides your research, as he or she will have important references on hand that will be of great help to cement your research.

You must be clear about the keywords or search terms, once you have them you can help yourself from thesauri such as UNESCO's which "is a controlled and structured list of terms for thematic analysis and the search for documents and publications in the fields of education, culture, natural sciences, social and human sciences, communication and information" (par.1) that allows you to have a clearer vision, however if you use the wrong words these can lead you to another path.

It consists of having an approach with material in several languages that is useful for the purposes of the investigation where the necessary information is collected that contributes to the research problem and helps to formulate the methodology that allows to investigate and have a broader vision of the field of the knowledge in which research is proposed and in other areas of knowledge.

For what? to identify what has already been done with respect to the topic in order not to duplicate efforts on something that has already been investigated and can be the point to reorient or reaffirm the topic on which the study is focused. It allows to identify the gaps, contradictions of the findings in order to make a constructive analysis of the approaches and methodologies of other researchers.



Image 38. Own elaboration.

Participation in the International Congress COLPARMEX.

Detection of literature

The sources of information are different types of documents that allow us to have access to knowledge.

Primary sources: contain original information, which has been published for the first time as articles, books, theses, seminars, conferences, videos, documentaries, speeches by experts, reports, internet pages, and which has not been filtered. They are the product of an investigation or of an activity they are in printed or digital form.

Secondary sources: the information starts from the primary sources but is synthesized and reorganized, such as compilations, reflection articles, essays, summaries, reports, reports, encyclopedias, dictionaries, books or articles that interpret other works or research.

Obtaining literature

Once the primary and secondary sources of interest have been located, they are consulted.

In the first place, in the amount of information you must select those that will be useful and discard some others, initially

you must refer to the primary sources, in the case of articles, some of these will be found in open access databases in different databases. which means that access to information is free and some others where it is necessary to give an economic contribution to have access to this information. We refer to these because they have had a rigorous evaluation process by experts, which allows us to have reliable information. Some of these are:



Image 39. Own elaboration.

Using images taken from google.com

It is necessary to clarify that the use of databases such as:

RINCÓNdelVAGO



WIKIPEDIA
La enciclopedia libre

Image 40. Own elaboration.

Using images taken from google.com

Although it has information that may be of interest, it is not scientifically rigorous. In the case of SCI-HUB, it is a website that has paid research works with public access, using them may incur the legal rights of authors and publishers and at the time of supporting the research it is necessary to check their location and access.

Consult the literature

It is recommended to take a highlighter and identify the abstract if it is in your interest to review the conclusions and recommendations because from this you can identify the gaps in the research or whatever is of interest to the study. According to the researcher's criteria, if the article is relevant

and answers their questions, it is an option to use it. If initially this does not give light on the way, it is an article that does not favor using it. When doing the search you can find 1200 results and how to choose from these the ones that best suit your search the initial filter may be the number of citations, the year of publication, the country, these filters are for the convenience of the investigation. With the search you can also find only 3 the result of this can be that you are not using the correct keywords that you are looking for only in Spanish language for which you have to do an advanced search.

In the case of books, to determine their usefulness for a matter of time, it is convenient to start by analyzing the table of contents, the initial part of each section as they provide an overview of the topics covered in the manuscript with this you can identify if it can be used as a reference.

With this, the following questions are replaced:

How much has been investigated?

Who have investigated?

What perspectives are you addressing the issue?

What gaps exist?

What achievements have been made?

Does it help me to develop the investigation quickly?

Is it related to my research problem?

Once the references or useful primary and secondary sources have been selected, they are carefully reviewed and the necessary information is extracted to integrate it into data matrices, noting the complete identification data of the reference, author, year, review, objective, abstract keywords, methodology, objectives, results, theoretical trends, instruments, and touches that information that allows to facilitate the use of the information.



Image 41. Own elaboration.

Participation in events.



Image 42. Own elaboration.

Participation in the Young Promises.

Extraction and collection of information of interest

The researcher must have his information in an orderly manner, otherwise, having a lot of information will not help him. When you download a document they have a series of codes which means that after a while when you search for this document you will not find it. There are many ways to collect information through document tables, file folders, Word tables, bibliographic managers which allow you to have the information at hand and will be the most efficient way to optimize time, as this can take a lot of time. time that could be used for research purposes.

Once you have the necessary information, the extraction of data and ideas that are extracted from the documents, it is important to have the reference of the document from which the information is extracted.

Construction of the theoretical framework

This section in research is extremely important to support the research question, the problem statement, the objectives and the methodological process to be used. When putting it on paper, it is recommended to use rules that help citation and referencing in a correct way and that the body of the manuscript is written in a logical and coherent way, since although it is necessary to show what the writer thinks about this by corroborating what was said or putting into discussion a theory, part of what authors said on the subject.

In different contexts the theoretical framework of the state of the art differs, however, in many investigations they consider it the same. However, it should be clarified that the state of the art is all those investigations that have been made regarding the research topic in the local, regional, national and world context and the theoretical framework reflects all those theories that support my research topic.

It should be written in an impersonal way, avoiding personal comments as this can bias the research, the narrative should be given clearly where the entire document is related and for this the use of connectors facilitates the researcher's work so that it exists coherence that does not become a patchwork quilt, this section can be written chronologically, by themes or by theories, but always in an orderly manner.

Many researchers ask how many pages should there be for the theoretical framework or how many references? and the answer to that question is as many as necessary where the topic to be investigated is based.

Do not forget!

For the theoretical framework to help us:

- ✓ Identify what has been investigated and what gaps exist in the subject;
- ✓ Better understand the field of study;
- ✓ In what contexts, individuals, case studies;
- ✓ Reaffirm the problem statement;
- ✓ What methodological designs can we use that suits our research;

- ✓ Document the importance of the study;
- ✓ To better interpret and understand the results obtained;
- ✓ Corroborate or contradict theories already proposed in other investigations;
- ✓ Helps avoid errors or limitations of other investigations;
- ✓ Identify the field of study;
- ✓ Selection of sources of the Information;
- ✓ What search criteria;
- ✓ Where to look;
- ✓ How to search;
- ✓ Information management and purification;
- ✓ Identify the study period.



Image 43. Own elaboration.

Participation in the International Congress COLPARMEX.



Define the scope of
the investigation

Zarick Juliana Díaz Puerto

“In matters of science, the authority
of thousands is worth no more than
the humble reasoning of a single
individual”

Galileo

Define the scope of the investigation

It is vitally important to define how far we want to go, professionally and personally. When we define what our goal is and what steps we will have to take to reach it, we find different edges and nuances that little by little define the path that we will follow over time to reach our goal.

Something similar happens with research, when we ask ourselves a research question, and we want to find the answer, we begin to define what are the factors, variables, and contexts that can influence the development of the research. These not only include the aspects correlated with the research topic but also include those situations external to it, for example the existing budget to carry out the research, the requirements of the experimental stages, sample sizes, availability of previous studies related to the subject, availability of physical, human, technological resources and even the global situation of the moment (conditions that generate shortages of resources or limitations such as a pandemic).

As young researchers there is no total autonomy when researching, but there is usually the mentorship of someone much more experienced and who has come a long way in the waters of research, which seeks to guide young minds in navigating The science. Therefore, having a tutor or tutors who will guide you along the way are a fundamental human resource to define how far you want to go with the research.

Based on the availability of resources and criteria mentioned above, which we will call determinants, the path that the research and the young researcher will take is defined, taking into account the points that will or will not be taken into account in order to answer that question or solve the problem that arose in the mind and for which the investigation is being carried out.

This is how different types of research arise, based on the scope that the research deals with throughout the study (how far the research goes and under what conditions), which we will see below.

The objective of this chapter is that you identify the types of research based on their respective scopes in a general way, and that

you manage to land these concepts to the situation in which you find yourself at the time of starting the investigation. It is imperative to define the scopes at the beginning of the investigation, taking into account that these can become variable and that, sometimes, they will not depend on a single factor. It is important that when you are proposing the research scopes, you give yourself to the task of proposing the different possible scenarios that can happen with your research (internally and externally) considering the time you determine to carry out your study, so as not to propose unrealistic scopes that result in frustration and the non-completion of the investigation as expected at the time of the preliminary draft. And one more thing, remember that time is a limited resource, so do not underestimate time in complex tasks that require attention to detail, and rely on the tutors you have, always raising your opinion, perspective and knowledge, while, in parallel You listen to the experts who will help you to check if the achievements are real or unreal in the time and resources you have.

Let's move on to see the types of research based on their scope.

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Image 44. Own elaboration.

Participation in the Young Promises.

Exploratory

What do you think when you read the word “explore”? I'll tell you what comes to mind, I think of someone who is in a new place, with a magnifying glass, glasses or binoculars, and a map in hand, walking carefully while he sees around him with his eyes wide open, attentive to all the elements in the environment and registering information in his brain regarding that new environment.

Well, landing this analogy to research, is what begins as exploratory research.

Exploratory research is then, that first phase of a study in which a situation, problem, product, service, population, context, or in general whatever our object of study is explored or known in a general way. That is, it is that first approach in which we know almost nothing or at least very little of what we are studying.

It gives us the first approximation to the object of study, where, as in the analogy that I proposed initially, we have to keep our eyes wide open to see all the factors and

elements that are present in that object and that directly or indirectly determine relationships and correlations in the context in which they are found.

As this is the first phase of a study and, we are only beginning to observe all those elements while we store the information that we are collecting, there is no specific methodology for it to be carried out, and we can almost get information from any source, from expert opinions, news, magazines, events and facts, to extensive studies that broadly describe what we are observing and studying.

With the information that we observe and store, we can determine whether the question we are asking or the problem we are trying to solve is in the context of that information. When we do this process of "matching" between what we see, analyze, think and do, we can establish the research hypothesis, where based on the information collected regarding the elements, variables and relationships present in the environment in which it is develops our object of study, we can identify the points that influence said problem or object of research.

To sum up everything we've been thinking about, exploratory research aims to:

1. Identify and recognize the specific context or environment in which our object of study develops;
2. Generate an initial hypothesis, based on the recognition of the environment or context of the object of study;
3. Laying the foundations for the next steps to be taken in the investigation, determining what information may be useful, what is concordant and what is not related to the object of study.

When to do exploratory research?

The answer is simple and concrete, when we do not know the context of the object of study.

What are the characteristics of exploratory research?

1. Research is based on observation and recording of information;
2. It is an unstructured process, so it is flexible;
3. Allows multiple sources of information that provide qualitative information;

4. It does not answer complex questions, and if it triggers more questions that can be the basis for further investigation;

5. Generates the bases for the next steps in the investigation, allowing to raise an initial hypothesis and laying interchangeable bases for the research methodology.

What are the steps to follow to carry out an exploratory investigation?

1. Choose what is the problem or what is the issue you want to address;
2. Confirm that the problem or topic is feasible to develop, based on the collection of information from different sources, identifying if this topic can be deepened in the future or it is necessary to change the objective of the research;
3. Establish a preliminary hypothesis that allows to continue with the development of the investigation.

What techniques to follow to collect information in exploratory research?

In the first place, you can start by observing the context in which your object of study is located, relating directly to this context to identify the factors and relationships that occur in that context, for this you can be in

direct contact with the situation, for example, go to the field or start giving that approach remotely.

A second very useful technique in this type of research is the documentary review, where you will identify all the primary and secondary sources that have already investigated on the subject or that have a perspective on it.

The third technique is based on asking experts, people who are knowledgeable about the topic you are dealing with and, through specific questions oriented through an interview, will allow you to give a broad and experienced panorama regarding factors that influence your research topic..



Image 45. Own elaboration.

Participation in the Young Promises.

What are the advantages and disadvantages of this type of research?

By way of advantages you will find that the resources to carry out this research are low in relation to other types of research, which is flexible as you collect information, it also allows you to identify if the topics you are dealing with are relevant to deepen and, finally, it allows to lay the initial foundations to carry out more in-depth and specific investigations.

As disadvantages you will find that the results you obtain from the research are not conclusive or accurate, so you will require more information that allows you to make decisions regarding your research.

With this, we see that then in order to carry out high quality scientific research with an impact on society, it is not enough only with exploratory research, but it is necessary to continue in the process of investigating and polishing the edges of the research until reaching the objective or raised form.



Image 46. Own elaboration.

Participation in the Young Promises.

Descriptive

If they ask you to make a physical description of yourself, what would you say?

Most likely, you start with your skin color, eye color, hair length, height, complexion, nose size and other physical traits that make you unique.

In the same way, descriptive research is about describing the context, situation or problem that we are investigating, it is about showing all the characteristics that make up the situation, identifying what the situation or problem under study is and not why it occurs.

Descriptive research, then, is only about measuring and describing the different variables that may affect your problem situation or your object of study, but not about altering these variables, it is about showing, based on exploratory research, those variables that have impact on what you are studying and that in one way or another would allow you to correlate the information previously obtained with the

measurements and descriptions that you are taking.

Continuing with this, this type of research seeks to quantify the data collected from observation and exploration, to understand in quantitative terms what. Generally when we are describing an environment, we are talking about populations, groups, or conglomerates of elements that we can associate with each other. For example, for an investigation in which I want to determine the context in which the problem of consumption of water contaminated by different bacteria is found, I will have the populations of people who consume that contaminated water, I will have the populations of different microorganisms that contaminate the water, I will have a group of factors that affect the growth of these microorganisms and in that way I can identify the different groups of variables, factors or people that affect my research topic and can be correlated with each other.

What is the objective of this research?

Describe the characteristics of the group, population or set of elements that are being studied, answering what it is.

What are the main characteristics of this research?

In principle, it is important to establish that what we are doing is observing, that is, we are taking the next step of exploratory research, we are visualizing the characteristics of the context and the environment in which our research object is located, so we must have different instruments that allow us to see and describe these characteristics in the most comprehensive way possible, without altering them, and identifying the relationships that arise between them. For this, it is necessary to collect data and analyze and study them that allow us to glimpse those correlations in which it can be immersed or, by which our object of study can be affected. Continuing with the example mentioned above, when carrying out the descriptive investigation of the consumption of water contaminated by microorganisms, it is identified that those who consume this water are people who do not have drinking water service at home

and, who are generally near some source of water. natural surface water, where animals and garbage dumps are also found, likewise, it is identified that, of the people who consume contaminated water, the most affected are children under 5 years of age, who can die from diseases caused by microorganisms they consume in water.

As we can see, we are only giving a general description of the problem without stating why it is occurring and, if we are establishing a "situational map" generating the correlations between the factors and variables that are part of the characteristics of the situation we are evaluating.

So the characteristics of this research are:

1. Describe the situations and contexts in which our problem or object of study is found;
2. Measurement and information gathering elements such as surveys are usually used to quantify the characteristics described in each situation or context;
3. At the end of the investigation, the following is usually identified: what happens, how it happens, where it happens, when it happens, and to whom it happens.

What are the steps to follow to carry out a descriptive investigation?

1. Based on exploratory research, see the characteristics of the object of study or problem and its context;
2. Limit the object of study according to the observed characteristics and scope that you want to give it;
3. Select the instrument and methodology for the collection of information, as well as the sources from which it will be obtained.

What techniques to follow to carry out descriptive research?

1. Observe and identify the problem or object of study and the context in which it is being carried out;
2. Elaborate and construct different methods for measuring variables and gathering information;
3. Observe and record the data, taking note of all the details surrounding the data that may mean a change in them;
4. Organize the information, based on a classification by importance or relevance for the object of study;
5. Analysis of the information previously classified in relation to the object of study;

6. Generation of bases and guidelines to continue with the development of the investigation, based on the information collected, classified and analyzed.

What are the advantages and disadvantages of conducting this type of research?

The main advantages of carrying out a descriptive research are based on the fact that the observation and description are carried out in the natural environment in which the variables and factors under study are found, that is, the conditions are not being altered. normal in which the problems that we identify for the investigation are presented and developed. Additionally, it provides us with qualitative and quantitative information that allows us to generate different inferences and correlations between said variables and, with this, determine the next steps to take in the research, as well as accentuate and make the object of study more specific and clear.

On the other hand, as disadvantages, there is the fact that since the variables that condition the context we are studying are not controlled variables, it is very difficult for these conditions to be replicated, so it

would not be possible to stay alone with this type research.

Likewise, the researcher at the time of collecting the information may not ask the correct questions that allow consistent results for analysis and categorization.

Based on the aforementioned, descriptive research is an important step in determining the situation in which our object of study develops and it is very useful as soon as the bases are laid to continue the investigation.



Image 47. Own elaboration.

Participation in the Young Promises.

Correlational

Let's continue with the imagination to understand a little more in our context what this type of research refers to.

As soon as I mention the word correlation, a thread that joins at least two points comes to mind, and which in turn can have more points of connection along the thread.

Well, that's what correlational research is all about, from the measurement of the behavior of two variables in a given context, it is possible to establish a statistical relationship between them, this is called correlation.

So this type of research is about finding those correlations between variables. Let us remember that in descriptive research we are in charge of identifying the variables present in the environment or context in which our problems or object of study develop, and we also observe how these variables are related to each other.

To land these concepts in everyday life we can think of the following situation. When

we see that the sky is gray and the air feels damp and cold, we could say that it is going to rain. In this case we are giving a hypothesis based on the correlation that we have seen days before regarding rainfall, cloudiness and humidity of the environment.

Continuing with the example of the consumption of water contaminated with pathogenic microorganisms, it is possible to establish that there is a relationship between the variables, consumption of contaminated water and acute diarrheal diseases, according to the collection of information where it was identified that most of the diseases Acute diarrhea are caused by pathogenic microorganisms that enter the human body through ingestion, and that one of the main routes of ingestion of these microorganisms is through contaminated water, so we can establish a correlation between these two variables.

It is important to bear in mind that, like explanatory research, what is done at this stage of the research is not to alter variables, but to measure them to have a clear correlation between them.

The importance of measuring these variables without altering them is based on the precise understanding of their behavior and relationship, because by understanding how one influences the other, we understand how the system works and in future stages of the research we can modify these variables to modify these relationships and / or behaviors, according to the results we expect to observe.

When to conduct a correlational investigation?

1. When I have clearly identified the variables that I want to investigate and I have a perception regarding the possible correlation that these may have;
2. When I do not modify variables on my own, but only seek to understand how their behavior is altered in the presence of another variable;
3. When the variables I want to analyze directly or indirectly determine my problem or object of study.

What are the characteristics of this research?

1. It does not alter the variables to be studied;

2. It is generally based on statistical methods that make it possible to identify the correlation coefficient between the variables;
3. Results can be positive correlation, negative correlation, or no correlation;
4. The fact that there is some type of correlation between the variables does not show the cause of the correlation, but only shows that both the behavior of one variable is influenced by the presence and alterations of another.

What are the steps to follow to conduct correlational research?

1. Based on the information obtained from the descriptive research, it is necessary to choose two variables that are in the context in which your problem or object of study develops;
2. Without altering the variables, that is, observing and taking note of their behavior "in their daily environment", they begin to identify if the behavior of one of the variables is affected by the presence of another;
3. From the previous step, determine if there is a correlation between the variables.

It should be mentioned that the simplest and most practical case is when we take into account for our correlation analysis only two variables, however, you can carry out this analysis with more variables, but you will require robust knowledge of statistics to carry out a design of experiments and computer tools that allow you to visualize the different correlations that occur between all the variables, and that have an impact on the model of your research.

What are the types of correlation that I can find between variables?

a. Positive correlation: It occurs when when one variable increases the other that you are analyzing also increases, or when one decreases, the other also decreases. In other words, we expect a similar behavior between variables, for example, we can say that there is a positive correlation between the variable "food" and "weight", the more food you consume day by day, your weight will increase, and in the same way decrease your portions your weight will decrease. Keep in mind that we are only considering these two

variables and the exercise is not one of them.

b. Negative correlation: It occurs when one variable increases the other decreases and vice versa. Continuing with the previous example, when you exercise more daily, your weight will decrease under normal conditions. In the same way, when you stop exercising in your daily routine, your weight will tend to increase. Keep in mind that we are still considering only two variables and food is not one of them.

c. No correlation: This occurs when altering one variable nothing happens with the other. For example, in university students, being late to class does not depend on the amount of food they eat before attending their courses.

As we could see previously, there may be different types of correlations that we can evidence in our daily life and that these examples will give us, which, like our daily life, also appear in the phenomena or situations in which we are investigating.

Like the other types of research, correlational research has pros and cons. The main advantage of this research is that it allows us to identify the correlation between two or more variables in a given context, without altering them.

Likewise, it allows to identify the behavior of these variables in their "natural environment" without altering them.

It allows you to collect a lot of information and is a good point of continuity for the research that is being carried out.

It allows the analysis of said correlation to land it on bases to continue with the investigation based on these analyzes.

However, due to the correlations generated between different variables, these correlations are sometimes confused with causes. Remember that correlations explain

the what and the causes explain the why, with this research we can identify what happens without delving into details of why.



Image 48. Own elaboration.

Participation in the International Galileo Chair.

So, this research provides a more specific overview of what happens to the variables in the context we are investigating, allowing a large amount of information to be collected and generating correlations between said variables. To implement this research, and depending on the variables, it will be necessary to use different

measurement instruments for said variables to identify these correlations without altering the variables.



Image 49. Own elaboration.
Participation in the International Galileo Chair.



Image 50. Own elaboration.
Participation in the International Galileo Chair.

Remember to always rely on your tutors to establish these measurement instruments that are useful to establish the correlation between the variables of interest that you observed in the descriptive and exploratory research.

Explanatory

Let's go back to the point of thinking that we mean by the verb explain. If we go to a Spanish dictionary, explaining would be defined as making the cause of something known, that is why on many occasions we use it as a way of claiming, for example: Can you explain to me what this does here? Seeking to understand what is the cause of the object not being in its place.

What explanatory research refers to is to identify the cause of the situation or problem that you are observing, that is, we have already gone from correlational research to explanatory research where we will determine the causes of those correlations.

To start this research, it is important that the research bases are well established, that is, that the general context in which the problem and the object of study develop is well described and the variables of the same have a well-defined role in said context, identifying the correlations present between said variables.

We carried out this research to identify the why, that is, we landed all the description

and understanding of the context made in previous research (exploratory, descriptive and correlational).

What are the characteristics of this research?

1. Take as a basis the correlations, variables and context that you identified in previous research;
2. Seeks to determine the causes of the problem you are studying;
3. It allows to generate conclusions to the preliminary hypothesis previously raised, according to the causal relationships identified at this stage of the investigation;
4. It requires experimental studies in the laboratory or populations that allow determining the causal relationships of the modification of the variables you are studying;
5. It contains a lot of information, so it is necessary to have the ability to analyze and structure the information to establish causal relationships, as well as contrast the results with previous research that can complement or support the results you are observing.

Although there are guidelines for conducting explanatory research, the steps to follow will depend on each investigation. Here are the guidelines to guide the investigation:

1. Seeks to answer why the correlations that you evidenced in the previous stage are presented (correlational research);
2. Generates experimental designs that allow corroborating why the behavior of these correlations occurs;
3. Determine the impact on your research, to understand the reason for the correlations that occur.

Beyond talking about the advantages and disadvantages of this type of research, the important thing is that you are clear about why you are at this stage of your research.

When you are in the explanatory research stage, you are looking to respond to the problem that you identified and defined in the exploratory research, so your motivation is to solve that problem or understand why it happens, to leave the precedent for future Research from other people who may continue your work.

You must rely on the theoretical knowledge, tutors and experts to design the experiments that are necessary to test your hypothesis and establish the causal relationships of the alterations of variables. However, you must bear in mind that all this is part of the main objective of the research and your professional and personal motivations that allow you to establish how far to go with the study you are conducting.

Determine how far it will go

It is vitally important that when you start the investigation you establish a scope, which in turn is modifiable and realistic. To establish this scope you must take into account:

- a) Resources, when we talk about resources we are not only talking about money, we are talking about physical resources (such as facilities to which you have access or to which you can have access due to the agreements in which your research can be immersed), human resources (tutors, work team and administrative team that promote the development of your research in a fluid way), and intellectual resources, you may be entering a research topic of which you do not know anything, for which you should take into account at the time of plan the scope, which will take a little more time to acquire the theoretical knowledge necessary for the development of the research;
- b) Time, time is a limited resource, because no matter what we do, we will always have 24 hours and 7 days a week. Therefore, it is essential that you take into account realistic times adjusted to the activities of your research, so that as you progress you

measure the activities based on time, and on whatever you establish, how much time you want and be willing to spend doing this research;

- c) Interests, there are investigations of all kinds and in all areas that you can imagine. The most important thing when you do research is that it is aligned with your personal and professional interests, since research is a lifestyle in which many times the personal and professional line will become invisible. So, choose something that you are passionate about and that if it is necessary to acquire more theoretical knowledge for its development, do not hesitate to spend more time learning about the subject, to achieve the objective of the research.

From these 3 factors, you will see how other sub-factors are derived that will make you make the best decision regarding what research to choose, what topic and how far you want to go with it.

The investigations can be endless, based on the point that the result of one investigation can lead to another and that to another and another, so we would be talking about an

infinite chain of investigations that could have the same origin. For example, let's recall the example of Isaac Newton, previously mentioned regarding the law of universal gravitation, it all started with an apple that fell from a tree and in a curious and exploratory way, research began to emerge regarding why the apple had fallen of that tree. One of the results of that research at that time was the law of universal gravitation, however, that result served as the basis for other studies related to gravity, planet earth and the solar system, and to this day we continue to study to gravity for different land and space applications. The point of this example is that can you imagine Newton doing all those studies by himself? Most likely not, so he had to define how far he wanted his research to go and lay the groundwork for future studies.

In the same way, it is important that you establish how far you want to go with your research, that you enjoy the journey and do not pursue the end. Many researchers are frustrated because the only thing they are after is a Nobel, and they do not enjoy the path of discoveries, publications, conferences, and academia, which are

circumscribed when you are a professional researcher.

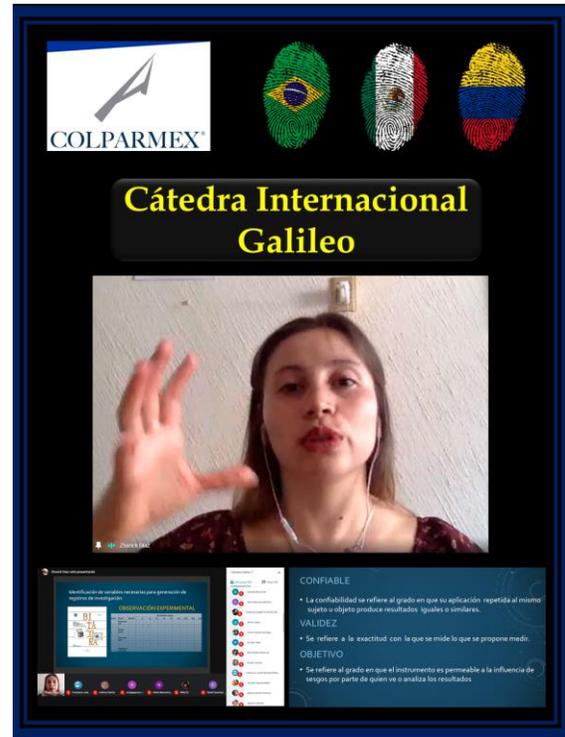


Image 51. Own elaboration.

Participation in the International Galileo Chair.

At this time in your life, as a personal, professional and vocational guidance, it would be good if you answer yourself the following questions:

1. At what stage of my life am I on a personal and professional level? (Example, I am a student, I have children or not, I have financial responsibilities or not);

2. What is my personal goal in doing this research? (Example, I do it because I applied for a scholarship, I do it because I plan to stay in the academy, I do it because it was a good opportunity at this time);
3. Do I see myself in 5 years doing research?;
4. Do I like the lifestyle that I will have with the research?

It is very important that you are 100% sincere with your answers and that you take the time necessary to answer them in depth, because depending on these answers you will determine what is the scope of it and under what contexts you are going to develop it.

Once you have defined the scope according to your vocational, professional and personal profile and decide on the research in the short, medium or long term, you will find different ways of presenting the results and disseminating the knowledge that you have managed to discover or relate to in new contexts.

In chapter IX we will see more about how to present the research results and get the most out of your stage in this world of knowledge.



Image 52. Own elaboration.

Participation in the International Galileo Chair.

IV

Establish hypotheses

Vili Aldebarán Martínez García

“Science is a way of thinking, much more than a body of knowledge”

Carl Sagan

Establish hypotheses

The hypothesis (small hypo and thesis conclusion) is a “small conclusion” of what we think will happen or what we will obtain with the findings obtained. It is important to highlight two aspects:

- a) The value of the information obtained through a rigorous process provides valuable information whether or not it supports the hypothesis raised;
- b) Not in all cases a hypothesis is formulated.

In this sense, it is feasible to consider that:

In the case of exploratory studies, it is not necessary to formulate hypotheses since we are precisely on the frontier of knowledge and we are not certain about what we are going to find.

In the case of descriptive studies, it is done when we are going to predict a possible outcome.

In the case of correlational studies, the hypotheses must be made precisely of a correlative nature.

Finally, in the case of explanatory studies, causal hypotheses are formulated.

In qualitative studies, it is rare to formulate a hypothesis.

The hypotheses will be formulated from the variables. There are different types of hypotheses.



Image 53. Own elaboration.

Participation in the International Galileo Chair.

SCHEME 3. TYPES OF HYPOTHESIS

Research hypothesis	<ul style="list-style-type: none">• They are the possible relationship between the variables, they are designated as $H_1, H_2 \dots H_n$.
Null hypothesis	<ul style="list-style-type: none">• They are the reverse of the research hypotheses, it is designated as H_0.
Alternative hypothesis	<ul style="list-style-type: none">• Provides an alternative explanation to the research hypothesis, it is designated as H_a, this type of hypothesis does not always exist
Statistical hypothesis	<ul style="list-style-type: none">• The research hypothesis is going to be represented with statistical symbols can be formulated when the data to be collected and analyzed to test or reject the hypotheses are quantitative (numbers, percentages, averages)

Source: self made.

Hypothesis testing

It is necessary to apply tests to the hypotheses to determine if they are accepted or refuted and this is part of the importance of the research design since it will indicate the way in which the data will be collected through one or more measurement instruments and the way in which they will be analyzed.

Detection of variables

We refer as variables to the characteristics that we are going to study, these will have value when we relate them to others, that is, when a variable has a relationship or incidence on one or more variables receiving different names such as:

Dependent variable. We refer to that factor (variable) that we fully identify and we are interested in knowing if other factor (s) that we assume affect it in any way and, if feasible, know with what intensity or what type of relationship their interaction maintains.

In this order of ideas. The independent variable (s) is (are) with the one (s) that we consider to explain the existing changes in

the dependent variable. It is important to note that when our research is well done and we find that the relationships that we had projected do not exist, remembering what we had commented at the beginning of the book, this is also a contribution to the body of knowledge.

Define the variables

It is important to define the variables (which must be feasible to be observed, measured and evaluated), so that anyone who reads our research is clear about what is being talked about, they can be described in two ways:

Conceptual definition. We refer to the exact definition that we can obtain from the specialized literature.

Operational definition. We refer to the procedures that we will use to measure the variable, always taking into account the criteria of both reliability and validity and that they are adequate for the research we carry out.

For example:

Variable	Conceptual definition	Operational definition
Type A behavior	“complex of action-emotion characteristics, displayed by individuals who are engaged in chronic exertion ...”:	Martínez Test - Type A Behavior (MT-CTA)

Exercise four

1. Write your hypothesis (s):

2. Define your variables

V

Select the
appropriate research
design

Vili Aldebarán Martínez García.

“The history of science shows us that theories are perishable. With each new truth revealed, we have a better understanding of nature and our conceptions, and our points of view, are modified”

Nikola Tesla

Select the appropriate research design

Certainly, when we start an investigation we do so with a passion that invites us to fly through little-known spaces in ways that border on the audacious, however, it is essential to reflect briefly to measure our possibilities and ask ourselves how far we can go with the resources that we have at the moment (time, money, information, permits, etc.). In addition to the above, it is important to see the current state of knowledge (also called the state of the art), to know where we are starting from and how far we think we can or should go. In this framework of ideas, we can consider that our research can start as we have seen in a previous chapter from the exploratory to the explanatory level and once the above is defined, we can identify what type of design will be the most appropriate for our research in particular, having that we can consider basically four options.



Image 54. Own elaboration.

Participation in events.

Experimental

Specifically, we refer to studies where we have control of the variables, remembering that these can be classified into Independent Variables (VI), which are controlled, manipulated and are those that are considered to have an effect on the Dependent Variable (DV). these RVs that are looking to obtain readings of how they are affected by the manipulation of the VI. This type of study is rare in economic-administrative sciences due to the complexity involved in working with humans, with special emphasis that participants must have a clear understanding of what is going to be done at all times and fully comply with the guidelines and requirements defined in the scientific, ethical and regulatory principles, both national and international. Kind readers are recommended to have the opportunity to review four documents that will shed light on the subject, considering that although the bibliography on it is much more extensive, these documents provide an overview of it:

1. The Nuremberg Code of 1947 (National Bioethics Commission, 2020);

2. The Declaration of Helsinki 1964 (revised in 2013) (National Bioethics Commission, 2020);

3.- International ethical guidelines for biomedical research in human beings. Prepared by the Council for International Organizations of Medical Sciences (CIOMS) in collaboration with the World Health Organization. Geneva (Pan American Health Organization and Council for International Organizations of Medical Sciences, 2016)

4.- Official Mexican Standard NOM-012-SSA3-2012, which establishes the criteria for the execution of research projects for health in humans (Ministry of Health, 2013)

Pre - experimental

This differs from the experimental one because there is no total control of the variables, although this affects the robustness of the results, they are very useful to obtain data and successive approximations in knowledge. To a large extent, there are two Variables that make it impossible to use the experimental method, these being the Strange Variables (VE), which can be conceptualized as variables that cannot be controlled efficiently and can be divided into Strange Situational Variables (VES), These being those that are related to the environment (for example, that the study participants have been subjected to the stress of an assault on their journey prior to the test, that they have suffered a considerable delay, etc.), and the Variables Strangers of Participants (VEP), these being those of each person in such a way that their mood, socioeconomic differences, intelligence and others may affect their responses. The VEP can be mitigated with an appropriate selection of the participants and the VES by providing people with a stable environment, however, in case of not achieving control of the same they generate what is known as a Confusion

Variable (VC), which can have an impact on DV, causing difficulty in determining whether the results obtained were determined by LV, CV or an interaction between both.



Image 55. Own elaboration.

Understanding the above, it is important to mention that this model is highly applicable in the economic and administrative sciences since, as they are very young disciplines with little more than 100 years of life (considering as its beginning the publication of the book *The Principles of Scientific Management*, by Frederick Winslow Taylor, published in 1911 as the starting point for the study of the field of

management), it is possible to understand that his body of knowledge is in full formation, so there are a large number of assumptions, few constructs and fewer definitions and consolidated theories.

As an interesting fact, it is important to mention that the second book published of great importance for the field of administration was in 1916 by Jules Henri Fayol, under the name of Administration Industrielle et Générale.

In this sense, the application of this research model is important to seek to contribute valuable findings to the body of administrative knowledge, considering that, although total control of EVs is not possible and there cannot be certainty of both internal and external validity, can be used with caution in exploratory studies considering that it is intended that the participants be selected randomly.

Quasi - experimental

This model is very useful for studies in economic, administrative and social sciences when the resources available are limited considering that within its characteristics are that groups are not selected randomly, but that already established groups are taken (groups of class or sports teams), there is little control over the VE, it is sought to have the greatest possible control over the dependent and independent variables and, as in the previous model, it is not possible to have the certainty of both internal and external validity. use with caution in exploratory studies.

Not experimental

In this section we refer to investigations that do not seek to manipulate the variables that are the object of their study, but rather, observe the phenomena that are of interest to them in their environment to seek to describe and analyze them without having a controlled environment. Although, it is not possible to extrapolate the data obtained or to try to create a theory based on them, they turn out to be very useful to "feel" the terrain on which one walks. These are very useful when it comes to contributing to disciplines so young that they are building their theoretical framework.



Image 56. Own elaboration.

Many times the road will be tiring and with great difficulties, so it is important to rest for a moment and continue.



Image 57. Own elaboration.

Participation in the International Galileo Chair.

VI

Sample selection

Beicy Viviana Acosta González

“Equipped with his five senses, man explores the universe around him and calls his adventures science”

Edwin Powell Hubble

Sample selection

- ✓ Before choosing the sample, it is necessary to know the population, answer questions such as who is the individual? What do you want to know about the individual? Are all the individuals used to obtain the information? Which individuals? How to locate to individuals?
- ✓ It is necessary to characterize the individual if they are people, companies, places, communities, animals, and all that you want to analyze is a population.
- ✓ Be realistic with the population.
- ✓ Have access in space to the population
- ✓ If the population is very large and impossible to analyze in its entirety.
- ✓ The economic resources that you will need.
- ✓ Time in data collection and processing.
- ✓ The population is sufficiently homogeneous with respect to the measurement characteristic.
- ✓ The population is adequate or sufficient in order not to waste resources on exhaustive analyzes.

Determine the sample

To determine the sample it is necessary to be clear about what the population is, what the sample is and what the sampling is. The population is the total of the set of individuals.

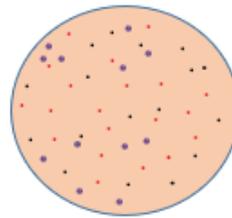


Image 58. Own elaboration.

The sample is a part of the population.

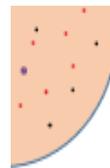


Image 59. Own elaboration.

Sampling is the process that is done to extract a sample from the set of individuals.

Extract the sample

There are probabilistic samples that indicate that all those belonging to the population have the same probability of being elected, physical mechanisms such as ballot boxes or tables of random numbers or tools such as Excel and non-probabilistic tools that are not guided by probability can be used. for convenience, installments or intentional.

Finite population is when the population is known, for the case to calculate the sample size for a population of 10,000 seedlings with a confidence level of 95% and a margin of error of 5% where the probability of the event is unknown, applying the following equation will be given the sample to use.

$$n = \frac{N * z_{\infty}^2 * p * q}{e^2 * (N - 1) + z_{\infty}^2 * p * q}$$

n = sample size

N = population size

z = statistical parameter depends on the confidence level

e = maximum accepted estimation error

p = probability of the event occurring

q = probability that the event will not occur

Infinite population the population is not known, in this case it is to calculate the sample size for an unknown population of frailejones with a confidence level of 95% and a margin of error of 5% where the probability of the event is unknown, applying the following equation will be given the sample to use.

$$n = \frac{z_{\infty}^2 * p * q}{e^2}$$

n = sample size

z = statistical parameter depends on the confidence level

e = maximum accepted estimation error

p = probability of the event occurring

q = probability that the event will not occur



Image 60. Own elaboration.

Participation in the International Galileo Chair.

Simple Random Sampling

It is constructed in such a way that the entire population has the same probability of being chosen.

Stratified Sampling

It is a simple random sampling for each stratum. A stratum is a group of individuals similar to each other and different from individuals in other groups. These groups are already defined, such as socioeconomic strata, municipalities, gender, age groups, income groups.

By conglomerates

It consists of randomly selecting a certain number of clusters (the number necessary to reach the established sample size) and then investigating all the elements belonging to the chosen clusters. It is a group of individuals very different from each other and each conglomerate is similar to the others.

Systematic sampling

The data must be ordered randomly, number all the elements of the population, but instead of extracting n random numbers only one is extracted, for this case we have a population of 8000 carrots with a

systematic sample of 500 to identify their acidity with a start of 10 is given by applying the following equation.

$$k = \frac{N}{n}$$

N= population

n= sample

By census

The entire population is taken from a set of individuals

Snowball

Some individuals are located, which lead to others, and these to others, and so on until a sufficient sample is obtained.

Quota sampling

The researcher selects individuals from the population in such a way that the segments are represented in the same population.

Convenience Sampling

The researcher directly and intentionally selects individuals from the population. The most frequent case of this procedure is to use individuals who are easily accessible as a sample.

VII

Data collection

Beicy Viviana Acosta González

“Facts are the air of science. Without
them, a man of science can never
rise”

Ivan Pavlov

Data collection

Identify or develop the measuring instrument

The use of collection techniques does not by itself give the results, it is necessary to identify the variables, these described as the characteristics or attributes of the individuals or groups of objects that are of theoretical interest to the researcher that can be measurable or characterized according to the Type of study. The analysis categories can also be given, these are given by the documentary review or by the researcher's results.

Identifying the variables or categories of analysis allows the researcher to have a broader vision and with them make decisions along the way of the investigation. The measurement scales can be nominal: gender, race, neighborhood; ordinal: measures, levels of study, strata; interval: seconds, notes, temperature in this case zero implies a unit of measurement; and of reason: height, meters in this case cannot give negative values.

If you are wondering at what point does the research design arise? The answer to that question depends on whether it is a

qualitative study once the research problem is posed and the scope to which the design is to be reached can change with a first approach to the field of study or in the collection of the data different from what happens in the studies or quantitative in these, you already have to have in posing the problem, have the theoretical perspective with the initial scope of the study and possible hypotheses if it is the case.

The researcher and those interested in the topic are suggested to take other references in which they can expand the topic.

The instruments can be given in two ways, one which is built from the review of the literature and the variable dimensions or categories that are to be analyzed, and two take one that has already been applied, but this must be adapt to the context to which you want to analyze, since it can be a sign of misuse as it is not applied to the study sample population or that it was done in a different time line.

In the construction of an analysis instrument, informed consent should be considered in accordance with the existing regulations where the title of the study, responsible, email or contact telephone

number, the use of the information is clarified.

When applying the instruments, it must be taken into account that the role of the researcher must be objective, limiting bias, it must not influence or incite the response, it must avoid emotional charge and be empathetic, as this is an important part so that the results are as indicated. Some data collection techniques are as follows:

Group interviews: In the presence of analysis groups, descriptions are made to the interviewees of the topic of interest, an example of this is the focus groups identifying the experiences, beliefs and attitudes of the participants at a certain time, or the discussion groups of a group of people selected by the researcher led by the interviewer is where a topic is discussed, the purpose is that a conversation takes place between all the participants, the objective of these interviews is to extract the information about the studied phenomenon that explains social relations, their structures.

Individual interviews: they can be given in a structured way, they are questions already defined; **Semi-structured** unlike the previous one, it occurs in a conversation

where the questions can be modified, added or removed according to the conversation with the individual of analysis, and the open interview the interviewee can express her point of view guided by the interviewer's conversation.



Image 61. Own elaboration.

Participation in the International Galileo Chair.

The above are of a textual type such as content analysis, discourse, theoretical categories, analysis of textual statistical data. These are helped by tools such as the recorder, pencil and paper, for the application of the interviews it is recommended to have expertise in the subject to limit biases and have the ability to start conversations since it may be the case of finding people with few words that may limit the investigation. They should be simple questions of short duration, with clear language, carry out a pilot test and validation by experts to verify their coherence with the objectives of what you want to investigate. These are the most used in research, however there are multiple classification of items, vignettes and temporal sampling of live experiences.

The questionnaires respond to categories already established by the researcher. It is an information collection system consisting of a set of questions that is used to extract information from people. The questions must be written in a clear and precise way that responds to the proposed objectives.

The ethical aspects of the use of information with informed consent must be taken into account, where the purpose of the

questionnaire is presented, the explanation of how it will be developed, for what purpose. Initially with questions such as age, educational level, profession and others that contribute to the analysis of the results.



Image 62. Own elaboration.

Participation in the International Galileo Chair.

They are descriptive statistical analysis, correlational analysis, multidimensional scaling. The questionnaires are not recommended in the “evaluation of highly complex questions, variables or constructs, analysis of controversial topics, or gathering detailed information about people's behavior” as stated by Páramo (2017), as it is better to use other techniques than better detail the unit of analysis.

Questionnaires with closed questions: these are questions that have fixed answers, subject to who builds the instrument, an example of this are:

Questions with a choice of yes-no answers.

Questions with true-false answer option.

Questions with multiple choice of answers.

Questions with a Likert scale answer option, in which the selection of items when the questionnaire is applied, the answers have the same intensity of measurement, the possibility of answering is between two and seven, they are summative (Guil, 2006).

Questions with Thurstone scale answer option, the selection of the items is by group

of experts, the answers have the different intensity of measurement, the possibility of answer is two, they are differential (Guil, 2006).



Image 63. Own elaboration.

Participation in the International Galileo Chair.

Questions with a choice of Guttman scale answers, the selection of items is by group of experts, they have few items, they measure very specific attitudes, they are cumulative (Guil, 2006).

Questionnaires with open questions, allow to have more extensive answers, answer to who ?, where ?, why ?, how ?, when ?; When using this type of question, it is not possible to generalize as it is possible to have different types of answers.

There are techniques that are based on participant observation, behavioral observation and behavioral maps, as well as techniques from secondary sources such as social mapping, image analysis, behavior traces, among others.

It is possible to use several techniques in order to be able to triangulate the information, but this will depend on the researcher's intentions, the triangulation of multi-method, methodological, theoretical, data, sequential data in time can be given, which It is recommended to continue researching the subject if it is of interest to your field of study.



Image 64. Own elaboration.

Participation in events.



Image 65. Own elaboration.

Participation in the Young Promises.

Calculate the reliability and validity of the measurement instrument

All investigations must be based on presenting data that are valid, reliable and truthful to be accepted scientifically, which is why the validation of the instrument at the time of supporting the reliability of the information is an important part of an investigation. For which, the validation by experts in the subject in which you want to investigate such as teachers, writers, psychologists can guide, reaffirm or suggest the instrument to avoid possible errors and bias of the information that you intend to acquire. Also the use of statistical methods when quantitative techniques are used.

Cronbach's Alpha, determines the internal consistency of an instrument, "Cronbach's alpha values between 0.70 and 0.90 indicate good internal consistency. The determination of Cronbach's alpha is indicated for one-dimensional scales between three and twenty items "(Celina and Campo-Arias, 2005: 572). However, Cronbach's alpha coefficient changes according to the number of questions and

according to the population in which the scale is applied, and the more questions the value will be closer to 1, the best practice is to calculate a Cronbach's alpha value for each group of items that make up the dimensions of the instrument. It is important to bear in mind that, if the value is close to 1, the greater the internal consistency of the items that make up the instrument, if the value is less than 0.50, it is necessary to rethink the questions so that they have better consistency or not to use that group of items. The Pearson correlation index is a test that measures the statistical relationship between two continuous variables, the absolute value of the magnitude can vary between zero and one, the positive sign indicates that the values of both variables change in the same direction, while that the negative sign indicates that they change in the opposite direction (Camacho-sandoval, 2008)

Expert analysis or Delphi method is used in order to collect structured judgments of experts on a topic in the case of the instruments, a series of questions is used that is applied to a group where the successes or possible errors of an instrument are identified according to the validity of people who know about the topic to be

investigated as stated by Garcia and Suarez (2013: 256),

1. It is an iterative process: consisting of successive rounds of consultations for participants to review their opinions.
2. Requires feedback: the experts receive the evaluations of all the participants before each round, to contrast their criteria with those of the rest of the group and offer their judgment again.
3. Requires anonymity for individual responses.
4. Its purpose is to build a consensus, this is a general group agreement based on the statistical processing of differences and coincidences between individual assessments and their modifications through the rounds.

Content analysis, determines if the items of an instrument are representative, this can also be done by expert analysis.



Image 66. Own elaboration.

Participation in events.

Apply selected instrument

Initially, when applying the instrument, improvisation should be avoided, the researcher or whoever applies it must know the topic of each question and the objective to which the research is to be reached

Carry out a pilot test, choose a number from the population to which the instrument will be applied, which will allow possible errors to occur, or to confirm that this is really the result of the instrument to be applied.

The use of tools such as a tape recorder, logbooks, annotations of notes, in the case of questionnaires or written interviews, printed the number of sheets as many as necessary and the use of pencil or pens.

What can happen if the question is not understood? Very technical words are used, answers are given that do not respond to what is being asked.

Encode the data

Interviews: the use of tools such as tape recorders, since pencil and paper, although used, can lose much of the content because it is conditioned on the agility that the researcher has to transcribe the data. The transcription of the information must be the same as the one heard, that is, if you are asked a question such as, do you consider that the food security of a country is influenced by the decision-making of the government? and in the speech that is transcribed there is something like “sumerce, the government is responsible for all the actions that commit to give stability to the populations and communities. In the previous example, words like sumerce that are typical of the dialect of a population, or fillers such as the repetition of words have to be placed and in the case that they are written interviews and have spelling errors or the like, the speech has to be placed as is of the individual.

These responses are taken to identify the convergences and divergences of the responses of the people from whom the information was taken.

In the data collection when the use of the technique is quantitative, it is given through the transcription of numerical order, values such as, if it is a woman 1 and if it is a man 2, can be taken, but in that case it is necessary to identify and know the numerical values that will be given to each item because analysis errors may be incurred when entering them in the Software and for the different types of scales, verify the intensity that was given to each item in order to avoid possible errors when processing the data.

In the case of studies where the researcher is involved in collecting the data and is part of the experimentation, reports or logs are taken, it is where the data collected is described daily for subsequent analysis in these cases the observation has to carry a process and it is recommended that a plan be made so that the encounters occur repeatedly, because in the first approximations misperceptions can be taken.

Consolidate file for analysis

The use of tools such as Excel, for data coding, since being freely accessible can help the researcher in the analysis of the information obtained, for quantitative methods there is the SPSS or R Program softwares that allows statistical analysis. In the case of ATLAS.ti or NVivo softwares that help you to easily organize and analyze information, content analysis, to be able to make better decisions and many others that can facilitate coding and obtaining results. However, it is necessary to have prior knowledge of its use so as not to err in the entry and analysis of the information.



Imagen 67. Elaboración propia.

Recibiendo el reconocimiento a Jóvenes Promesas 2019 en el Congreso Internacional COLPARMEX.

Initially, the data must be subjected to a process of reflection identifying which ones could have some type of error such as did not answer what was asked or that they have left empty spaces in the case of questionnaires for possible events, these documents will not be included in the results for organize them this is done in order to analyze, interpret and reach conclusions that respond to the objectives and the theoretical basis used.

The analysis of the results can be complex and tedious, the findings will be contrasted with what is known about the area under study, to show them in written form of texts, graphics, figures that allow them to be interpreted.



Image 68. Own elaboration.

Receiving the recognition of Young Promises 2019 at the International Congress COLPARMEX.

- ✓ Do not forget!
- ✓ The techniques or instruments to be used must be related to the theoretical review, the objective of the research and the problem statement, since they are used to respond to them.
- ✓ The use of tools facilitates the coding and obtaining of the results, however, it is the researcher's expertise in analyzing the data that guarantees that they are valid.
- ✓ Help yourself to someone who knows the subject so that you guide the analysis of the results.



Image 69. Own elaboration.

Receiving the recognition of Young Promises 2019 at the International Congress COLPARMEX.

VIII

Analyze the data

Andrea García Valerio

“I am one of those who think that science has great beauty. A scientist in his laboratory is not only a technician: he is also a child placed before natural phenomena that impress him like a fairy tale”

Marie Curie

Analyze the data

This chapter seeks to share the importance of properly selecting the statistics that achieve a better fit to identify significant findings, mentioning, for example, that when a weak scale such as Likert is used, it is not possible to use multivariate statistical models.

In the case of so-called weak scales such as nominal and ordinal, it is feasible to use descriptive statistics.

To select the type of analysis that you will carry out, it will depend on the data that you have obtained; In the event that the data collected is both quantitative and qualitative, an analysis will be performed for each one.

The analysis will depend on:

1. The variables;
2. Hypothesis, and;
3. Scope and depth of the investigation.

Selection of statistical tests

The first thing to do is describe the data (descriptive statistics) and then see the relationship between them.

The main statistical analyzes that can be performed are:

- a) Descriptive statistics for the variables (individually);
- b) z scores;
- c) Ratios and cups;
- d) Inferential statistics calculations and reasoning;
- e) Parametric tests;
- f) Non-parametric tests;
- g) Multivariate analysis.

Next, we will mention each of them, however, its analysis will not be deepened since it is not the end of this work.

Descriptive statistics

The first thing is to describe the data, the values or the scores obtained for each variable.

Frequency distribution: set of scores ordered in their respective categories.

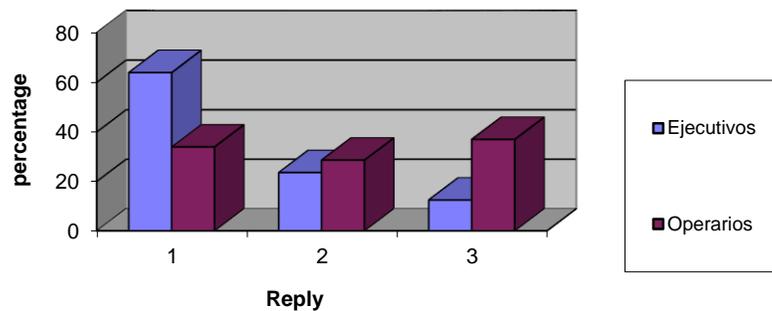
Frequency distributions can be presented in

the form of histograms or graphs, for example:

A study that was carried out in a micro company in the Valley of Mexico to discriminate the factors that generate work stress at operational and managerial levels.

HISTOGRAMS

Stressors from the physical environment



Answers:

1 = There are no physical stressors

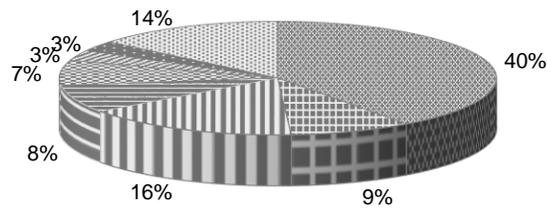
2 = They are sometimes exposed

3 = Yes there are physical stressors

Image 70. Own elaboration.

CIRCULAR GRAPHICS

Main occupational health problems worldwide.



Bibliographic source: Asian - Pacific Newsletter.

- 40% Mental disorders;
- 9% Musculoskeletal diseases;
- 16% Heart disease;
- 8% Diseases of the nervous system;
- 7% Respiratory diseases;
- 3% Tumors;
- 3% Skin diseases;
- 14% Accidents.

Image 71. Own elaboration.

Another type of graphics

Relationship of stressors with catecholamines in operators

Operators	Age and Gender	Symptoms	Stressors	Obtained values
1	47 M	11	33	100 - 20 - 40
2	20 M	3	33	110 - 40 - 40
3	23 M	10	30	100 - 30 - 40
4	36 M	1	25	100 - 45 - 45
5	29 F	8	24	100 - 40 - 40
6	44 M	2	28	100 - 48 - 42
7	51 M	1	34	130 - 50 - 51

Relationship of stressors with catecholamines in operators

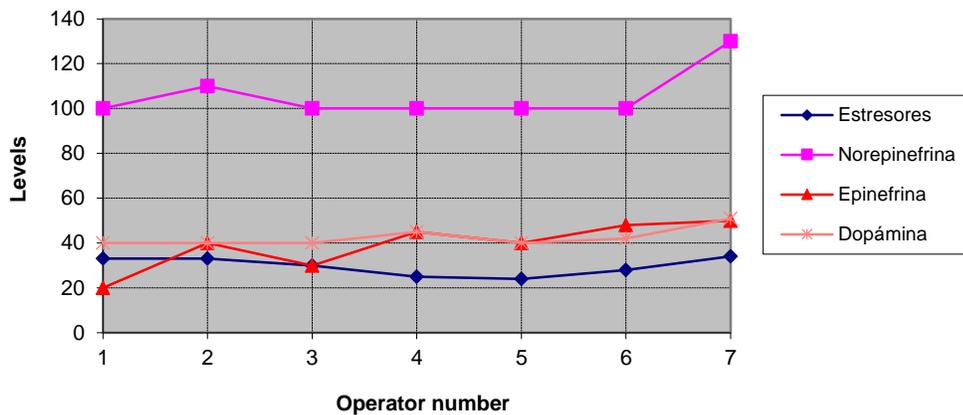
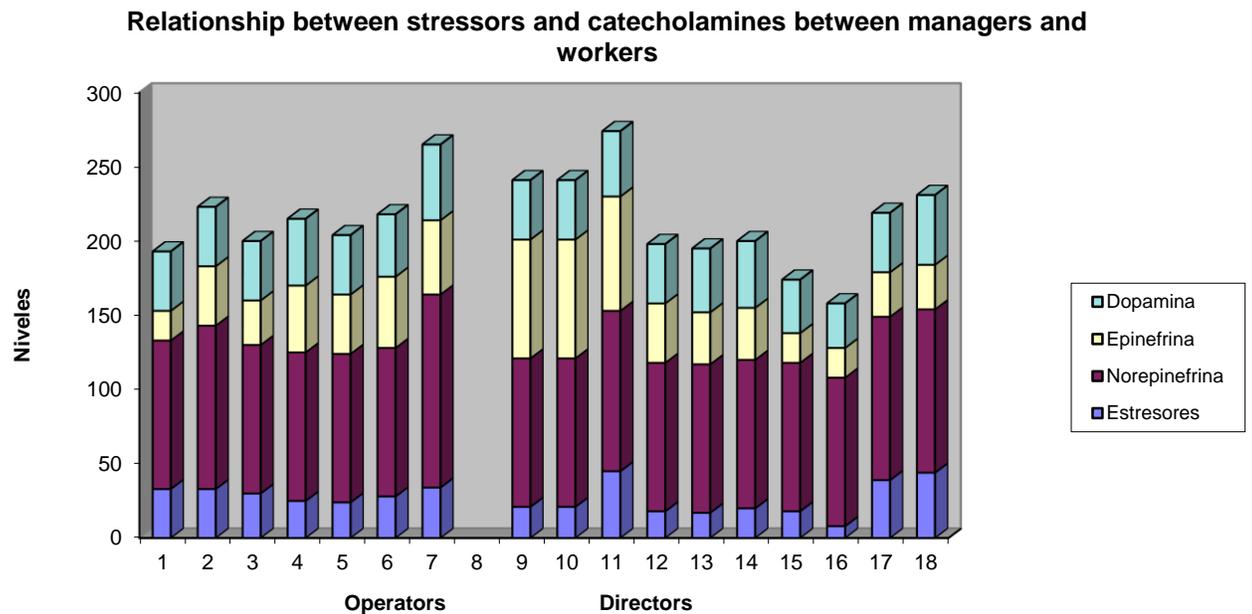


Image 72. Own elaboration.



In each variable, its frequency is obtained, if feasible it is plotted and its frequency polygon is drawn.

Image 73. Own elaboration.

In addition, measures of central tendency and of variability or dispersion must be calculated.

In this order of ideas, the mode, median and mean, are the most used measures of central tendency. The variability measures indicate the dispersion of the data on the measurement scale, that is, they indicate where the values obtained are dispersed.

The range, standard deviation and variance are the most used measures.

When describing the data, the measures of central tendency and variability are interpreted together and not in isolation.

A useful indicator is skewness, which is used to find out how much a distribution resembles the theoretical distribution called

the normal curve and which is an indicator of the side of the curve on which the frequencies cluster the most.

You should keep in mind that only what is needed will be calculated according to the purpose of the investigation.

Z scores

A Z-score tells us the direction and the degree to which an individual value obtained departs from the mean, on a scale of standard deviation units.

$$z = \frac{x - \bar{x}}{S}$$

X = score to transform

\bar{X} = mean

S = standard deviation

It can also be used to compare measurements from different tests or scales applied to the same subjects.

Ratios and Rates

One reason is the relationship between two categories, example:

Ratio of men to women in managerial positions:

$$\frac{\sigma 27}{\varphi 9} = 3$$

The reason is for every 3 men there is a woman in a managerial position.

A rate is the relationship between the number of cases, frequencies or events in a category and the total number of observations, multiplied by a multiple of 10, usually 100 or 1000.

$$Tasa = \frac{\text{Number of events during a period}}{\text{Total number of possible events}} \times 100 \text{ ó } 1000$$

Example: General mortality rate

$$\frac{\text{Number of deaths}}{\text{Population number}} \times 1000$$

Inferential statistics

Because it is difficult to obtain data from the entire population, we will almost always use the most representative samples possible and the statistical results obtained from these samples are called “statigraphs”; the mean and standard deviation of the distribution of a sample are statistic. When we manage to obtain data from the entire population, they are called “parameters”. Due to the costs and complexity of obtaining total data from a population, the parameters are usually inferred considering the statistics.

Inferential statistics is used to:

- a) Test hypotheses;
- b) Estimate parameters.

Hypothesis testing

It is to determine if the hypothesis is adequate with the data obtained in the sample. If it is consistent with the data, this is kept as an acceptable parameter value. If the hypothesis is not, it is rejected.

You can never be totally sure of the estimate; even if you work with safe levels of confidence or significance, you can make a mistake.

Significance is the probability that an event occurs ranges between 0 and 1, where 0 means the impossibility of it happening and 1 that the phenomenon will occur.

The significance level of .05 indicates that the investigator is 95% confident.

The significance level of .01 indicates 99% certainty.

That is to say: $0.05 + 0.95 = 1.00$ y $0.01 + 0.99 = 1.00$

Analyses can be divided into parametric and nonparametric. Each of them has its characteristics and assumptions that support it; the choice will depend on this, it should be noted that in the same investigation parametric analyzes can be carried out for one hypothesis and non-parametric for another.

Parametric analysis

To perform parametric analysis you must:

- a) Have a normal distribution;
- b) The level of measurement is by intervals or ratio;
- c) When two or more populations are studied, they have a homogeneous variance.

The most used parametric tests are:

Pearson's correlation coefficient and linear regression: It is a test to analyze between two variables measured at a level by intervals or ratio; is symbolized as r . Linear regression is a mathematical model to estimate the effect of one variable on another; is associated with r .

T-test: it is a test to evaluate whether two selected groups differ significantly from each other with respect to their measures.

Contrast test of the difference of proportions: it is to analyze if two proportions differ significantly from each other.

One-way analysis of variance (one-way ANOVA): it is to analyze whether more than two groups differ significantly from

each other in terms of their measures and variances. The t test is for two groups, and one-way analysis of variance can be used for two or more groups.

The factorial analysis of variance (ANOVA): it is a test to evaluate the effect of two or more independent variables on a dependent variable, it forms an extension of the one-way analysis of variance, only that it includes more than one independent variable; evaluates the separate effects of each independent variable and the joint effects of two or more independent variables.

Analysis of covariance (ANCOVA): analyzes the relationship between a dependent variable and two or more independent variables, eliminating and controlling the effect of at least one of these independent variables.

Nonparametric analysis

To perform this analysis you must:

- a) Accept non-normal distributions;
- b) Can analyze nominal or ordinal data.

The most used non-parametric tests are:

Chi square or χ^2 : to evaluate hypotheses about the relationship between two categorical variables.

The correlation and independence coefficients for cross tabulations: coefficient to evaluate whether the variables included in the contingency table or cross tabulation are correlated.

The Spearman and Kendall ordered rank correlation coefficients are measures of correlation for variables at an ordinal level of measurement.

Multivariate analysis: We refer to those who analyze the relationship between various independent variables and at least one dependent, require the use of a computer for their analysis; the main methods are:

Multiple regression: it is to analyze the effect of two or more independent variables on a dependent one.

Linear analysis of patterns: represents interrelationships between variables from regressions, as well as analyzing the magnitude of the influence of some variables on others, direct and indirect influences.

Factor Analysis - Used to determine the number and nature of an underlying constructor group in a set of measurements.

Multivariate analysis of variance (MANOVA): analyzes the relationship between two or more independent variables and two or more dependent variables.

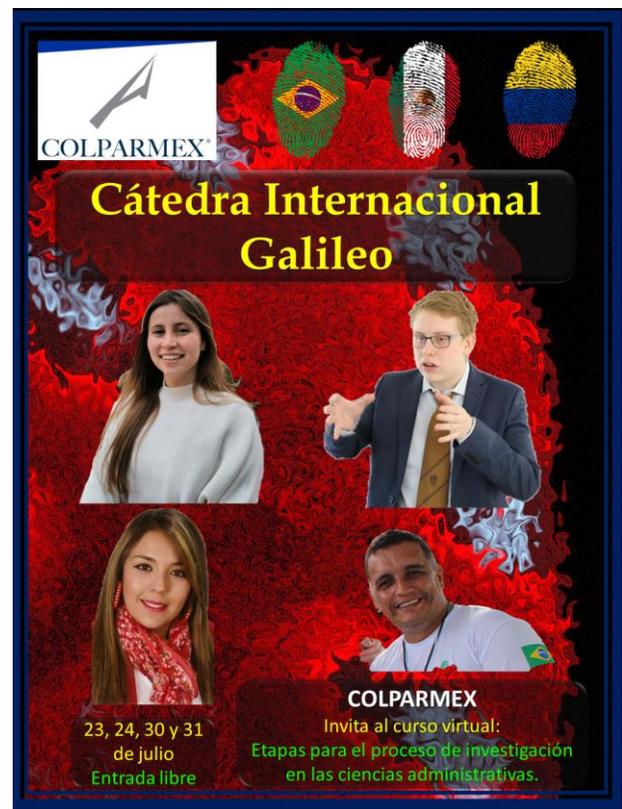


Image 74. Own elaboration.

Participation in the International Galileo Chair.

IX

Present the results

Zarick Juliana Díaz Puerto

“You don't really understand
something unless you are able to
explain it to your grandmother”

Albert Einstein

Present the results

We have come a long way full of ups and downs, sometimes the results are not as we expected, we have to repeat tests, rethink hypotheses, and in some cases start from scratch.

We have come across consistent results, others that are not, some that are justified in experiments, others that do not even appear to be logical.

And that is how research happens, we will not always have the results we expect in the time we expect it, however, it is imperative to show others our results.

You may wonder, but what is the use of showing something that is not in accordance with what was initially proposed? Or what if I could not prove the hypothesis? That is precisely what showing the results is about, even if they are not what we want see. The fact that you do not have those expected results does not imply that your research did not work, or that you lost all the resources used in that study. On the contrary, it implies that you have now managed to verify a way not to do things, that now, you

have already traveled a path of trial and error, which allows you and others to understand where not to go, in the case of continuing with the investigation.



Image 75. Own elaboration.

Participation in the International Galileo Chair.

Reporting the results is a fundamental step in research, not only because you publicize the fruits of your work (expected or not), but because by disseminating these results, the interested community that develops in that area of research, science or market, they will have the possibility to discuss them, to see

points that may not have been reached with your research and take your research results as a basis to start new related studies.

In the same way, what you are doing now can also be done by someone else on the other side of the world, or even in the same country. Cases have been presented where very similar investigations from opposite sides of the globe are published at the same time, and by researchers who did not even know each other. Thus, what you are doing now may be being studied by someone else, and showing your results will allow you to show a comparative or continuous point with respect to those other studies.

Based on the fact that we plan to carry out an impact investigation and, in which different communities and people are interested, it is important that we think in what language we are going to present the results. Let's think about something, right now, what is the universal language par excellence of science? Yes, English. When we publish or disseminate our results in English we are opening up that a greater number of people globally have the possibility of understanding what we are disseminating, we are keeping the door open

for all those who speak the language that at the moment is the most common and, therefore, that the discussion and impact of the research increase.



Image 76. Own elaboration.

Participation in the International Galileo Chair.

Prepare the investigation report

The first thing that comes to mind when we think about writing a report is something long and full of information. But this is not always the case, of course it will depend on the type of report. Research reports are used to show all the relevant information found during the research, which allows making decisions and correlating studies.

It is about telling a story, the story of how the investigation arose from its context to its conclusion, it is then about:

1. Show what is the context of the problem;
2. Why is this object of study chosen (justification);
3. What is the state of the art at (macro level) of the research you carried out;
4. What methodology did you use to carry out your study, what results did you obtain using that methodology;
5. Analysis of your results;
6. What did you conclude from your research;

7. What areas of opportunity or perspectives can you present to the research you conducted;
8. Where did I get the information that supports everything I mentioned in my research (references).

Of course, and depending on the type of research you are conducting, place of dissemination of results and requirements, each research report will be different, and will depend on the requirements they give you, how extensive each point mentioned above can be. But without a doubt, to have a complete overview of your investigation, it is necessary that you report all the points and that you have them clear in your mind to give that common thread to the history of your investigation. It is useful that you make mental maps that allow you to identify where you are generating gaps in the story or, where you can improve the relationship of the actors in your story, always based on facts, reliable sources and true results.

How to present the results?

Presenting research results will depend on the place where you want to present them, for example, we can talk about discussion forums, national or international congresses, diffusion or indexed magazines, scientific or diffusion books, theses, science fairs, school fairs, contests, among others. Before starting to prepare the report and with the story you want to tell clear in your mind, it is important that you identify the requirements of the place where you publish, since generally there are pre-established templates or formats that determine the order and extent of the content. Below, you will see an example regarding how the research results are presented in the format of the thesis for graduate engineering at UNAM.



UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO
PROGRAMA DE MAESTRÍA Y DOCTORADO EN INGENIERÍA
INGENIERÍA AMBIENTAL – AGUA

DESINFECCIÓN DE PATÓGENOS EN AGUA EMPLEANDO DIFERENTES
NANOPARTÍCULAS EN PRESENCIA DE LUZ VISIBLE.

TESIS PARA OPTAR POR EL GRADO DE:
MAESTRA EN INGENIERÍA

PRESENTA:

TUTOR PRINCIPAL:

COMITÉ TUTORAL:

Image 77. Own elaboration.

As you can see, a cover is established according to the guidelines of the university, with a specific order and type.

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RESUMEN.....	IX
ABSTRACT.....	XI
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Image 78. Own elaboration.

Likewise, it happens with the index and numbering of this, since in some cases Roman numerals are required and in other Arabic ones.

Remember, before defining the format and content of your document, it is essential that you review the pre-established formats for your document, even if they are conferences or magazines.

In the case of congresses, they always bring a template on which you must enter all your information, and you can usually find it on the event website.

Always remember to use graphs, and punctual but significant data that demonstrate the collection of information in a key way and give the reader a general perspective regarding the results of your research, allowing them to understand even if they have not read the total content of your document. in general, what is it about.

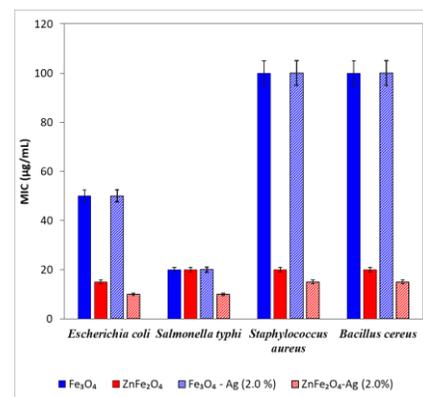


Image 79. Own elaboration.

For example, despite not knowing what the research is about or where this graph comes from, you manage to identify that the behavior of four different compounds, identified with bars, was evaluated in four different bacteria.

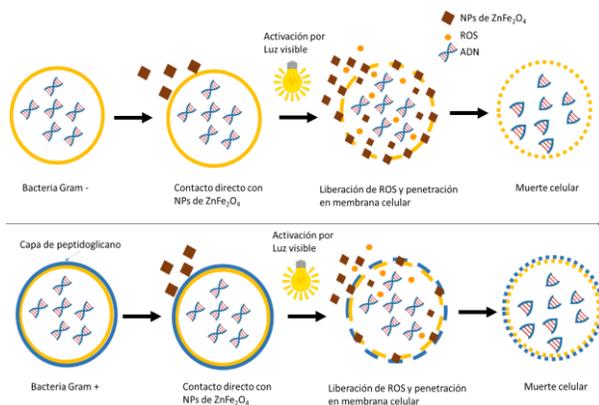


Image 80. Own elaboration.

Always seek to use friendly colors and simple images that help you briefly and accurately explain the objective and result of your research.



Image 81. Own elaboration.

Participation in the International Galileo Chair.

Where to find forums to share them?

First of all, keep in mind that not all branches of research share or disseminate information in the same way, so I suggest you identify if the branch in which you are has trade associations that disseminate research and carry out events where all the members participate and the knowledge regarding the subject or area that you are investigating is updated.

For example, in the case of research in chemical sciences, there is the American Chemical Society, an association of high prestige worldwide, where different events of scientific dissemination and the renewal and updating of knowledge are constantly being carried out.

In its link, you will find all the meetings available in the current year and future events.

<https://www.acs.org/content/acs/en/meetings.html>

Like the association that we gave as an example, there are a number of specialized associations in the area of your interest, so it is relevant that you subscribe to their newsletters and be aware of the events.

You can also look at the page of your university, or places with which your university has an agreement and see the participation requirements.

It is important that you be clear about this: "There is no single formula for success", so I suggest you look for yours, following the guidelines that we broadly outline in this book and if you find a more complete way, do not hesitate to share us your experience.

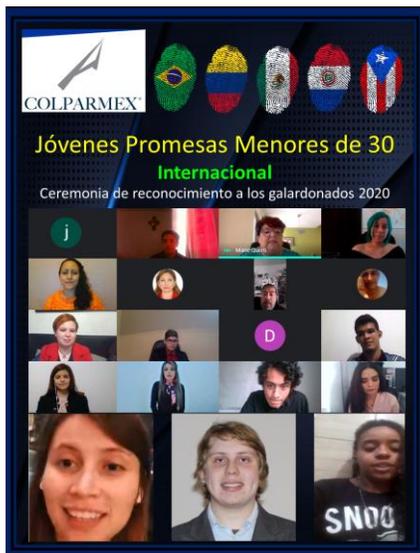


Image 82. Own elaboration.

Participation in the Young Promises.

Present the investigation report

As we saw before, in the investigation report there are 8 points that you must show, and that in turn tell the story of your investigation in a logical, consistent and precise way. In addition, all the information that you are presenting is supported in studies that you carried out, in other studies done by other people and in different publications and reports from where you collected the information.

There is no universal way to do the research report, so it is important to check the format of each university, forum, school, teacher or magazine. And we reiterate the importance of having those ways defined, as it is what determines the guidelines of your report.

Always be clear, even if it is a complex investigation with language that is not common for everyone, try to make the story as fluid as possible and that it does not happen to you, that using complex language without the proper context ends up being a distraction for the background of your research.



Image 83. Own elaboration.

Participation in the Young Promises.

It is also important that you define the type of references that are being requested, as not in all cases all sources of information are considered reliable or trustworthy sources. Additionally, I recommend using a bibliographic manager that allows you to store, order, put and manage all the references you handle, at your convenience. These bibliographic managers are usually available in universities, but if for some reason you have not had the opportunity to approach any of them, I leave you a brief list of those that are useful and quite simple to handle:

- Mendeley
- Endnote
- Zotero
- Papers
- Refworks

Identify the one that best suits your resources (remember that we are not only talking about money) and choose the one that will accompany you in the process of writing your research report.



Image 84. Own elaboration.

Participation in the Young Promises.

X

New Knowledge

Zarick Juliana Díaz Puerto

“The most useful science is the one
whose fruit is the most
communicable”

Leonardo Da Vinci

New Knowledge

Thinking of discovering something is an exciting idea that fills our minds with brilliance, excitement, adrenaline, and strength. When we start to investigate we find countless ways and in some cases we come to discover knowledge.

Discovering something should not be the objective of your research, but rather solving the problem you are raising, since discovering things, from my point of view, is a collateral effect derived from the solution to the problem and methodology you are raising.

When the way in which we solve the problem results in an innovative mechanism, we can speak of the generation of new knowledge.

The generation of new knowledge is evidenced in:

- a) Research articles in indexed journals;
- b) Research results books;
- c) Technological products;
- d) Patents;
- e) Licenses.

The products that can be derived are:

Industrial design, integrated circuit diagram, pilot plant, industrial processes, business secret, technology-based companies, Innovation generated in business management and regulations, rules, regulations or laws.

As we can see, there are many ways to generate knowledge and contribute to society.

To take advantage of the new knowledge generated, there are different legislative figures that grant intellectual property over an invention, and it generally varies from country to country. Then we will introduce patents and licenses.

Patents, licenses

In Mexico, patents are defined as: "the exclusive right granted by the State over an invention" and are processed before the Mexican Institute of Industrial Property (IMPI) by means of a technical document that describes the technological progress of the invention.

The IMPI is the Mexican Institute of Industrial Property, and there not only patents are processed, but also trademark registrations, request for bibliographic or technical searches of documents or patents, and even raise applications to file lawsuits against third parties for invasion of rights. Patents in Mexico only cover the national territory, that is, if I make an invention and want to implement it in Mexico, Chile and Colombia, I will have to go through the patent registration process in each country to protect my invention. Likewise, making the request has a cost associated with the number of pages you present and for the concept in which your request is located. A great advantage is that you can perform the entire process online, however, I suggest you visit the IMPI page to register and learn more about the procedures and fees associated with each procedure.

Before carrying out any intellectual property registration process and especially when you are conducting an investigation in an institutional framework, it is vitally important that you define with your tutor and institution how intellectual property rights govern, and once you are clear about

it, decide which one. It is the best way to start the patent application before the IMPI.

It is important to consider and know the Mexican Industrial Property Law, which establishes what is considered and what is not considered an invention to be patented, as well as everything you need to know to start the process of filing the patent. This information can be found under the name of "FEDERAL LAW OF PROTECTION TO INDUSTRIAL PROPERTY".

On the other hand, there are licenses, these refer to the "contract" by which, whoever has the patent, assigns the right of exploitation for a specified time to another person or organization. Let's think about a car, the car is yours, you bought it with your savings and you drive it, but your brother asks you to go to the movies, you lend it to him only to go to the movies and on the condition that he return before midnight. That is the principle of the license, whoever owns the license now has the power to exploit the patent for a defined time and pays an associated amount, and whoever owns the patent receives the associated amount and assigns the license to exploit the patent for a specific time. There are several

conditions to grant licenses and there are different types of license that govern in the Mexican territory, in all cases their duration, conditions, field of application and the amount of royalties are established, which in turn must be fair and reasonable.



Image 85. Own elaboration.

Participation in the Young Promises.

Publications

Most research generates new knowledge, and there are different ways to disseminate these research results.

The most common way that research results are presented is at events and in written publications. There are a number of magazines and events in which you can publish the results of your research, however, it is necessary that you filter the quality of these events and magazines so that your research has the impact you want.

Journals are classified according to different factors, one of them is the impact factor, which is determined by the number of citations made to the articles in that journal. The Anglicism Journal is generally used to refer to these magazines. There are different organizations that make a ranking of the best journals at a global level and their corresponding impact factor, with the aim of constantly evaluating the quality and activity of research carried out globally. The journals that are evaluated and entered into the ranking of these organizations are indexed journals, these journals refer to all those that are in a world scientific database

Possibilities of taking them to your application

Once we have completed our research and our results are translated into next steps to improve the problem we are dealing with, we can think of large-scale application, of transforming the world from our square meter with our ideas and now, results and inventions.

However, it is important that you always keep in mind the scope of your research, the one that was based on resources (human, physical, technological, personal, economic, etc.), because in case you have already reached that scope or that your resources have already been used up, it is important to rethink how far you want to go with your research and look for new sources of funding and support. Once you have those points covered, it is important to keep in mind that applying your knowledge on a larger scale than your research will require the articulation of four key factors:

- a) a) Industry;
- b) b) Government;

- c) c) Academy;
- d) d) Society.



Image 88. Own elaboration.

Participation in the International Galileo Chair.

These factors in common will be the ones that allow a successful application of your research outside the laboratory.

The industry knows the market and will allow you strategic alliances that insert your product or service to the market, the government establishes the regulations that govern society, so your product and the way to insert it into the market must be aligned with the objectives and policies

governmental, the academy is in charge of generating knowledge, so you must be in a constant investment in research to continue improving your product or service, or generate solutions to other problems; and finally there is society, which will use your product or service, so your solution must be framed in the needs of the people and that is what they expect to see.

Currently there are different supports from the industry and government, which seek the articulation of these four factors. However, all these programs do not reach their maximum effectiveness when, as researchers, we do not consider that there is a world outside our research and that this world has rules, needs, markets and intellectual and human potential.



Image 89. Own elaboration.

Participation in the International Galileo Chair.

XI

Where can we get
support?

Vili Aldebarán Martínez García

“Science makes real progress when a
new truth finds an environment
ready to embrace it”

Piotr Alekseevich

Where can we get support?

We may find ourselves on the threshold of entering higher or postgraduate studies and, certainly, being able to select the best option for us will be defined by different factors such as:

- a) Suitability of the studies for our profile;
- b) The teaching staff;
- c) If applicable, the laboratories or equipment to which access would be made;
- d) The links of the study center with institutes, laboratories, companies or organizations with which we would seek to link later;
- e) The distance from the study center to the place of residence;
- f) The means of qualification;
- g) The prestige of the study center;
- h) The economic aspects related to studying at the selected institution (these include not only those related to tuition fees, but also all related aspects such as qualifications, equipment or requested supplements, food, and even expenses sometimes not considered as parking lot).



Image 90. Own elaboration.

Knowing the UNAM. University City. CDMX.

As we can see, selecting an educational institution is a multifactorial decision, within which we suggest that you consider the following aspects:

Regarding prestige, it is very important that you consider aspects as objective as possible, avoiding falling into one or more of the following fallacies:

- a) The false prestige. There are educational entities that "create their own ranking", in such a way that they come to present a panorama where said institution is in a

position that does not correspond to reality, the suggestion is to review rankings that present a solid methodology and are free of conflicts of interest, as an example we can suggest that you consult the Shanghai International Ranking of Universities or ARWU (Academic Classification of World Universities) on its page <http://www.shanghairanking.com/>;

- b) Lack of validity. It is terrible to enter the selected institution and see that things do not correspond with reality, however, it is devastating to find out that you have done or are studying in an institution that lacks the validity for the studies they offer. In the case of Mexico this is the Recognition of Official Validity of Studies of the higher type (RVOES). It is important to highlight the verification that said document continues to be valid. For this, it is possible to verify the electronic address <https://www.sep.gob.mx/es/sep1/SIRVOES>;

- c) The lack of links with the organizations or programs that had offered.

The points previously analyzed are of paramount importance for those of us who are going to select an institution. In this order of ideas, the suggestion is to make the selection using the criteria that best suit our interests.

To have a closer view of reality, it will be very useful to visit the selected institution (some have events such as open doors), review productivity (articles, patents, participation in international events), talk with both students and with graduates.

It will be of great help to assess the decision beyond the local scope, since there is the possibility that an institution will be overrated because relatives or acquaintances are graduates of it, because "they have told us that it is the best" or, simply, because advertising tells us that it is the best option.



Image 91. Own elaboration.

Knowing the Humboldt University. Berlin.

Scholarships

Once we have selected the institution we want to enter, we can find that our financial resources are not enough to study there. This could be an insurmountable wall, however, there are options to seek support.

At this time, it is important to assess our strengths. For a moment, suppose we have superior and fully identified athletic abilities, this opens up the possibility for us to seek athletic scholarships. This is a great possibility that we must carefully explore so that we are students who practice a sport and not athletes who study.

Now, considering the previous lines, we could suppose that having an important performance in academic and / or research aspects will facilitate access to some type of support, however, at least in some universities visited the answer was in great measure of indifference receiving answers such as "we are a university, we do not dedicate ourselves to research", or "we do not have scholarship programs for outstanding students, only for athletes." This is the importance of visiting the selected institutions prior to spending a

significant amount of time seeking to enter them. With this simple approach we can identify the vocation of the institution in question and, possibly, we have access to high-level programs where our skills are not only valued, but also encouraged and we can be part of a work team that catapults us and lead us to visualize new horizons.

A small consideration, education is certainly the best investment we can make, however, there are alternatives whose cost can result in “a bit heavy” debts when seeing that the remuneration obtained in the labor field does not correspond to the expectations created, therefore , it is always important to make a prior balance on the economic conditions that the studies will require.



Image 92. Own elaboration.

Participating with the District University. Colombia.

Once the institution is selected, we can start the process of looking for the necessary support to participate in the selected program. It is important to start the selection process well in advance since some selection processes for scholarships can last months and you must have previous letters of acceptance from the teachers who will act as advisers during the development of the studies.

It is time to make a parenthesis and, without the desire to be exhaustive, but useful for our kind readers, we can divide the scholarships considering.

By its origin:

- a) Scholarships that upon successfully completing the established parameters, it is not necessary to return the resources received;
- b) Credit scholarships, which, through financing or loan schemes, allow the payment of studies to be deferred;
- c) Intra-institutional scholarships, being those that each organization provides based on its own rules and / or norms;
- d) Scholarships awarded by institutions that can be national or international, including financial, business, government, foundations, among others.

For the supports it provides (may include one or more of them):

- a) **Exemption from registration and / or tuition fees.** In these cases, it may include, in whole or in part, the payment of these concepts;
- b) **Transfers.** These can be both national and international and can cover the total of the required transfers or only part of them, with the possibility that it covers only the fellow or includes one or more people;

- c) **Mobility grants.** These cover totally or partially expenses related to studies that require transfers;
- d) **Scholarships for the allocation of resources.** This can be a fixed or variable amount of resources allocated;
- e) **Grants for specific projects.** These may include purchasing material, equipment, or providing a labeled budget (meaning that resources are specifically earmarked);



Imagen 93. Elaboración propia.

Participando con la UPTC. Colombia.

- f) **Food scholarships.** Which can be fixed or variable and be both in money and in kind and are intended to cover the food needs of the fellow;
- g) **Scholarships for residency.** This can also be variable or fixed, and be in money or in kind (in some institutions there is a residence for scholarship holders).

For its purpose:

- a) **For special projects.** Sometimes special projects are carried out in which scholarships are offered for them;
- b) **For special studies.** These can include university studies, postgraduate courses, stays, short courses, diplomas and other academic programs;
- c) **Research.** Unlike the previous ones, these can include formal classes, but, to a large extent, they will be developed by participating directly in one or more projects;
- d) **Social service scholarships.** Although many careers require the completion of a social service to qualify, there are options that will help obtain resources to do it;
- e) **Grants for qualification.** These are intended to support students to consolidate this process.



Image 94. Own elaboration.
Participating with the UPTC. Colombia.

Where can we find information about scholarships?

An excellent option to start the consultation is the UNAM page.

<http://www.becas.unam.mx/portal/index.php>

As you can see in it, you can see information related not only to the highest house of studies, but also directs to many other options that may be for UNAM students such as:

ExxonMobil Scholarships for Research 2019-2020

<http://www.becas.unam.mx/portal/index.php/component/content/article/37-becas/129-becas-exxonmobil-para-la-investigacion>

International Student Mobility, Bachelor

Level <http://www.becas.unam.mx/portal/index.php/component/content/article/37-becas/123-movilidad-estudiantil-internacional-nivel-licenciatura>

For students who are not part of the UNAM such as:

Scholarships for exchange stays or full postgraduate studies of the EURICA Erasmus Mundus program.

<http://www.becas.unam.mx/portal/index.php/component/content/article/37-becas/131-becas-para-estancias-de-intercambio-o-estudios-completos-de-posgrado-del-programa-eurica-de-erasmus-mundus>

It is also possible to enter the pages of the country where the institution we wish to enter is located as:

Becas y lectorados MAEC-AECID.

<https://www.aecid.es/ES/becas-y-lectorados/buscador>

Foundations and organizations that support for this purpose such as:

Erasmus.

<http://www.erasmusplus.gob.es/>

Foundation Carolina.

<https://www.fundacioncarolina.es/>

Scholarships Santander.

<https://www.becas-santander.com/es>

Ibero-American Graduate University Association.

<https://www.auiop.org/index.php/es/becas-auiop>

To study in Germany it is suggested to review:

<https://www.daad.mx/es/estudiar-e-investigar-en-alemania/estudiar-en-alemania/>

To study in Canada it is suggested to review:

<http://www.studyincanada.ca/mexico/becas.htm>



Image 95. Own elaboration.

Participation in the International Galileo Chair.

XII What makes up the bibliography?

Andrea García Valerio

“Science is made up of errors, which
in turn are the steps towards truth”

Julio Verne

Bibliographic references

Bibliographic references are very important since they provide the foundations of the investigation, in addition to the recognition of the authorship of the information that you have taken from other authors; at the same time that they allow the reader to expand their knowledge by consulting the sources.

The list of references must be presented in alphabetical order according to the author's first surname; citations must be complete and in the language in which they were consulted; the references only include books, articles, etc., which have been cited in the body of the thesis; The rest of the books, dictionaries, etc., consulted to structure the research should not be included as references, they are included in the bibliography.

Here is a brief example of bibliographic references:

"Work stress is being increasingly viewed as a health problem." (Ramírez, 2001)

Papalia (1988 p.417) mentions that "Stress is the physiological and psychological reaction of the organism to the demands made on it";

stress is an inevitable part of everyone's life. "Some stress is essential, and some is really invigorating." As Selye said (quoted in Papalia, 1988, p.417) "The complete lack of stress is death". But stress is increasingly being seen as an aggravating factor in diseases such as hypertension, heart disease and ulcers.

"Studies show that stressful working conditions are actually associated with absenteeism, increasing delays and the intention of workers to leave their jobs." (Ramos, 2001, p. 87-88).

Fontana (1995) and Ivancevich (1989) identify as the most important stressors: organizational climate, organizational structure, characteristics of the task, technology, leadership influence, shift work policies, scarce personnel, overtime, salary, scarce promotion, uncertainty and insecurity, conflict of functions, poor communication, family influence, competition between colleagues.

It should also be taken into account the enormous differences between the characters on the screen - contrast, color, brightness - and the rest of the documents and the keyboard

(Mondelo, Torada and Barrau, 2000, p.126-127).

Bibliography

Here we must include the documents, the interviews and all the material that was used for the investigation; Make sure you don't leave any important books or documents off the list.

We must consider the style requested by the institution and study area to which the work is going to be presented since normally each discipline has a recommended style, in the following table we show some examples of the most used styles:

Discipline	Style	Example
Biological and environmental sciences	Harvard	Murray, R., Bender, D., Botham, K. & Kennelly, P. J., 2010. <i>Harper. Bioquímica</i> . 28 ed. México: Mcgraw-Hill Interamericana.
Administration, law, economics, education, psychology	APA	Murray, R., Bender, D., Botham, K., & Kennelly, P. (2010). <i>Harper. Bioquímica</i> (28 ed.). México: McGraw-Hill Interamericana.
Medicine	Vancouver	Murray R, Bender D, Botham K, Kennelly P. Harper. Bioquímica. 28th ed. México: McGraw-Hill Interamericana; 2010.
History, art	Chicago	Murray, Robert, David Bender, Kathleen Botham, y Peter J Kennelly. <i>Harper. Bioquímica</i> . 28. México: McGraw-Hill Interamericana, 2010.

Image 96. Own elaboration.

It is important to remember that there are bibliographic managers that will allow us

to organize the references, reuse them, incorporate them into our writings

quickly and easily and will save us a lot of work. In addition to finding some of these managers in your Word word processor, it is possible to find them on the internet <https://www.citethisforme.com/>

Let's not forget that through references and bibliography you are avoiding plagiarism which from a legal point of view is an infringement of the right of the creator of an artistic or intellectual work of any kind, and the most important thing is a lack of ethics.

Appendices

The appendices are optional, they must contain material that complements the investigation, in no way should it be believed that the appendices are surplus or filler material. In the event that it is only an appendix, it is simply called an "appendix", but when using two or more they will be distinguished with a letter and ordered alphabetically; for example: Appendix A, Appendix B, and so on.

Some forms that are part of the appendices are:

- a) Tests or measurement instruments, surveys, questionnaires, etc .;
- b) Little used statistical formulas;
- c) Data tables that are too long or of little importance;
- d) Descriptions of laboratory equipment and methods used in the investigation.

The importance of the appendices is that other researchers can use them for other investigations.

Appendices must be included with their title in the thesis index.

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