BUILDING A CULTURE
in Research Ethics, Bioethics and Scientific Integrity

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Book review

The book "Building a Culture of Research Ethics, Bioethics and Scientific Integrity", is the product of collective reflection and discussion processes, among SNCTeI* actors, linked to the Ministry of Science and Technology (Minciencias) and the Universidad Nacional Abierta y a Distancia (UNAD); Universidad Minuto de Dios, Bogota (UNIMINUTO); Universidad Libre, Cali; Universidad de Nariño, Pasto; Universidad del Sinú, Cartagena; Universidad de San Buenaventura, Cartagena and independent researchers interested in research ethics, bioethics and scientific integrity. It points out the importance of training, for the generation and appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity, as part of the roadmap proposed from the Research Ethics, Bioethics and Scientific Integrity Policy - EIBIC+, (Minciencias, 2018).

It addresses the topics: Cognitive Biases, Attitudes and Behaviors that affect research and innovation processes in the Areas of Knowledge identified by the Organization for Economic Cooperation and Development - OECD: Environmental Sciences; Basic Sciences, Social Sciences, Humanities, Arts and Education; Biomedical Sciences and Engineering. All research and innovation processes should be self-critical, fostering a culture of EIBIC at all educational levels.

*Sistema Nacional de Ciencia, Tecnología e Innovación (National System of Science, Technology, and Innovation) – SNCTeI

+EIBIC: Política de Ética de la Investigación, Bioética e Integridad Científica

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Introduction

Minciencias, as the governing body of the National System of Science, Technology, and Innovation (SNCTeI), considers within its mission the formulation and articulation of public policy to consolidate a knowledge society. This purpose involves generating knowledge, technological developments, and innovation, as well as developing capacities and taking advantage of regional and sectoral potentialities, so that the knowledge society translates into social welfare, reduction of inequalities, sustainable human development of communities, peace, and social justice.

Since 2013, Colciencias (now Minciencias) has led a process of collective reflection and discussion, jointly with several SNCTeI stakeholders interested in research ethics and scientific integrity issues, as well as with bioethicists. Thus, in the midst of these reflections, a Research Ethics, Bioethics and Scientific Integrity (EIBIC) policy is being developed, which was adopted by Resolution 0314 in 2018, as a roadmap to generate a culture of transparency, integrity, and excellence, as the fundamental pillar of trust and reliability in the practice and results of science, technology, and innovation.

In this regard, this book represents the consolidation of leaderships and the commitment of a SNCTeI community in pro of a knowledge that articulates the capacities and interests of its diverse actors (university, business, state, and society) to consolidate a responsible, relevant, and timely CTeI (Science, Technology and Innovation) for the Colombian society, with global projection. The perspective hereby presented is the result of the work developed by the Training Roundtable Discussion[1] in the configuration of a theoretical and conceptual framework around the discussion on the importance and effective contribution of training, and in the generation of culture in Research Ethics, Bioethics and Scientific Integrity. It is necessary to explain the contribution of educational training in the generation of this culture in order to guide the efforts in this area in a coherent manner with what can be expected from the educational processes that address these issues. On the other hand, the efficient use of public resources requires us to clearly identify the benefits, achievements, and scope of EIBIC education. This reflection was developed through a strategy agreed upon by one of the subgroups of the Training Roundtable[2], which has contributed to the development of the roadmap proposed by the EIBIC policy to achieve the goals set forth therein.

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[1]   Magda Liliana Rincón. Ministry of Science, Technology and Innovation: contract No. 241 - 2021. Fundación Tecnalia Colombia contract: No. 221 – 2022.

[2]   The roundtable discussions correspond to the work strategy adopted for the implementation of the Research Ethics, Bioethics and Scientific Integrity Policy (Colciencias, n. d.). Each variable of the Policy has been implemented through a roundtable discussion, which responds to the same name of each variable: Governance, Institutionality and Training. A roundtable discussion was also formed to follow up and monitor the implementation process and evaluate the impact of this policy.

According to one of the publications of the governance and institutionalism roundtables in relation to the reflection developed around the roles and responsibilities of the different actors of the SNCTeI and the need to define values shared by all,

> Ethics and scientific integrity, as a guarantee of credibility in science, are the result of the way in which those who do science interact, the way in which they apply their principles, agreements and rules, both tacit and explicit, and, therefore, of the institutional agreements that shape national science, technology and innovation systems and determine their functions and the roles and responsibilities of the various actors that constitute them. The sociopolitical and social context, and the value that society gives to science, knowledge, and know-how, frame these institutional agreements, as well as the interactions among their actors. (Rojas, et al., 2022, p. 11)

The development of capacities to generate responsible interactions, behaviors, and decisions in the daily work of researchers, their teams, students and other actors in the system requires meeting the challenges arising from an open, participatory, diverse and plural debate on the science and knowledge that the country requires. This need to justify the contribution of training in the generation of a responsible scientific culture is the guiding thread of this reflection. This text is the result of the document that gathers the development of these deliberations both in its theoretical aspect in general and in its practical aspect according to areas of knowledge, so that this text constitutes a pretext for the academic communities to weave and appropriate a systemic look between sciences and disciplines, to consider the necessary and sufficient knowledge to generate and support the generation and strengthening of a culture in favor of the care of life and its meaning.

Indeed, one of the distinctive features of our EIBIC policy is its commitment to include the ethics of research in all scientific disciplines and their fields of application. In other words, there is no science, technological development or innovation that does not contain or raise an ethical assessment or considerations. Likewise, this policy states, from its very design, that responsibility is a matter that depends on the researcher when making decisions, as well as on the institutional framework in which these are framed. Therefore, responsibility is both individual and institutional. Hence the importance of training as a strategy for the generation of individual capabilities and to promote institutional reflections.

Since the researchers who developed this academic exercise come from diverse backgrounds, in addition to the theoretical and disciplinary review, they gathered the contributions of attendees to the X National Dialogue on Research Ethics, held in 2021, in relation to the contents herein presented. The result is a route to support the path in

the rigorous task of doing science with consciousness in Colombia and empowering Our America in the face of planetary governance relations, based on reflections about the importance of education in the context of the Research Ethics, Bioethics and Scientific Integrity policy, as a strategy that contributes to the achievement of the policy's objective, focused on the promotion of a change of culture and behavior.
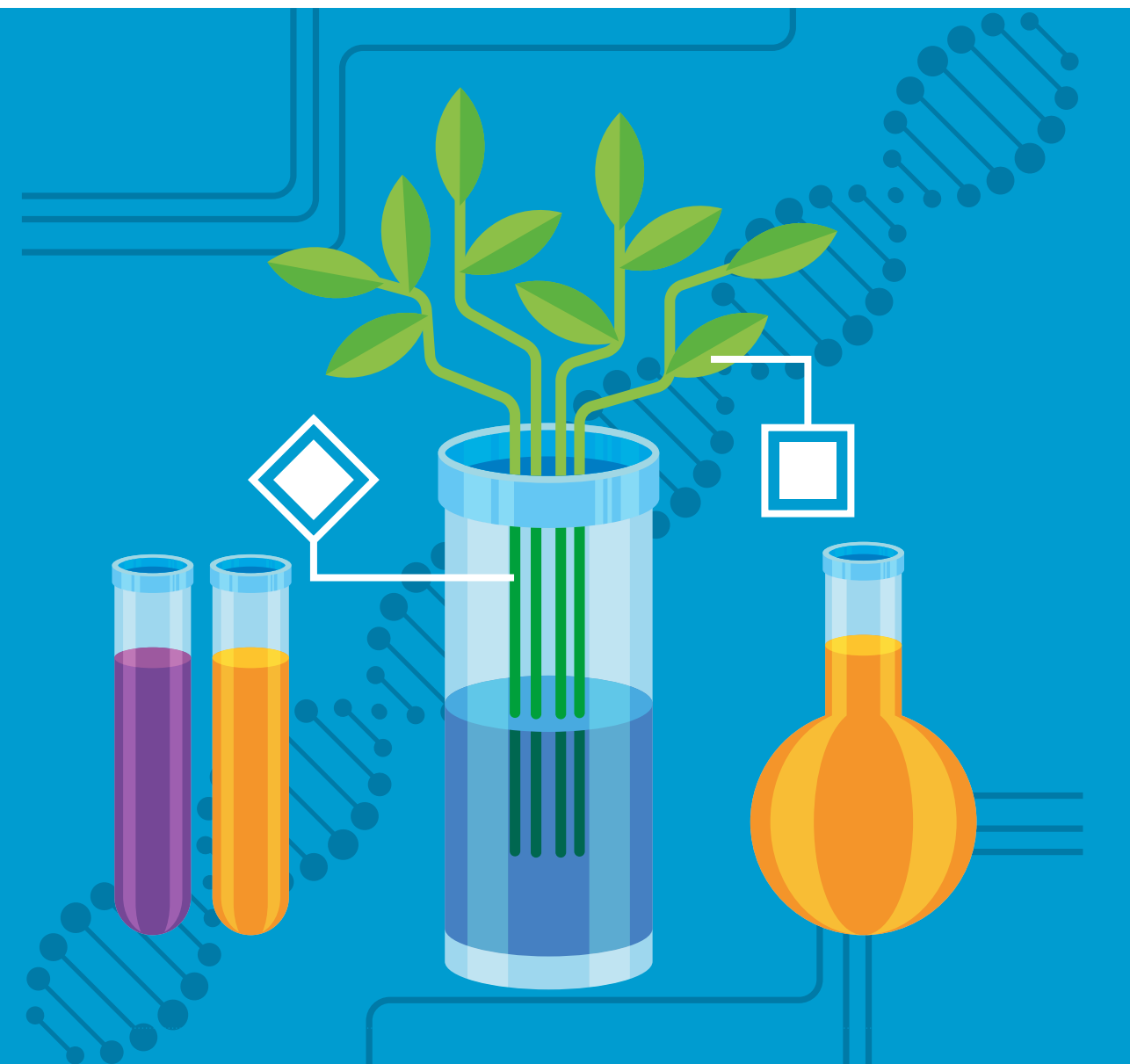
Foreword

To address an issue such as generating responsible conduct in the practice of scientific research is highly topical, especially in the face of a science that is subjected to techno-logical interests that prevent it from looking at itself beyond epistemological questions that seem to ignore ethics completely.

Historically, science responded to an ethical mandate, it was conceived for the good of humanity. That is, to facilitate the lives of human beings, to cure their ills, to extend their lives. These are aims that we all share, goals that mark an inescapable good that can be adopted as an ethical objective: to live a good life. The ethical question "What for?", which refers to the ends, must complement the question "Why?", which refers to the principles. The answers to both must correspond for an action to be considered ethical. Both refer to the intention of the will, to the theoretical side in accordance with intentionality and to the practical side in accordance with action. If we ask a scientist why he does science, he may answer with irreproachable ethical principles, which is not so easy to sustain when we add the why, for which he must consider the social, historical, and effective character of his work. The why demands as an answer the consideration of the values that justify the why. "The good of humanity" is a desirable answer, and is - or, rather, was - an inescapable answer for science.

Why should it be proposed today as an objective to consolidate a responsible, relevant, and timely CTeI for Colombian society, with global projection, as is done in this book? The answer not only concerns the exercise of scientific work in Colombia, but also in the whole planet, because there has been a universal shifting of the historical objective, of the historical purpose of science, which has become techno-science, since the purposes are set by the technique.

This book aims to provide elements to be considered in a joint action between scientists, educational institutions, and the State in order to recover the scientific vocation, which, in itself, was ethical. We can argue that these three pillars - the scientist, the educational institutions and the State - were, from its beginnings in the 17th century, the protagonists of the growth of science as proposed by modernity; but, in the proposal made by the authors of this book, a new character is added, which is actually the one that today motivates the need for reflection and adequate responses, from an ethical point of view. This character is the company, and it generates ethical difficulties because, essentially, it has interests different from those of science, including those of the State, and often does not benefit, but harms society. Companies seek their own financial profit, and normally this goal clashes with and is placed above the objectives that science, society,

and the State should have. We can see how, nowadays, these three protagonists of social relations are subject to business interests instead of criticizing them and putting them in second or third place.

For this reason, this paper proposes the need to educate society by generating a culture in which science recovers its primordial value: the good of humanity. In order to recover the ethical values that allow us to recognize that scientific research is something desirable, and not to distrust it and finally despise it. The last, despise, is what should inspire the protocols that turn human and non-human beings into the subject of experimentation, into the object of analysis in closed or open-air laboratories, into the value of commercial gain, into an unrestricted instrument of technology. Science must recover its love of knowledge for knowledge's sake: that which has historically turned scientists into sages who marvel at the mysteries of matter, life, the cosmos.

The current deformation of the scientist's life that turns them into a gear in a machine producing objects that only have value if they can be part of the market forces us to think about whether what they do is ethical, indeed, whether they are human, whether they have not reached the ideal of the cybernetic future of behaving as part of a machine. Our team has worked on this book to create training systems to generate a more respectful culture of ethics that puts the highest priority on the value of life. In the face of a scientist who studies and works for the good of humanity and the planet, this book, which deals with research ethics, bioethics and, above all, provides guidelines for scientific integrity, can contribute relatively little. It is valuable because scientists tend to relegate these objectives to the background.

True scientists would look with surprise at an institution that asked them not to lie and not to carry out research for their own benefit; that would not use people, but rather invite them to work with them to achieve more truthful and authentic results; that would propose values such as responsibility, cooperation and prudence; that would ask them for reports that are not only truthful, nor only for their own benefit, but also for the benefit of others; to ask for reports that are not only truthful, but also suitable for review by other scientists, without hiding or keeping secrets, without additional interests, without confidentiality documents, and to recommend them to work at the same level as their collaborators, to know step by step the progress and setbacks of the research, not to lose sight of the objective and to give up or abandon the research as soon as they notice any sign of possible harm.

The true scientists would not consider those doing similar research, or perhaps the same research that they are doing, as competitors to be destroyed by any means, they would not hide their data or their progress, they would collaborate with others so that science would grow and not themselves. A true scientist puts science and the good of humanity before his own profits and reputation. And, therefore, they cannot publish a

scientific work per week to appear in all the most recognized journals; they do not accept to be valued by the number of successes and not by the values they pursue; they do not pay a wage to have their work and achievements published; they do not declare, as we have learned that happened in Spain, that they work in a place where only their name will appear as a researcher, which will mean receiving huge sums of money while they continue to work in universities that never promised to make them rich.

Any lack of ethics, as Kant warned, implies lying, falsehood, simulacrum, and much scientific activity today is nothing more than a simulacrum. Truthfulness is the greatest virtue that a scientist must practice, for when they work for themselves and not for society, they must lie; when they maintain that they have obtained data or findings in their research one week after another, they must lie; when they publish work done by others, including themselves among the authors in order to obtain benefits and prestige, they must lie; when they use a person without explaining the possible damages of their research and promising them benefits that are only potential, be it in hard or soft sciences, they must lie; when they alter statistical data by adding or subtracting variables to their benefit, they must lie; when they lead two or three or more research teams on different issues, they must lie. Kant (2005) considered truthfulness to be the greatest of virtues because it is impossible to violate ethical norms without lying. Therefore, a scientist who does not lie is reliable; a science that produces scientists who do not lie is reliable; a dialogue between truthful scientists who have different proposals to solve a problem is enriching and does not generate fear or anxiety or uncertainty, which are common trends in our time, but quite the contrary: it stimulates to ask, to seek, to know; it generates confidence in the truth.

This book takes on the important challenge of finding the keys to educate and train, that is, "to generate responsible interactions, behaviors and decisions in the daily work of researchers, their teams, students and other actors in the system". It is interesting to note that, in the search for the factors that influence when analyzing the conditions that contribute to the lack of ethics, the authors of this book focus on cognitive biases. Of course, it is very important to recognize them, especially in the teams themselves, and, in this sense, the book provides a lot of information on their possibility and types, with a very detailed analysis that tries to show the formative processes that have an impact on the interaction between cognitive biases, attitudes and behaviors to obtain cultural appropriation of the problem.

At the same time, we must be aware that all knowledge, in itself, is biased because it comes from subjects: the object, the objectivity, always depend on a subject that makes them so. It is important, therefore, to know, both for the scientists and for those who collaborate with them, what this dependence is; to identify beforehand in any research the biases that impact on their attitudes and behaviors. These may be purely cognitive or ideological, but also the most abundant and most damaging: financial. In this regard,

I must acknowledge the relevance of the question posed in the book: how can training modify cognitive biases in the areas of knowledge; but I agree with the authors Flechas Chaparro and Bernal Lizarazu when they say, "what is relevant in the face of biases is our attitude towards them". I agree that this is what is really relevant, since biases are not only cognitive for a scientist, and, if they are, they can be modified, but not avoided. But I ask myself, is it necessary to avoid them? And I answer no. Once it is recognized that knowledge without biases is not feasible, the attitude towards them must be that of criticism in dialogue, that of recognition and transformation of the bias with others who will contribute their own biases. The desire to eliminate biases can lead to inaction and discouragement, for there will always be some.

This book, like many of the ethical, bioethical, and even scientific analyses of the attitude of scientists today, emphasizes the lack of values in our culture, and I do not agree with this, because there are values. Our culture values above all wealth and success, and, as a means to obtain them, winning, excelling, and succeeding. And this at any level: moral, financial or social (winning in sports, in commerce, in relationships, which, wherever they take place, acquire a commercial character; winning in any contest or competition, in video games and in science, or -even- techno-science, which seeks to beat nature or, better yet, fate, to beat even death). The greatest difficulty for ethics today is to recognize other values: those that we can sustain because they are bearers of life, joy, serenity, trust, peace, conditions that any man would choose to live and that many times people try to buy with "profit". In the face of the cult of profit prevailing in our culture, it is interesting to sustain the gratuitousness that supposes surrender, sacrifice, solidarity, foreign to a culture in which everything has a price, cost, payment, reward, prize.

Ethics is not knowledge or philosophical proposals, not even anthropological or social findings; ethics is praxis.

There are multiple speeches that call for ethics, sustained on diverse and complex theoretical proposals. The problem is how to create intentions, how to change wills, how to manifest ends that change those wills, that is, how to change the prevailing values. Totalitarian regimes have given us and continue to give us guidelines: propaganda, publicity, insistence on an idea or a purpose at all times and in any place and in the face of any doubt or interest. Perhaps undervaluing freedom, as those who adopt these methods do, would be an answer... and thus generate an army of "good scientists" obedient to slogans respectful of life and the future? Is this an ethical option?

This book does not give answers, it cannot give them, neither this one nor any other. It only proposes to continue searching and, above all, not to lose hope of being able to turn around this culture that, based on the denial of freedom, leads us to an uncertain future. The book's response is the commitment to find ways for science that free it from its subjection to technology and help it to find its primary vocation of valuing the human and the non-human, seeking a balance between the two.

Warning

There is social and individual ethical responsibility in all the links of science education... In other words, there is no science, technological development or innovation that does not contain or raise an ethical assessment or ethical considerations. There is conscious science in Colombia. And we must empower Our America before the relations of planetary governance, from reflections on the importance of training in the context of the policy of Research Ethics, Bioethics and Scientific Integrity, as a strategy that contributes to the accomplishment of the policy's objective, focused on the agency of a change of culture and behavior. It is necessary to recognize the importance of a fluent feedback between the different actors of the system that allows to generate a dynamic balance, where the whole and the parts converge towards the same objective, in this case, the appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity.

It is crucial to identify cognitive biases (recognition) and the importance of training in the transformation or elimination of cognitive biases that affect attitudes and behaviors, since they have an impact on the Research Ethics, Bioethics and Scientific Integrity culture of the SNCTeI.

María Luisa Pfeiffer PhD.
The National Scientific and Technical Research Council (CONICET).
Argentina Redbioética UNESCO 2023

Chapter 1

Methodology[3]

In order to develop the activities proposed to address the question of the importance of training for the generation and appropriation of a culture of Research Ethics, Bioethics and Scientific Integrity, a subgroup of the Training roundtable in 2021 was organized as a conceptual development group, with the aim of reflecting on the importance of training for the appropriation of a culture of Research Ethics, Bioethics and Scientific Integrity.

The working route to address the question was based on the identification of common aspects of all research, technological development, and innovation processes, and of the cognitive biases associated with these processes. These common aspects also made it possible to find similarities and differences between the areas of knowledge, which facilitated the identification of some cognitive biases that influence the attitudes and behaviors present in the processes of research, technological development and innovation, and which could represent a factor of ethical risk, i.e. affect the reflective capacity and capacity for action of individuals, as well as institutions, in the face of the consequences of their decisions in the field of science, technology and innovation activities.

This group started its activities in February 2021 with this objective in mind, for which it developed the following activities.

1.1 Initial literature review

A review of the state of the art and documents resulting from the work of the Training Committee was conducted, such as the Diagnosis of training capacities in Research Ethics, Bioethics and Scientific Integrity and the *Diagnosis of training needs in Research Ethics, Bioethics and Scientific Integrity.* As a result of this initial phase, some basic authors and relevant aspects were identified.

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[3]   Prepared by the Conceptual Development group, a work team of the Training Roundtable Discussion for the implementation of the Research Ethics, Bioethics and Scientific Integrity Policy.

1.2 Expert consultation

Given the shortage of specific bibliography on the impact of training for the appropriation of a culture of Research Ethics, Bioethics and Scientific Integrity, especially in some areas, and the need to define an integrated route for the development of the exercise, it was considered necessary to consult experts in order to define basic aspects that would guide the reflection.

Therefore, an event was organized on the topic: Importance of training for culture change in Research Ethics, Bioethics and Scientific Integrity, with the support of the PhD in Bioethics of the Universidad Militar Nueva Granada, which included two sessions:

1. **April 16, 2021:** Socialization of the results of the Diagnosis of training needs in Research Ethics, Bioethics and Scientific Integrity, and socialization of the progress of the discussion (review) on the importance of training for the fulfillment of the objective of the policy. This event was in charge of the Training Roundtable Discussion group and Minciencias.

2. **April 26, 2021:** Based on what was socialized in the first session, the invited expert PhD.[4] proposed some minimum aspects to be considered for the development of the reflexive proposal. For this first exercise, the Conceptual Development group designed some questions to clarify the expert's approach to the topic.

The expert's input highlighted six aspects:

Outrage: Considered the gateway to identify that biases exist and become aware that "something is going wrong".

Responsibility: Addresses awareness, as the individual perceives him/herself as an agent of change, and autonomy, inasmuch as the individual acts in response to the situation.

Culture: It is built from everyday behaviors, in which several autonomous agents perform exemplary actions and reproduce them to develop patterns of behaviors from which culture emerges.

Ethics: From culture there is not only agreement on certain actions, but there is a general awareness of a norm of action of what is right and wrong.

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[4] Invited expert who was familiar with the progress of the Training Roundtable Discussion's work and was the prologue author of the book resulting from the research on training needs in this area.

Imagination: Allows ethics to transcend into more general aspects, projecting courses of action in probable future contexts, guiding how one should act.

Education and training: Includes the institutional rules that provide feedback and give structure to what is generated by the culture.

Additionally, the members of the Roundtable discussion agreed that it was necessary to identify common aspects for the different actors of the National System of Science, Technology, and Innovation (SNCTeI). This allows, on the one hand, to assume that there are shared cognitive biases, attitudes, and behaviors, and, therefore, susceptible to be addressed under similar parameters, and, on the other hand, to generate a complementary view from the different sectors and areas of knowledge. Likewise, the importance of a fluid feedback between the different actors of the system is highlighted, which allows to generate a dynamic balance, where the whole and the parts converge towards the same objective, in this case, the appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity. Finally, we consider the question of the methodological path for the initial identification of what is common to the actors: cognitive biases.

1.3 Inclusion of cognitive biases, attitudes, and behaviors

In May 2021, based on the results of the initial discussion carried out by the group, the guidance of the expert and the review on the topic of attitudes and behaviors and their impact on the generation of culture, which one of the members of the group had been conducting in parallel, a researcher joined the work team and contributed to the identification of the importance of addressing the issue of cognitive biases as the basis of the conceptual proposal. Thus, the group decided to direct the discussion towards the identification of cognitive biases (recognition) and the importance of training in the transformation or elimination of cognitive biases that affect attitudes and behaviors, since they have an impact on the Research Ethics, Bioethics and Scientific Integrity culture of the SNCTeI.

1.4 Cognitive Bias Identification

In order to generate the discussion object of the proposal, on the one hand, the group focused on defining aspects common to the various areas of knowledge, identifying similarities in the stages of development of research, technological development and

innovation processes, and, on the other hand, addressing possible cognitive biases that affect behaviors that affect ethics, bioethics and scientific integrity in each area. This verification helped to establish that the processes of science, technology and innovation share common aspects in their development, and that, in this sense, it would also be possible to infer that, regardless of the area of knowledge, they share some cognitive biases.

1.5 Cognitive Bias Classification

Once the initial identification of cognitive biases in each area had been conducted, a classification of the cognitive biases identified was made according to the typology defined from the theoretical review on the subject. The classification was socialized with the group to adjust it and identify aspects common to all areas of knowledge.

1.6 Consultation

Considering the decisive role of the participation of the various SNCTeI actors in the implementation of the EIBIC Policy, representatives of the various areas of knowledge were consulted on the relevance of the cognitive biases identified, consultations made by roundtable discussions according to areas of knowledge in the framework of the IX National Dialogue on Research Ethics (2021), organized by Minciencias.

From culture there is not only agreement on certain actions, but there is a general awareness of a norm of action of what is right and wrong.

Table 1. Roundtable Discussion of the Conceptual Development Group at the 9th National Dialogue on Research Ethics

Execution date	Friday, October 1, 2021
Time	10:45 a. m.–12:30 p. m.
Event title	Advancement of the conceptual development proposal on "Importance of training for the appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity".
Purpose of the roundtable discussion	Socialize the progress of the conceptual development and obtain feedback on the proposal. To broaden the view on the cognitive biases identified in relation to the theoretical-conceptual development on the importance of training in the appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity.
Modality	Virtual | Zoom platform
Methodology	Discussion by areas of knowledge based on guiding questions: • Which of the identified cognitive biases do you consider relevant in relation to research, technological development, and innovation activities? • Which emerging cognitive biases related to scientific research, technological development and innovation activities do you consider that can or should be included?
Social sciences, humanities, arts, and education attendees	80, approximately
Environmental and basic sciences	60, approximately
Biomedical sciences and engineering	100, approximately

Source: Author's preparation

Cognitive Bias Refinement

The consultation made it possible to identify the need to define minimum criteria for classifying cognitive biases that would allow for their refinement by area of knowledge, as well as to identify cross-cutting biases in all areas. As a result of this phase, criteria were defined that made it possible to have greater clarity on when we are talking about cognitive bias, and thus select only those that met these criteria, and the respective actors had identified as relevant for the area of knowledge. Additionally, a comparison was made between areas of knowledge to select those cross-cutting biases and those specific to each area of knowledge. A comparison matrix was used for this activity. This refinement work was conducted by the same knowledge areas that have been working on the implementation of the policy in question.

1.7 Conceptualization

The previous work guaranteed the structuring of a document that could give evidence of the path followed on how the formative processes in topics related to Research Ethics, Bioethics and Scientific Integrity cooperate in the modification or elimination of these cognitive biases and attitudes, as well as in the generation of behaviors, coherent with the generation and appropriation of a culture in the subject. The guiding question of the reflection was the following: How can training modify the cognitive biases (of the areas of knowledge) that impact on attitudes and behaviors in Research Ethics, Bioethics and Scientific Integrity?

This document gathers the result of this process, which deepens in each of the defined aspects and areas of knowledge. Once the group's work was reviewed and consolidated, the following route was structured:

We are invisible to ourselves, and only careful reflection can allow us to unveil our own presuppositions.

Figure 1. Document structuring path
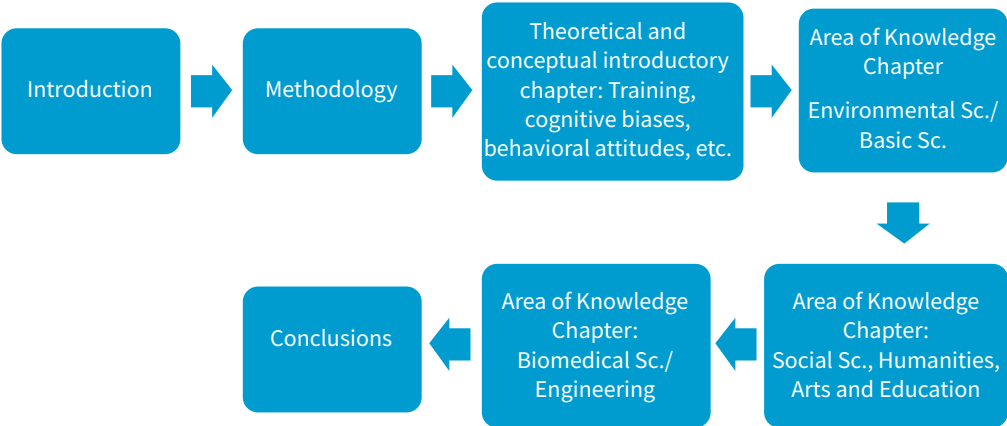
Likewise, in order to unify the approach to the subject in the different areas of knowledge, agreements were reached on the structure of these chapters:

Figure 2. Agreements on the approach structure by areas of knowledge

Theoretical development based on the initial bibliographic review on the importance of training for culture change in EIBIC: review of training roundtable discussions, selection of basic authors.	Discussion of the cognitive biases that influence attitudes and behaviors in EIBIC in each area of knowledge, based on the joint matrix re-visited and bias characteristics.	Concluding section to respond concretely by asking the following question: How can training modify the cognitive biases (of the areas of knowledge) that impact attitudes and behaviors that go against the EIBIC?
Theoretical 1	**Cognitive Bias** 2	**Proposal / To do** 3

The following is a summary of the process conducted by the Conceptual Development Group of the Training Roundtable Discussion to address this topic:

Figure 3. Summary of the 2021-2022 Conceptual Development Group Methodology
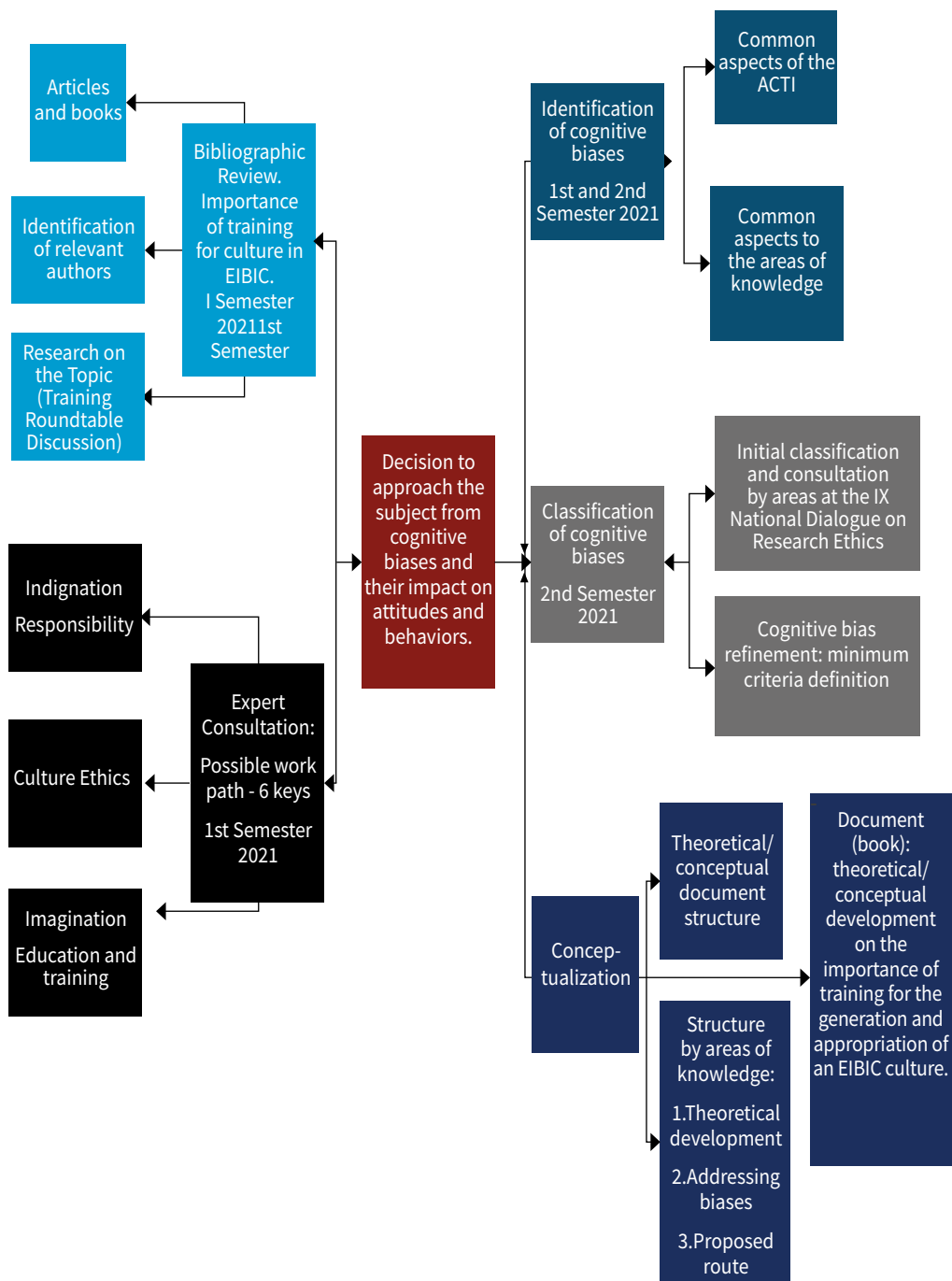
Source: Author's preparation

Conceptual Development on the role of training in the generation and appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity: transformation of cognitive biases, attitudes, and behaviors

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Abstract

Objective: A conceptual development is proposed which establishes the importance of training in the appropriation of a culture of Research Ethics, Bioethics and Scientific Integrity in the processes of science, technology, and innovation, as part of the roadmap adopted for the implementation of this policy by the Training Roundtable Discussion group that has been supporting this process.

Methodology: Based on the conceptual verification of cognitive biases, attitudes and behaviors, their interrelation and impact on the development of a culture, the role of training in the transformation of cognitive biases that have an impact on attitudes is identified, which at the same time influence ethical, bioethical and integrity behaviors

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in science, technology and innovation, evidencing the appropriation of a culture on the subject and resulting in the proposal of a conceptual model.

Results: Identification of the existence of a varied and flexible interaction between cognitive biases, attitudes and behaviors; the need to build conceptual and methodological tools to address in a concrete way the cognitive biases of science, technology and innovation processes; the importance of the social psychology approach in addressing attitudes as an adjuvant mechanism in the process; the various ways in which training influences patterns of behavioral change; and, most relevantly, the impact of training on the interaction "cognitive biases-attitudes-behaviors" and, therefore, on the appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity.

Keywords: Cognitive biases, attitudes, behavior, culture, research ethics, bioethics, scientific integrity

Resumen

Objetivo: Se propone un desarrollo conceptual que establece la importancia de la formación en la apropiación de una cultura en Ética de la Investigación, Bioética e Integridad Científica en los procesos de ciencia, tecnología e innovación, como parte de la hoja de ruta adoptada para la implementación de esta política, desde el grupo de la Mesa de Formación que ha venido apoyando este proceso.

Metodología: A partir de la comprobación conceptual de sesgos cognitivos, actitudes y comportamientos, su interrelación e impacto en el desarrollo de una cultura, se identifica el rol de la formación en la transformación de los sesgos cognitivos que impactan en las actitudes, las cuales a su vez influyen en los comportamientos éticos, bioéticos y de integridad en ciencia, tecnología e innovación, que evidencian la apropiación de una cultura en el tema y dan como resultado la propuesta de un modelo conceptual.

Resultados: Se identificó la existencia de una interacción variada y flexible entre los sesgos cognitivos, las actitudes y los comportamientos; la necesidad de construir herramientas conceptuales y metodológicas que permitan abordar de forma concreta los sesgos cognitivos de los procesos de ciencia, tecnología e innovación; la importancia del enfoque de la psicología social en el abordaje de las actitudes como mecanismo coadyuvante en el proceso; las diversas formas en que la formación influye en los modelos de cambio comportamental, y, lo más relevante, el impacto que tiene la formación en la interacción «sesgos cognitivos-actitudes-comportamientos» y, por lo tanto, en la apropiación de una cultura en Ética de la Investigación, Bioética e Integridad Científica.

Palabras clave: Sesgos cognitivos, actitudes, comportamiento, cultura, ética de la investigación, bioética, integridad científica

Resumo

Objetivo: Foi construído um desenvolvimento conceitual que demonstra a importância da formação na apropriação de uma cultura em ética em pesquisa, bioética e integridade científica nos processos de Ciência Tecnologia e Inovação desenvolvidos pelas diversas áreas do conhecimento, sendo esta proposta um dos objetivos da Mesa de Capacitação, grupo de trabalho que apoia a implementação da política de ética em pesquisa, bioética e integridade científica na Colômbia.

Metodologia: propõe-se um modelo conceitual que consegue estabelecer o papel da formação na transformação de vieses cognitivos que impactam atitudes, que por sua vez influenciam comportamentos éticos, bioéticos e de integridade em Ciência, Tecnologia e Inovação, que mostram a apropriação de uma cultura em o sujeito.

Resultados: Identificou-se a existência de uma interação variada e flexível entre vieses cognitivos, atitudes e comportamentos; a necessidade de construir ferramentas conceituais e metodológicas que permitam uma abordagem concreta dos vieses cognitivos dos processos de Ciência, Tecnologia e Inovação; a importância da abordagem da psicologia social na abordagem das atitudes como mecanismo contribuinte no processo; as várias maneiras pelas quais o treinamento influencia os padrões de mudança comportamental; e, mais relevante, o impacto que a formação tem na interação «preconceitos cognitivos-atitudes-comportamentos» e, portanto, na apropriação de uma cultura em ética em pesquisa, bioética e integridade científica.

Palavras-chave: Preconceitos cognitivos, atitudes, comportamento, cultura, ética em pesquisa, bioética, integridade científica

2.1 Introduction

According to the American philosopher Charles Sanders Peirce (n. d., p. 5), "Few people care to study logic because everybody thinks himself to be proficient enough in the art of reasoning," but -he adds- "I observe that this satisfaction is limited to one's own ratiocination and does not extend to that of other men." This observation sums up one of the reasons why it is so difficult to conduct one of the fundamental tasks posed by philosophy from its very beginnings: self-knowledge. The certainty that our own knowledge is true and well-structured prevents us from seeing our own errors, even though we do not have the same difficulty in pointing out the errors of others. We are invisible to ourselves, and only careful discussion can enable us to unveil our own presuppositions and identify in ourselves the logical errors that we can relatively easily attribute to others.

This difficulty in identifying our own flaws in reasoning can extend to the work we undertake together. In organizations such as governments, armies, companies and study groups, this self-concealment also occurs, the consequences of which extend beyond the individual and end up creating calculation problems of great magnitude: failed public policies, huge war defeats, large-scale economic losses, and unfeasible academic projects or those of little or no application. Although the institutions themselves are not precisely cognitive agents susceptible to self-knowledge errors, the agents that make decisions within these institutions are[7]. Hence the importance of having tools to identify these errors that, starting from projections with the best intentions of success, end up generating failures that impact not only those who plan, but also those who are harmed by these design errors. These analysis tools are known in psychology as *cognitive biases*.

Cognitive biases are tools that allow us to identify general structural factors such as the environment, the personal history of each agent or the limitations of human cognition. When these general factors are converted into dispositions for the action of each particular agent, we are talking about *attitudes*, specifically biased attitudes. Finally, once these attitudes are concreted into observable events, we refer to *behaviors*. Accordingly, when a systematic behavior is observed that has undesirable consequences, it is important to observe the attitude that underlies this behavior, and, ultimately, the bias that makes the agent think that his action strategy could have positive results, when reality shows the opposite.

When designing research, technological development, or innovation projects, it is common to find that working groups focus exclusively on their object of study, ignoring the structures that determine their own analysis and that can lead to undesired results. Specifically, in matters related to research ethics, there is a risk that projects may be approached with the best of intentions but are fraught with bias or neglect with respect to unexpected consequences or expectations that are not fulfilled as they should be. The confidence that researchers usually have about the relevance and social commitment of their own studies may blind them to their own limitations, their biases, and the risks of applying methods that are successful in some contexts but may fail in others. Hence the importance for the agents involved in the CTeI processes to be aware of cognitive biases and how these are established through attitudes and end up materializing in behaviors. This analysis seeks to remedy the consequences of biases as far as possible and, thus, to improve the project formulation process by including ethical guidelines that will enable CTeI to contribute to building a better society.

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[7]   Although there is the concept of institutional bias or structural bias or systemic biases, what those express can be included in the category of availability biases, which will be included below: in brief, structural biases are conditions of the environment that negatively condition the agent's decision making and lead him to make systematic errors, particularly related to prejudices and exclusionary attitudes (Gassam Asare, 2019).

This chapter will begin by defining what cognitive biases are and how they originate in the very structure of human cognition, which allows us to understand them as something that is part of our nature and that we can try to mitigate as much as possible without pretending to have total control over them. Subsequently, a proposal for categorizing cognitive biases will be presented, according to their usefulness in the design of research, technological development, and innovation projects, in order to then establish criteria for identifying cognitive biases so that they can be used in the project design process. Subsequently, the impact of cognitive biases on attitudes and their coadjutant role in the generation of behaviors and, therefore, in the appropriation of culture in Research Ethics, Bioethics and Scientific Integrity will be presented. Finally, a proposal for behavioral transformation is presented from three models of behavioral change, based on the interaction between cognitive biases-attitudes-behaviors.

2.2 Cognitive Bias

2.2.1 Definition

The expression cognitive bias was popularized by psychologists Daniel Kahneman and Amos Tversky in the late 1970s and has one of its most recognized formulations in Kahneman's text Thinking, Fast and Slow (2011). According to this author, it is easy for people to identify errors of judgment in decision-making or in the behaviors of someone else in a given situation, but conceptual tools are needed to understand the general cognitive factors that underlie these errors. It is therefore important to identify the patterns that emerge from behaviors resulting from bad decisions, and from this arises the definition of bias as a systematic tendency to make mistakes when acting in certain circumstances. Thus, by identifying not only the particular errors in behavior, but also the biases that respond to a certain pattern of behavior, it is possible to better identify the causes and viable solutions to prevent these biases or, at least, to control their consequences on the processes as much as possible.

It is reasonable to think that no one seeks to make the same mistake repeatedly, unless their objective is to deceive an opponent or to achieve some end in an unscrupulous manner or, simply, to remain firm in their position regardless of whether or not it conforms to reality. For this reason, the origin of biases must be understood according to mechanisms different from those of rational decision making, which starts from an objective analysis of real data to take a course of action accordingly. To explain this, Daniel Kahneman (Kahneman, 2011) appeals to the figure of the "two systems" that constitute our cognition:

- First, there is system 1, which works almost automatically and whose purpose is to save the agent as much energy as possible in cognitive work. To achieve this "automation" of behavior, system 1 converts the cognitive processes that have been successfully internalized into habits. Thus, when the agent finds himself in a given situation, he is accustomed to responding in a certain way and does not have to spend much energy thinking about the best solution strategy.

- Then there is system 2, which works consciously and whose purpose is to analyze in detail the particular situations faced by the agent, in order to produce the most appropriate response. This system 2 demands a cognitive effort and, with it, a significant energy expenditure. For this reason, the agent tends to avoid resorting to this system and to unload the cognitive work on system 1, which works with less effort.

With this in mind, we can then understand that the automation of cognitive strategies that are successful in certain contexts can lead to extrapolating these same strategies in contexts that are not appropriate. This leads to systematic error, as far as agents tend to act automatically and avoid resorting to a conscious process. In other words, the automatic responses of system 1 persist because they are usually successful, and it is also for that reason that it is difficult to identify and accept when a strategy is not working.

In addition to automation, there is in agents, as mentioned above, an innate security in their own rationality that makes it difficult for them to identify their own mistakes. People are able to identify other people's mistakes and not see their own because they have difficulty seeing themselves objectively. Each person considers that he or she has the criterion of rationality in himself or herself and from his or her own perspective evaluates others, but hardly questions those same criteria that he or she believes to be true.

Adjusting the cognitive strategies that lead to a decision-making process puts the agent in the situation of having to resort to system 2 and expend cognitive resources, which, in addition, leads him to question the methods that he considers most appropriate and that are part of his practical rationality. The identification of biases is a tedious and challenging task, but it is often necessary to avoid the errors resulting from an unexamined decision-making process growing in such a way that they become increasingly difficult to solve. This is why identifying biases makes it possible to systematize errors in order to search for causes and solutions in a more general way and applicable to various contexts.

2.2. 2 Types of Cognitive Bias

This section will attempt to propose, based on a general analysis of the types of biases identified in the contemporary literature, a typology that fits the objectives related to

Research Ethics, Bioethics and Scientific Integrity[8]. This typology will have three main components: availability biases, egocentric biases, and intuition biases.

Availability Biases

Availability biases are those in which *decisions are conditioned by the information available to the agent or the way in which this information is presented.* The cognitive framework in which these types of biases occur is due to the fact that the transmission of information, either from an external agent or from the physical environment, is not a neutral process in which a message passes back and forth without any modifications other than those that may be introduced by external noise. Given that concrete situations present the agent with time pressures and perspective limitations, it is common to fall into this type of bias; but it is also possible to diminish the consequences when there is more awareness of the cognitive structure that underlies them and when habits of critical thinking are promoted to strengthen critical skills in interpretation.

According to the above, we would have two general types of bias: some more related to the immediate situation (anchoring, framing and availability heuristics) and others related to the particular history of the agent (prospect theory and perceptual salience), as discussed below:

- Anchoring effect

- Framing effect

- Availability heuristics

- Prospect theory

- Perceptual salience

Egocentric Biases

The second category includes those biases whereby the interpretation of information is mainly conditioned not only by the pressure of the concrete situation, but also by the *agent's general traits acquired through his personal history.* As an active interpreter of the situation, the agent does his part in reading the information from the environment and projects his own experiences or the strategies that may have brought him success in the past to achieve positive results in relation to the problem he must solve in the present,

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[8]   Some categorization proposals can be found in Caverni et al. (1990), Juárez Ramos (2019), Hilbert (2012) and Haselton et al. (2005). However, each categorization responds to the specific need for exposure and there is no stable consensus among the authors

or that may be presented to him in the future. As in the previous case, critical thinking and the strengthening of analytical habits can help reduce the negative consequences that can result from this type of bias.

Egocentric biases can be divided into two groups: those that have to do with adjusting the world to one's own beliefs (confirmation bias and cognitive dissonance) and those that focus on the agent's reference to himself (*egocentric bias, effort justification*).

Intuition Biases

Finally, we have a group of biases that are more general and have to do with the difficulties that human beings have, given their limited cognitive capacities, to *interpret information from the environment in a reliable way* all the time without falling into errors.

There are two general types of fallacy in this category: biases that have to do with the confusion between certainty and truth (*mere exposure effect and superficial truth*), while there are others that have to do with introducing extra information to make sense of the scarcity of data (*intuitionism, apophenia*).

Table 2. Types of cognitive biases

Type of bias	Description	Division	Bias (specific)
Availability	Biases that condition the decision according to the way information is available in the environment.	Immediate situation	Anchoring Framing Availability Heuristics
		Agent-environment relationship	Prospect theory Perceptual salience
Egocentric	Biases that condition the decision according to the agent's personal history.	Adjustment of the world to one's own beliefs	Confirmation bias Cognitive dissonance
		Self-reference	Egocentric bias Effort justification
Intuition	Biases that condition the decision according to the limitations of human cognition.	Confusion between certainty and truth	Mere exposure effect Superficial truth
		To make sense of or complete the limited data	Intuitionism Apophenia

Source: Author's preparation

2.2.3 Criteria to identify cognitive biases

The requirement to be clear about when reference is made to a cognitive bias defines the search for characteristics that indicate whether or not a bias of this type is being addressed. For the purposes of this identification of biases, two possible indicators are initially proposed: on the one hand, the requirement that it be repetitive, and, on the other hand, that its initial intentionality be positive; both aspects were addressed previously. However, since it is possible to speak of cognitive bias only if there is clarity about what is "right" and what is "wrong", it is important to have some criterion that allows us to identify this difference, so in our case the principles and conducts established in Research Ethics, Bioethics and Scientific Integrity (Minciencias, 2022), aspects validated as part of the implementation of the Policy on Research Ethics, Bioethics and Scientific Integrity, which specifically orients desirable conducts in the CTeI processes, and in this way it is possible to identify if the biases are associated with possible conducts against the EIBIC.

Based on the above, the criteria that help to define whether a cognitive bias is being addressed are the following:

Table 3. Criteria to define cognitive biases

No.	PROPOSED INDICATOR
1	Identify whether the bias corresponds to a pattern (repetitive)
2	Analyze whether bias generates problems or erroneous results in EIBIC (this can be determined by relating bias to established conducts and principles).
3	Identify whether the target was intentionally positive (initially)

Source: Author's preparation

Once the specific cognitive bias has been defined according to the typology described above, it is identified how these biases interact through attitudes to subsequently manifest themselves in conducts, always taking attitudes as mediating agents and interaction with the environment and peers as factors that drive this conversion into conducts. Hereafter, a definition of attitudes will be made, making distinctions between the approaches that have addressed this definition, and then we will move on to the definition of the functions of attitudes before addressing behaviors.

2.3 Attitudes

By addressing cognitive biases, attitudes and behaviors and their interrelation as the basis for the appropriation of a culture, it is reasonable to propose that it is the cog-

nitive biases that impact the attitudes that people have towards the defined object or situation (in this case, towards Research Ethics, Bioethics and Scientific Integrity) in the development of science, technology and innovation processes. These attitudes have a direct influence on the behavior of the actors involved; these conducts are, finally, the action that evidences the appropriation of the culture, as far as they demonstrate the following of standards, norms and guidelines on the subject.

Although variants of the interaction between these constructs (biases, attitudes, behaviors) are presented, this document attempts to show the path that is structured when moving from cognitive biases to attitudes and how these become a mediating factor that influences behaviors. Therefore, a concrete model applicable to the processes of science, technology and innovation is offered. Thus, this section focuses on the approach to attitudes as one of the links that help in the realization of the process of appropriation of a culture.

2.3.1 Definition

Although the study of attitudes began in the 1930s, it can be said that there is still no agreement on their definition, characteristics, and scope. According to Guerra de los Santos and Cantillo Galindo (2012), they have been defined as hypothetical constructs or as real elements, of a conscious or unconscious type, covering the cognitive, emotional, and behavioral sphere. However, according to Escobar-Melo and Díaz Amado (2008), especially in the 21st century, the focus of study has been strongly oriented to social cognition: the framework of social psychology from which it has generally been approached, although this area of psychology began to use the technical term attitude since the early 20th century (Guerra de los Santos and Cantillo Galindo, 2012).

In the chapter "Attitudes in interpersonal relationships" (Guerra de los Santos and Cantillo Galindo, 2012), the models for approaching the study of attitudes are presented, which can offer a reference in relation to the appropriation of the approach addressed by this document.

For Guerra de los Santos and Cantillo Galindo (2012), there are two main functions of attitudes:

- Motivational functions: They are represented as a response to the needs of the individual or the group.

- Cognitive functions: oriented to the selective choice of information. Each of these functions presents an internal classification that allows understanding its application to the motivational or cognitive field.

Table 4. Models for approaching attitudes

Model	Description of attitude approach
Unitary Models Fazio (1990) Pratkanis and Greenwald (1989)	Attitudes associated in memory with an affection for a given object. A positive or negative affect has been considered in this sense. Model represented by the MODE proposal (Fazio, 1990): objects with which one has direct experience generate more accessible attitudes, i.e., more stable attitudes, more resistant to criticism, while offering more confidence; attitudes guide conducts through automatic activation of the attitude in the presence of the object, or through careful analysis of the information.
Dual models Wilson, Lindsay, and Schooler (2000)	Considers that one can have both an explicit (conscious) and an implicit (unconscious) attitude towards an object; it is possible to show different affects towards the same object. These dual attitudes have different mental representations, are formed by different cognitive processes, and are activated in different contexts.
Process models Schwarz and Bohner (2001) Gawronski and Bodenhausen (2006)	Constructivist perspective of attitudes, whereby attitudes are formed for each specific situation, according to feelings, beliefs, and most salient conducts. This generates a "selective access to information", thus influencing the evaluation of information. The APE model - of associative-propositional evaluation (Gawronski and Bodenhausen (2006) - defines that one acts positively or negatively towards the object, according to the affection associated with it or the thoughts it generates. Likewise, affect can be transformed by beliefs. They emphasize that attitudes are not found in memory.
Metacognitive model Pretty, Briñol and DeMarree (2007)	Attitudes remain in our memory, thus generating positive or negative evaluations. Characteristics: The activation of attitudes depends on the context; having antagonistic attitudes (good/bad) towards an object, the activation will depend on the closest experience or contexts where they are related, on the valuation that the subject makes of the attitude towards the object.

Source: Prepared by the authors based on the Classification of Attitude Approach Models in "*Las actitudes en las relaciones interpersonales*" (Guerra de los Santos and Cantillo Galindo, 2012).

Table 5. Attitude functions

Functions	Type	Description
Motivational	Adaptive or instrumental	Related to the attempt to obtain the greatest gratification from experiences and relationships, and to diminish unpleasant aspects. In this case, the function of attitudes is to allow rapprochement with what we consider pleasant and to avoid what we consider unpleasant, therefore closeness and consistency with rewards and punishments is fundamental in this function.
	Self-defense	In this case, attitudes protect the individual from negative feelings towards himself, towards others or towards a group. In general, from this perspective, all people have defensive attitudes that they will use to a greater or lesser extent, according to the context.
	Value expressive	It is oriented to make known the individual's core values and the type of person he/she believes him/herself to be. This approach considers that attitudes serve the individual to obtain social approval.
	Cognitive with respect to the environment	This function refers to the contextual framework that attitudes provide for the search for information about their surroundings. In this way, attitudes help to understand the environment that surrounds them.
Cognitive	Information processing	They provide a frame of reference for organizing and understanding information coming from the outside world.

Functions	Type	Description
Cognitive	Active research of attitude-relevant information	Selectivity in the search for information, oriented towards information with which they feel more identified or closer (in accordance with their attitudes).
	Perception of attitude-relevant information.	This function is intended to serve as a filter for the evaluation of incoming information.
	Recall of attitude-relevant information	Attitudes allow for greater recall of issues where they were more intense (for or against) than where they were neutral.

Source: Own preparation based on the Classification of Attitude Approach Models in "*Las actitudes en las relaciones interpersonales*" (Guerra de los Santos and Cantillo Galindo, 2012).

For the purpose of this paper, i.e., how training can have an impact on the transformation of cognitive biases -then, attitudes and behaviors-, in this case, for the generation and adoption of a culture in Research Ethics, Bioethics and Scientific Integrity, within the framework of the science, technology and innovation processes developed in the country, the approach from social psychology is considered the most relevant for the study of attitudes, since it allows exploring them from the perspective of the mediating agent; in this case, between cognitive biases and conducts.

From this approach and according to Escobar-Melo and Díaz Amado (Escobar-Melo and Díaz Amado, 2008), attitudes are a subjective construct that belongs to social psychology, referred to "a comprehensive way of approaching socially mediated conduct" (p.75). For these authors, attitudes have three dimensions:

- **Cognitive:** It refers to "beliefs regarding the attitude object in terms of assumptions about what it is like and relative objectivity in relation to it" (p.75).

- **Affective:** It relates to "evaluative feelings of favorability or unfavourability, feelings that refer to particular emotions" (p.75).

- **Behavioral:** It is oriented to the "tendencies to action, in terms of how a subject responds or acts before that object, person or group of people, which constitute the objective or target of the attitude" (Morris and Maisto, 2001; cited by Escobar-Melo and Díaz Amado, 2009, p. 75).

Escobar-Melo and Díaz Amado (2008) consider that attitudes can be understood as true dimensions that influence the conduct of a given subject, also as mediators and guides of conduct or as complex responses of the organism resulting from the influence of the groups in which it lives or the social situations it experiences (p. 75).

We understand attitudes as a mediating construct between cognitive biases and behavior, to the extent that they contribute to the process through which cognitive biases are consolidated in beliefs, affections and evaluations of the environment, conditions that in turn guide or condition the behavior of people in the face of certain objects or situations, in this case, in the face of research ethics, bioethics and scientific integrity. Based on this approach, the following section will specifically address the behavioral aspect and the conceptual approaches that contribute to the transformation of behaviors, always bearing in mind that behavior is in constant interrelation with cognitive biases and attitudes.

2.4 Behavior

2.4.1 Definition

Behavior, understood as the construct referring to the conducts that an individual evidences in a given situation, allows, within the framework of Research Ethics, Bioethics and Scientific Integrity, to account for compliance with guidelines, norms, standards, among others, aligned with the "must be" of the development of the processes of science, technology and innovation dictated by the scientific community to which one belongs.

This section will address the most representative models of behavior change that can be applied to the case of interest, in such a way that they are the conceptual basis for developing a proposal regarding the roles that can be played by the training processes in the acquisition and transformation of behavior, therefore, in the appropriation of culture in Research Ethics, Bioethics and Scientific Integrity.

2.4.2 Models of behavioral change

Although there are several models for behavioral change, this paper will focus on three: *individual-centered models*; *integrative individual-environment models*; and *contemporary models*, specifically, *behavioral design*.

The characteristics and elements that make up each of these models allow us to propose the role that training plays in the acquisition and transformation of behaviors within the framework of each of the models, always considering the premise of the existence of an interrelation between cognitive biases, attitudes, and behaviors.

Individual-centered models

According to Alvarez (2010), individual-centered behavioral change models are oriented to attitude change and cognitive restructuring, and to a stepwise or "motivational" change. The following table provides a synthesis of the individual-centered behavioral change models proposed by Alvarez (2010).

Table 6. Individual-centered models of behavior change

Model/Authors	Characteristics
Festinger (1954) Cognitive dissonance	Cognition is a determinant of behavior. Behavior and cognition may not be aligned (dissonant), so the individual would be in charge of making the changes in cognition to achieve the desired behavior.
Fischbein and Azjen (1975) Self-regulation and rationality Perceived behavioral control	• 1975-Cognitions are changed by experiences or by deliberation about them. • In self-regulation it is the individual who predicts, manages, and controls his or her behavioral change. • 1985-"Perceived behavioral control": internal reinforcers aid attitudinal and behavioral change and maintenance.
Weisten (1988) Adoption of precautions	• Staged model focused on motivation: • Information about the situation. • Calculation of risk. • Recognition of one's own susceptibility. • Decision for action. • Desirable conduct.
Eagly and Chaiken (1993) Persuasion and cognitive response approach.	Behavioral change depends on the validity and credibility that the individual gives to the message and the source of the message (external persuasion) or the individual's own argumentation to do so (self-persuasion).
Prochaska, Norcross, and Diclemente (1994)	Behavior change: "any activity that a person undertakes to help him modify his thoughts, feelings or behaviors" (Prochaska, Norcross and Diclemente, 1994, cited by Álvarez, 2010).

Model/Authors	Characteristics
Flórez (2003) Heuristic Scheme DPPP (psychological dimension promotion-prevention)	Complex stage model: each stage brings the individual closer to the desired behavior, and each stage has limits, facilitating variables and barriers. It combines group influence with the subject's gradual decisions.

Source: Author's preparation based on "Psychological models of change: from individual-centered models to psychosocial models in health psychology" (Álvarez, 2010).

Taking into account that in all models of behavior modification centered on the individual, cognitions are fundamental, either because they are on a par with behavior change, because they regulate the emotions that affect behaviors or because they are precursors of behavior change itself, it could be said that knowledge of the situation or knowledge related to the desired behavior fulfills various objectives at the cognitive level, such as the discussion and generation of awareness about the distorted knowledge or perceptions regarding the behavior, the identification of advantages and disadvantages of the behavior and the validity of the arguments against it, the emotional aspects that impact on the beliefs or attitudes and the possibility of concretizing the behavior and maintaining it.

Despite the importance of knowledge, the development of capacities or the acquisition of skills on behavioral modification in models centered on the individual, it is important to take up again what De la Cruz Tomé (2003) defined when he emphasizes that "the problem is that information alone does not guarantee behavioral change" (p. 208); for behavioral change, a prolonged period of time and constant accompaniment are necessary.

Integrative individual-environment models

Some authors approach behavioral change as a process where individual aspects related to beliefs, cognitions, emotions, among others, converge with aspects of the environment that positively or negatively affect behavior change. In this paper, these will be referred to as *integrative individual-environment models.*

According to Batlle (Batlle, n.d., p.2), among the models that have analyzed at some point the environment-behavior relationship are the following: interconductism, inter-conductual psychology, functional contextualism, neuroscience models that work on the brain-environment interrelationship, cognitive-behavioral models based on learning theories, information processing models.

According to Fuentes (2009), these models are based on understanding changes in behavior based on the interaction of the individual with his *social environment,* while Batlle (n.d.) associates them with behavior as a product of the "association of external

stimuli and internal cognitive processes" (p.5). Bandura (1980) manages to consolidate the postulates of this approach as "social learning theory", defining that behavior patterns can be acquired by one's own experience or by observing the behavior of others and including the cognitive process as fundamental for the acquisition and maintenance of behavior.

For Bandura (1980), the social learning theory identifies three regulatory systems of behavior, which in some respects are aligned with aspects defined by other theories:

Table 7. Regulatory systems of social learning

System	Description
First system	Antecedent stimulus that triggers the behavior, making it possible to predict to some extent the consequences of the behavior and getting the behavior into action. These antecedents that drive the behavior are various contextual factors.
Second system	Influence of behavioral feedback, defining that behavior is largely controlled by its consequences. Punished or poorly reinforced behavior is discarded, while behaviors that are reinforced are maintained and strengthened.
Third system	Cognitive control: influence that the individual's cognition has on the change of behavior; cognitive mechanisms can lead to different response options in response to the antecedents and consequences of the behavior.

Source: Own preparation based on *The Social Learning Theory of Aggression* (Bandura, 1980)

Based on these behavioral models, the role of training is broad and varied, from basic knowledge about the possible consequences of the desired behavior, which influences decisions to carry it out or not; the acquisition of response patterns associated with the desired behavior; the symbolic management of situations where behaviors must be put into practice; to the acquisition of behaviors by observing them in other people, and the consequences derived from their adoption.

It is important to mention that there are some aspects considered necessary to achieve behavioral change (Schwarzer and Gutiérrez-Doña, 2009, p.11), referring to perceived self-efficacy related to the belief that the person has about their own abilities to develop the action (behavior) or to maintain it, and strategic planning, focused on the

preparation of the individual to respond to the difficulties that may arise when applying the behavior, for example, how, where and when to adopt the behaviors (Schwarzer and Gutiérrez-Doña, 2009).

In this model, the knowledge one has about the behavior and the "training" to perform the behavior successfully will have an impact on the acquisition of the desired behaviors and their maintenance over time.

Contemporary models of behavioral change: behavioral design

Contemporary models of behavioral change have kept pace with technological development and neuroscience research. Because of this, they have made it possible to combine constructs from different areas to achieve the goal of large-scale behavior transformation in public policy; behavioral design is one of these models with evidence of positive results. Sánchez-Navarro (2018) considers behavioral design as "an emerging field that combines theories and methods to understand design as a tool to influence people's behavior" (Sánchez-Navarro, 2018, p.1), having as a premise that people's decisions are influenced by both rational factors and "impulses and emotions" (p.1) that are "linked to cognitive biases and mental shortcuts that affect the way we act" (Sánchez-Navarro, 2018, p.1). In this regard, Arellano and Barreto (2020) frame this type of models in what they call behavioral governance, which they consider a combination of "neurosciences, evolutionary psychology and behavioral economics" (Arellano Gault and Barreto Pérez, 2016, p.927), so it is understood that behavior change does not occur only from rationality, but that other less conscious factors intervene in people's decision making.

One of the postulates of the behavioral design perspective is that "the best way to modify behavior is to modify behavior" (García Arteagoitia, 2020). Thus, these initiatives focus on establishing guidelines that influence the adoption of behaviors so that, from the generation of habits, attitude change is achieved, contrary to what behavioral sciences generally propose to start with attitudinal or cognitive change interventions (2020). According to Olivera (2020), with behavioral design, "action-oriented results are sought... changing a given behavior rather than modifying a way of thinking" (p.1).

According to Eslava and Silva (2021), although behavioral sciences have been essential for the achievement of public policy objectives, approaches to behavioral change have had to be reoriented from classical behavioral paradigms - according to which behavior is modified "based on coercion and material incentive" - to implement contemporary approaches based on "nudge, boost, think, among others" (Instituto Mexicano de

Economía del Comportamiento [IMEC], n. d.; Hertwig and Gradwig (2020); Hertwig and Gradwig (2020)). f.; Hertwig and Grune-Yanoff, 2017; John et al., 2009; cited by Eslava and Silva, 2021). These new "behavioral design" tools are defined in the following table:

Table 8. Behavioral design tools

Tool	Concept
Nudge	It refers to "small nudges"; more specifically, to "interventions that modify the architecture of the decision seeking a change in behavior that is light, inexpensive and respects people's autonomy" (Eslava and Silva, 2021).
	Social norms largely regulate individual behavior, so the perception of "what others do" or "what others think we should do" influences behavior (Bicchieri, 2008; cited by Eslava and Silva, 2021).
	Cognitive processes are a source of people's error, since they inadequately guide individuals "who do not know", i.e., those who do not have the knowledge or have distorted knowledge (IMEC, 2020).
Boost	They are "light educational interventions that use the expansion of people's capabilities to enable them to make better decisions" (Eslava and Silva, 2021).
	Focused on the capabilities or lack thereof of individuals, they aim to provide knowledge and skills required by the individual, to achieve behavior change (IMEC, 2020).
Think	They are "spaces for deliberation and argumentation techniques for people to make collective decisions" (Eslava and Silva, 2021).
	It seeks "change in behavior through the conscious processes of the individual and places its efforts on people's reason and discussion" (Arellano and Barreto, 2020, p. 927)"; in this way, it builds 'strong institutional frameworks' where people collectively reflect and make decisions, thanks to the possibility of public and free dialogues with others.

Source: Author's preparation based on (Eslava and Silva, 2021; Bicchieri, 2008, cited by Eslava and Silva, 2021; IMEC, 2020; Arellano and Barreto, 2020).

Based on the above, due to the structural changes that the world is facing due to globalization, within the framework of the behavioral design model, it is necessary to reorient the efforts of the training and knowledge acquisition processes to develop in individuals the capacities and skills that allow them to "put their knowledge into action" and thus respond adequately to the demands of rapid adaptation of the environment (Calderón Jemio, 2000).

2.5 Role of training in the appropriation of culture in Research Ethics, Bioethics and Scientific Integrity

2.5.1 Overcoming biases and attitudinal changes through training

Based on José Ortega y Gasset's maxim, according to which "I am me and my circumstances, and if I do not save them, I do not save myself" (1914, p. 322), Tomás Moratalla (1997) proposes a change in attitudes that involves recognizing the context in which the agent finds himself and also recognizing the interdependent relationship

between the agent and his circumstances. There is no change in attitude that does not imply a change in the way one relates to one's surrounding world, and it is training that enables this transformation. Therefore, the role of training is associated with the following factors that help build the path that drives change:

Indignation: Every change of attitude and every awareness prior to a work of ethical transformation implies an affectation with respect to the surrounding world that moves the agent to change his situation. When I am indignant about the situation I live in, I move to improve it. If I do not start by becoming indignant, the world will be indifferent to me, and my biases and attitudes will remain intact.

Culture: Culture must be conceived not as the ready-made result of great products of knowledge and action, but as a process in which a type of configuration of social life is gradually being built. The agent is the protagonist of this gradual change, despite the fact that at first sight the results on a large scale are not so remarkable. It is in the constancy of continuous action that a type of culture is consolidated and, therefore, the change of attitude requires the perseverance of the agent.

Ethics: Ethics is not conceived as a set of rules to be followed, but as a conscious attitude towards the way we act and the consequences of our actions. It is also conceived as a projection that drives us to make our actions better and better.

Responsibility: It is the axis through which ethics acquires its real manifestation and has three basic elements:

Awareness: The agent perceives himself as the protagonist of his actions, as well as the one who assumes their consequences, to the extent that it is within his reach.

Autonomy: From the moment of awareness, the agent is not guided in his actions by external impositions or automatic responses, but by a sense of being the one who can take control of his actions.

Exemplary: Through his actions, the agent serves as a model in his community, while taking other models as a reference point for his own improvement.

Imagination: It is the element that allows us to transcend the current situation and its criteria to look for creative ways to act and to overcome the limits imposed by the biases that make us act unconsciously.

Regarding the possibility of modifying or transforming attitudes, Guerra de los Santos and Cantillo Galindo (2012) consider that a person changes his or her attitude when it is no longer useful to achieve his or her objectives, when it is no longer useful to adapt to the situation in which he or she finds him or herself, either because it is a new situation or because the socio-environmental circumstances have changed in a habitual one and he or she must display other conducts in order to remain in the desired environment. (Guerra de los Santos and Cantillo Galindo, 2012).

According to Escobar-Melo and Díaz Amado (2008), in social science research, "attitudes continue to be considered as the underlying conceptual framework that supports research, be it opinion, favorability or intentionality in relation to future actions or beliefs and values that accompany human actions" (Escobar-Melo and Díaz Amado, 2008).

Considering that attitudes are based on the way the environment appears to the agent, how the agent uses his own history to justify his relationship with the environment or how the same limitations of cognition distort the agent's attitudes, it is also important to go to the bottom of the attitude and find the cognitive bias that sustains it and where the roots of the behavior to be modified lie. From the behavior, which is what the analyst has available for observation, it is possible to identify patterns that constitute attitudes, and, from the attitudes, it is possible to identify the biases that justify those attitudes and make the agent think that he is behaving rationally and that he does not need to question his motives.

Table 9. Representation of the problem path in the appropriation of culture in the EIBIC.

Problem identification path		
Behavior	Attitude	Bias
(directly observable)	(disposition)	(Cognitive structure)

Source: Author's preparation.

Table 10. Representation of the path of transformation and appropriation of culture in EIBIC

Transformation path		
Identifying the wrong behavior (Indignation)	Taking responsibility (From the wrong agent to the agent of change)	Ethical and cultural changes (Identification of biases, attitudes, and creation of strategies for change)

Source: Author's preparation.

2.5.2 Role of training in changing behaviors

Previously, the interrelation between cognitive biases, attitudes and behaviors was identified, emphasizing that it is the behaviors that can evidence the appropriation of a culture in ethics, bioethics and integrity in the development of science, technology and innovation processes, and that, depending on the model of behavior change that is addressed, the impact of training in the generation, change and maintenance of behaviors and, therefore, the appropriation of culture will follow a different path, by impacting in different ways the constituent elements of each model.

This section will present three proposals of the role of training in the appropriation of culture in Research Ethics, Bioethics and Scientific Integrity, as it is identified as an inciting or mediating factor in the process of acquisition and transformation of behaviors, and by assuming that training as a process of knowledge acquisition, development of capabilities, training of skills, as well as an integral process of transformation of the individual at personal and social level. The role of training in the appropriation of culture will be proposed for each of the behavior change models addressed: individual-centered models, integrative environment-individual models, contemporary models: behavioral design.

The first proposal proposes the role of training in the individual-centered behavioral change models, as shown in the following figure:

Figure 4. Role of training for behavior change in Research Ethics, Bioethics and Scientific Integrity: individual-centered models.
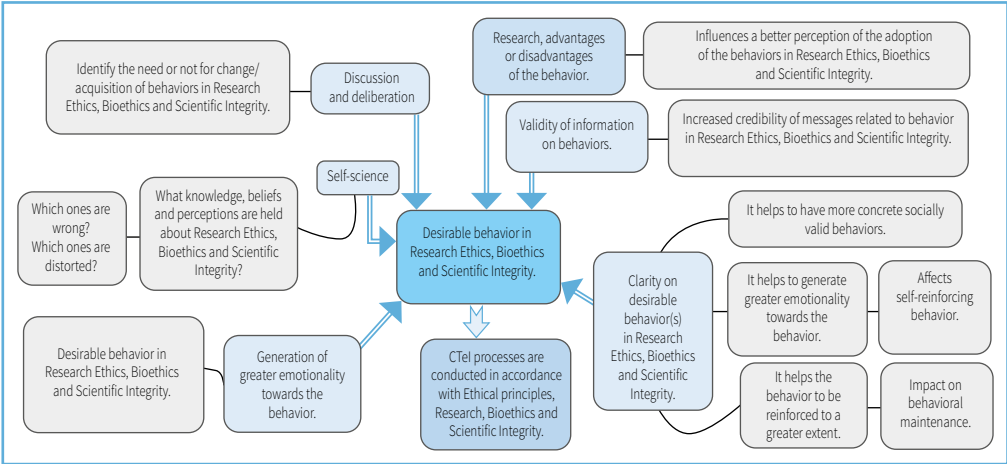
In the so-called individual-centered models, training plays several roles in behavior change, named in this exercise according to their function.

Discussion and deliberation role: They allow the individual to recognize through reflective and deliberative processes the need to change or assume behaviors related to Research Ethics, Bioethics and Scientific Integrity; a change in thinking is evident.

Self-awareness role: It guides the individual in a first phase to identify what knowledge, beliefs and perceptions are held regarding the behaviors related to Research Ethics, Bioethics and Scientific Integrity, in order to subsequently establish whether this knowledge is real, wrong or distorted, and make the corresponding adjustments, which leads him/her to become aware of the need or importance of the behavior.

Emotion generation role: It cooperates in the establishment of emotionality in the behaviors in Research Ethics, Bioethics and Scientific Integrity; in this way, it influences beliefs and attitudes towards the behavior.

Advantages and disadvantages identification role: It clarifies to the individual the advantages and disadvantages of assuming the behaviors related to Research Ethics,

Bioethics and Scientific Integrity, thus improving their perception and adoption by relating them to greater advantages.

Information validity role: It helps the individual to recognize as valid in his or her particular context the messages that reach him or her about behaviors in Research Ethics, Bioethics and Scientific Integrity, thus influencing the decision to carry them out.

Clarity role over behavior: It gives clarity on desired behaviors, which allows:

- implementation of them in a concrete way in their context,

- to be considered valid by the social group,

- generate associated emotional processes that become "self-enforcing factors" of the behavior,

- promote further reinforcement of the behavior (internal and external) that helps to maintain it over time.

The second proposal on the role of training for the appropriation of a culture of research ethics, bioethics and integrity is approached from the models that in this document have been called integrative -individual-environment- and is graphically synthesized below:

Figure 5. Role of training for behavior change in Research Ethics, Bioethics and Scientific Integrity: integrative individual-environment models.
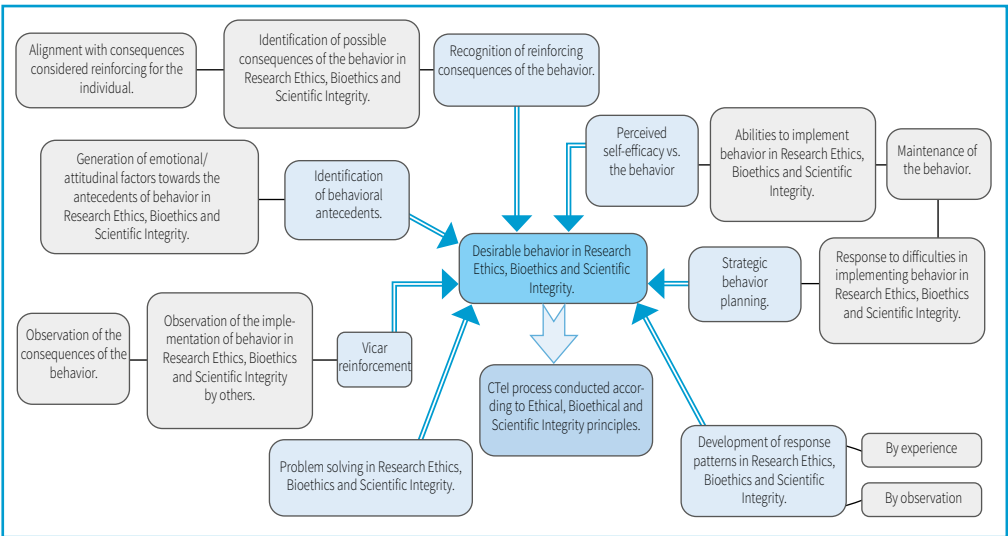
Source: Prepared by Magda Liliana Rincón Meléndez (2021) for the Ministry of Science, Technology, and Innovation (contract No. 241-2021) and Fundación Tecnalia Colombia (contract No. 221-2022).

According to integrative models of behavior change, the role of training includes seven fundamental functions.

Identification of behavioral antecedents: It generates positive emotional and attitudinal aspects that precede and drive the implementation of behaviors in Research Ethics, Bioethics and Scientific Integrity; it is related to the requirement, from integrative models, of having sufficiently strong antecedent factors to drive or trigger the behavior.

Role of recognition of reinforcing consequences: It allows both the identification of possible consequences for the execution or absence of behaviors related to Research Ethics, Bioethics and Scientific Integrity, as well as the personal recognition of those consequences perceived as more reinforcing for the individual.

Vicar reinforcement role: Specific type of training considered highly effective for the acquisition and maintenance of the behavior, which enables the learning of behaviors in Research Ethics, Bioethics and Scientific Integrity through the observation of "others" in their context that perform the same behaviors, while allowing to observe the positive or negative consequences for these "others" of the implementation of the behaviors.

"Response Pattern Development Role": Develops concrete responses to situations that require behaviors in Research Ethics, Bioethics and Scientific Integrity, and guides the individual to make these responses flexible and adaptable to various situations.

Problem solving role: Increases the individual's capabilities and skills at a behavioral level to provide solutions to problems in Research Ethics, Bioethics and Scientific Integrity.

Perceived self-efficacy and strategic planning: They are related to the possibility of maintaining acquired or modified behaviors over time, that is, of their being constant. In the role of perceived self-efficacy, the training increases the individual's perception of his or her ability to perform the desired or required behaviors in Research Ethics, Bioethics and Scientific Integrity. While, in the strategic planning role, capabilities are developed to cope with the contextual difficulties evidenced when implementing behaviors in Research Ethics, Bioethics and Scientific Integrity, expecting the individual to project both the difficulties and the behavioral solutions.

The last approach proposes the role of training for the appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity in contemporary models of behavior change.

Figure 6. Role of training for behavior change in Research Ethics, Bioethics and Scientific Integrity: contemporary models of behavioral change
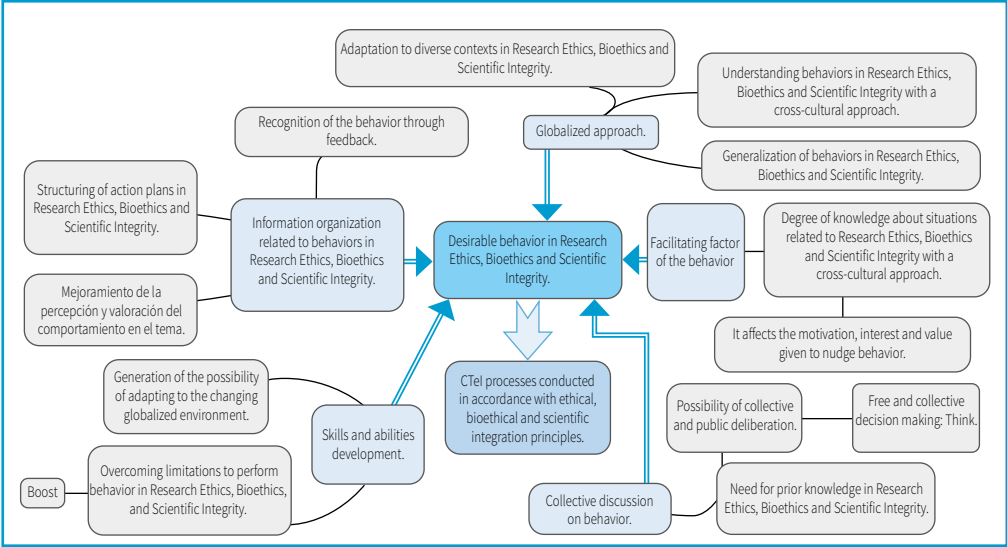
In contemporary models of behavioral change, five roles of training can be identified.

Facilitating role of the behavior: Associated with what contemporary theorists call *nudge*, according to which the degree of knowledge about Research Ethics, Bioethics and Scientific Integrity situations allows "nudging" the behavior to be established. The formative processes influence the motivation, interests, and value that the person gives to the behavior in Research Ethics, Bioethics and Scientific Integrity; this pushes the individual to acquire or change the behavior.

Skills and capabilities development role: Associated with boost, it considers that training should be used to increase the technical or more operational skills required by the individual to conduct the behavior. In this case, contemporary models start from a person's limitations in action skills.

Collective discussion role: Training is the basis for arriving at thinking, referred to collective decision-making regarding behaviors, in this case, in Research Ethics, Bioethics and Scientific Integrity, since, without the minimum knowledge on the subject, collective discussion is oriented towards making erroneous decisions or influences the impossibility of freely participating in decisions on behaviors.

Information organization role: Impacts on the development of individual and collective action schemes when faced with situations related to Research Ethics, Bioethics and Scientific Integrity. It also helps to improve the individual's perception and assessment of the behaviors on the subject and leads to their adoption and implementation. Finally, the formative processes become feedback mechanisms for the behavior, thanks to which they improve their implementation and obtain greater reinforcement for their execution.

Globalized approach role: The transcultural vision of the formative processes develops in the individual the ability to apply the behavior in Research Ethics, Bioethics and Scientific Integrity in diverse contexts, and skills for the generalization of behaviors and their adaptation to structural changes, as a result of current global changes.

From the above, it is evident that, regardless of the behavior change model addressed, training plays fundamental roles in the acquisition and transformation of behaviors that impact on the appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity. Thus, they fulfill various functions in each model, both in the cognitive and emotional spheres required to drive the behavior and in the practical field aimed at the application of these behaviors for problem solving and in the mechanisms of reinforcement of these behaviors.

Conclusions

The model proposed is *cognitive biases-attitudes-behaviors*. It allows to stablish a methodological route where training can operate as a transforming factor of cognitive biases that impact attitudes and behaviors in Research Ethics, Bioethics and Scientific Integrity, and that are present in the development of science, technology, and innovation processes. Therefore, the role of formative actions is fundamental to achieve substantial changes at the cognitive level, which, through attitudes as a mediating link, are evidenced in behaviors; in this way, they allow to account for the appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity.

Although the model proposed in this document establishes a defined path in the interaction between cognitive biases, attitudes, and behaviors, it is assumed that the interaction between these three constructs is varied and flexible, so it is relevant how the formative processes impact this interaction; this results in cultural appropriation in the subject.

It became evident, in the methodological route developed, the need for the groups of actors involved in the processes of science, technology and innovation to start with

the identification and acceptance of their own cognitive biases, both individual and of the group to which they belong, to guide in this way the formative actions to these processes of discussion, in pursuit of the search for transformations that really impact on the ethical, bioethical and integrity attitudes and behaviors of the processes of science, technology and innovation.

It is possible, from the conceptual development conducted, to conclude that training plays a basic and fundamental role in the appropriation of a culture of Research Ethics, Bioethics and Scientific Integrity in all areas of knowledge.

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Theoretical framework: Importance of training for the generation and appropriation of the culture of Research Ethics, Bioethics and Scientific Integrity Basic and Environmental Sciences

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Abstract

Ethics applied to research is important to achieve valid scientific knowledge that is based on values and developed with a social approach. This chapter presents a theoretical framework on the importance of training from the approach of virtues for the actors that carry out the processes of CTeI; it addresses the cognitive biases and their implications in the attitudes and behaviors related to the EIBIC, and establishes aspects associated with the training for the appropriation and generation of a culture in Research Ethics, Bioethics and Scientific Integrity in Basic and Environmental Sciences, thus contributing to the implementation of the Policy on Research Ethics, Bioethics and Scientific Integrity.

Keywords: ethics, bioethics, cognition, scientific knowledge, science, educational process.

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Resumen

La ética aplicada a la investigación es importante para alcanzar un conocimiento científico válido, que se fundamente en valores y se desarrolle con un enfoque social. Este capítulo presenta un marco teórico sobre la importancia de la formación desde el enfoque de las virtudes para los actores que realizan procesos de CTeI; se abordan los sesgos cognitivos y sus implicaciones en las actitudes y comportamientos relacionados con la EIBIC, y se establecen aspectos asociados con la formación para la apropiación y generación de una cultura en Ética de la Investigación, Bioética e Integridad Científica en Ciencias Básicas y Ambientales, con lo que se contribuye a la implementación de la Política de Ética de la Investigación, Bioética e Integridad Científica.

Palabras clave: ética, bioética, cognición, conocimiento científico, ciencia, proceso formativo.

Resumo

A ética aplicada à investigação é importante para alcançar um conhecimento científico válido, baseado em valores e desenvolvido com uma abordagem social. Este capítulo apresenta um quadro teórico sobre a importância da formação a partir da abordagem das Virtudes, para os actores que realizam processos de CTI, aborda os preconceitos cognitivos e as suas implicações na geração do conhecimento, e estabelece aspectos relacionados com a formação para a apropriação de uma cultura de ética da investigação, bioética e integridade científica nas ciências básicas e ambientais, contribuindo para a implementação da Política de Ética da Investigação, Bioética e Integridade Científica.

Palavras-chaves: Ética, Bioética, Conhecimento, Conhecimento científico, Ciência, Processo de formação.

3.1 Introduction

The evolution of science and technology have allowed the continuous development of peoples for their well-being; however, it is important to consider the difference between development and economic growth: the latter is the one associated with *developmentalism* and overexploitation of non-renewable resources, and with the increase of the market with irreversible impacts on the environment (Serrano et al., 2015). It is proposed that development should value logic and science, as well as cultural traditions, the community, the environment, and that it should recognize different value systems (Rojas, 2001; cited by Guzmán Díaz, 2013). In this context and from the ethical perspective, development will manage to have a more humanistic approach, considering

that we cannot continue to generate changes that negatively influence living beings and their environment directly or indirectly.

This chapter is developed in three stages:

1. The theoretical framework on the importance of training for the generation and appropriation of a culture of Research Ethics, Bioethics and Scientific Integrity (EIBIC) in basic and environmental sciences is presented,

2. cognitive biases related to elements in EIBIC of basic and environmental sciences are described,

3. finally, and based on the above, we propose aspects for training in EIBIC and the modification of cognitive biases in the basic and environmental sciences, thus contributing to the implementation of the Research Ethics, Bioethics and Scientific Integrity Policy.

3.2 Importance of training for a culture of Research Ethics, Bioethics and Scientific Integrity

When considering ethics in relation to research, it is emphasized that it is a part of philosophy that deals with good and bad; it develops with moral action, making it possible to modulate our moral orientations (Marcos, 2001). In practice, ethics orients the discussion before good or evil, or before good or bad actions. Morality, as stated by Cortina (2000), cited by Ojeda de López et al. (2007), is that "set of principles, norms and values that each generation transmits, in the confidence [that] it is a good legacy of guidelines on how to act in order to lead a just life" (p. 349). Although ethics is strictly theoretical, it is supported by other sciences or disciplines, which gives it a practical character: this is the case of ethics applied to scientific research, which should be aimed at working on scientific knowledge and, in an ethical way, to work in teaching and research to promote the training of interdisciplinary teams that allow scientific production to solve problems (Ojeda de López et al., 2007).

According to Siqueiros-Beltrones and Jaime (2015), "Science is a social invention and constitutes a collective phenomenon; the same property must be attributed to the scientific method, so its application is not necessarily at the individual level, but of the scientific community" (p. 32). Likewise, they highlight that "ethics is practical philosophy

and is essential in scientific training; its observation guarantees a search for adherence to the scientific method and the purposes of science (Siqueiros-Beltrones and Jaime, 2015, p. 48).

The reliability of the results and knowledge generated in research processes through the scientific method is fundamental. According to Michalek et al. (2010), mistakes in ethics in scientific research generate difficulties in the advancement of science. However, this is not its only effect, since it implies, among other things, a distrust in the products generated and the economic impact. These aspects are also related to problems in the generation of products with validity and representativeness of the research process and include methodological approaches, structure and adequate management of theoretical foundations that provide knowledge for research. In addition, the handling of data and statistics, as well as the choice of lines of research, can sometimes be fueled by non-scientific causes, such as economic interests. Some examples of ethical misconduct related to scientific research that have an impact on the advancement of science include fabrication or falsification of results, manipulation of data, graphs or images, plagiarism, and conflicts of interest (Marcovitch, 2007).

For Siqueiros-Beltrones,

> the understanding of the concept of paradigm and the management of theory, as well as the methodology and the exercise of ethics as components of the scientific method and its philosophy, stand out as the modulators of the scientific personality, and contribute to the use of the individual virtues of the scientist. (2002, p. 194)

The preparation of the scientist implies considering the value of education and training in his or her training, including research ethics. As established by Siqueiros-Beltrones and Jaime,

> The well-trained scientist obtains qualification through the integration of the three basic components (education, training, qualification). The latter implies a compenetration in specific theoretical and methodological knowledge, which he applies based on the ethical rules governing scientific activity. (2015, p. 76)

In relation to environmental ethics, its emergence is associated with the need to extend ethics for coexistence with nature (Legorreta, 2010). It has been proposed as environmental ethics that which is related to the use of the environment for the benefit of human beings, while ecological ethics conceives the human being integrated in an environment, where humans share their life with other species, which makes life possible (Costa, 2009). Traditionally, Western philosophy has denied the moral relationship between human beings and nature; nowadays, a responsibility towards nature is being recognized.

Concerning the shortcomings in the ethics of research related to the Sustainable Development Goals, on what was expressed by the former Secretary General of the United Nations,

> Our globalized world is characterized by extraordinary progress alongside unacceptable and unsustainable levels of poverty, fear, discrimination, exploitation and injustice, and environmentally irresponsible behavior at all levels. However, we also know that these problems are not accidents of nature, nor are they products of phenomena beyond our control. They are the consequence of people's actions and omissions. (Ki-moon, 2014; cited by Ramos Serpa and López Falcón, 2019, p. 186)

A relevant aspect to consider is that "the use of biotechnology for human evolution is not disqualified, it will depend on the use given to wisdom" (Casquier and Ortiz, 2012, p. 282). Hence the importance of the responsibility and ethics of the researcher, who finds himself in a scientific and research system that "requires him to constantly compete for recognition and credit, which ultimately translates into resources and professional position of researchers, propitiating [sic] in some cases the emergence of ethical misconduct and fraud" (Camí, 2008; cited by Opazo Carvajal, 2011, p. 62).

Although it is often not recognized in scientific environments, ethics in research is indispensable. As established by Siqueiros-Beltrones and Jaime,

> Scientific research is based on ethical values and principles, such as trust, honesty, responsibility, and respect. The progress of scientific research depends both on compliance with these ethical principles and on the veracity of the results and conclusions of the experimental work. (2015, p. 91)

These authors also consider education as one of the mechanisms for preventing the deviation of ethical principles. For Cuadros-Contreras, it is relevant to promote the ethical training of researchers; but it is not possible "without the production of a common, affective and valuative sense that accompanies, from the first moments at an early age, until the greatest milestones of our academic career, the effort to know" (Cuadros-Contreras, 2019, p. 235); in this same line, referring to training in bioethics, Abellán and Maluf (2014) mention that, in addition to develop at the university level, it should be implemented in secondary education, when the adolescent and young person are defined and reaffirmed in their personal ethical criteria. These positions, according to Rangel, are in accordance with "the basic moral character of any individual that is formed from early childhood" (2019).

Thus, training in EIBIC is a gradual process, without forgetting that, in addition to research activities, the scientist participates in processes that involve establishing ethical considerations. For Siqueiros-Beltrones and Jaime,

participation as scientists, researchers, or experts, leading to decision-making on bioethical topics requires an ethical recognition of our own capacities and competencies, as well as self-criticism, both individually and at the level of the scientific community... It is not convenient to improvise ethical principles; one is not born knowing ethics; even when ethics is based on honesty and moral education, it requires special attention. (Siqueiros-Beltrones and Jaime, 2015, p. 89)

Similarly, Bunge (1978) emphasizes the importance for the scientist to consider as a manifestation of his professional and scientific honesty to be trained throughout his active life, considering that, however prepared they are considered, they will always be half-finished products. Today, researchers in training are facing ethical, epistemological, and methodological debates, which will have repercussions in the scientific, techno-logical, social, cultural, economic and institutional spheres due to the consequences of their decisions.

Abellán and Maluf (2014) consider "three components in Bioethics training: the sociocultural context, conceptual and methodological frameworks". Furthermore, as mentioned by Rangel (2019), training is a "process that can be reflected in the change of attitudes and behaviors that lead to the formation of a professional with human and social sensitivity, critical of his training and his participation in the construction of a society with well-being and better quality of life...". (p. 88).

Today, researchers in training are facing ethical, epistemological, and methodological debates, which will have repercussions in the scientific, technological, social, cultural, economic and institutional spheres...

Figure 7. Importance of training in Research Ethics, Bioethics and Scientific Integrity in basic and environmental sciences.
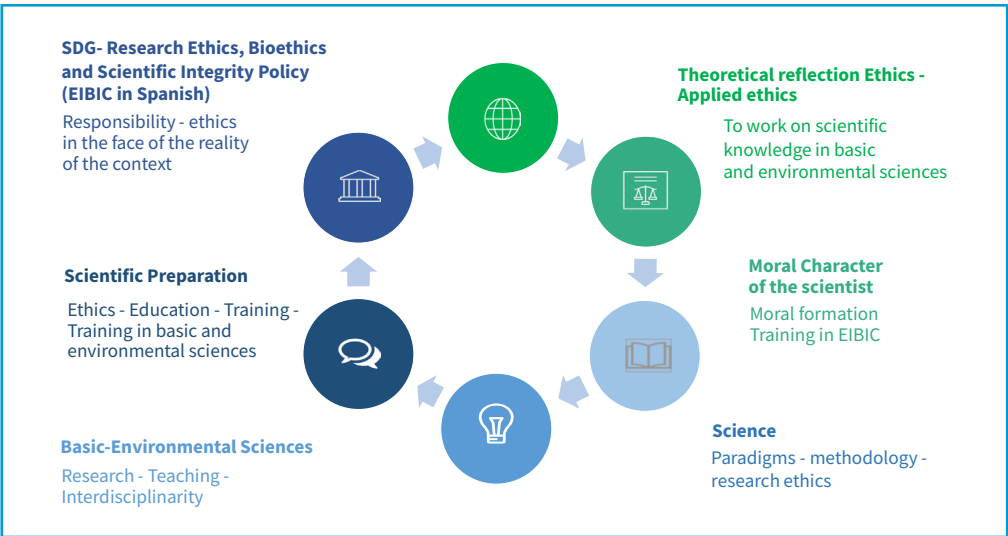
Source: Author's preparation

3.3 Cognitive biases, attitudes and behavior in science, technology, and innovation

Cognitive biases are systematic errors resulting from the evolutionary need to generate judgments quickly (Rodriguez, 2012). According to Villaruel-fuentes, "it is understood as a mechanism by which a resolution is reached quickly, even if this implies a certain degree of superficiality" (2019). For Rodríguez (2012), it implies a subjective and selective filtering of information, which leads to wrong decisions and conduct in certain contexts, on many occasions, of an ethical nature. They affect especially critical capacities in the scientific world, such as making objective value judgments, attributing causal relationships, or establishing hypotheses (Redondo, 2020). For Romero-Fernández, "science as such, and not only its products, has ethical implications" (Romero-Fernández, 2016, p. 5), and the neutrality of science is questionable, considering "the research process, its policies and economic determinants, biases in the transmission of information, etc." (Romero-Fernández, 2016, p. 4).

3.3.1 Cognitive biases and basic sciences

One of the common aspects in a scientist is the decision making about the data obtained from experiments, the experiments themselves and their conclusions, among others, which can be disturbed by the presence of cognitive biases that interfere in the achievement of results, validity, and reproducibility. Redondo (2020) reports recognized cases of scientific activities in which the presence of biases has negatively influenced the results; this is the case of the use of the pesticide aldrin, used between 1950 and 1970, when the United States Department of Agriculture banned its use, since the measurement of its risk was not adequately performed because it did not take into account all the variables.

The existence of these biases can lead scientists to adopt attitudes related to rejecting ideas that do not coincide with their way of thinking, or the opposite, accepting ideas, even if they are not sufficiently proven, among others, which would damage the ethical nature of the research.

Egocentric biases: As the lack of knowledge related to epistemology. In this sense, it is important to consider that ethics is the discipline of philosophy that studies the principles that regulate the moral action of human beings and epistemology; it studies scientific research, scientific knowledge, and is a discipline of philosophy (Bunge, 2006). Ethics in research is associated with the interaction that these two have, and the consideration of epistemological trends allow the achievement of valid products obtained with scientific rigor (Romero Fernández, 2016). According to Siqueiros-Beltrones and Jaime (2015), many researchers relegate the philosophy of science from their discussions, and, by following methods, work on a problem, while the scientist understands and manages the philosophy of science, and thus confers the status of scientific to the research.

Methodological concepts: The researcher must take into consideration a fundamental objective of the research activity: to obtain valid knowledge. According to Siqueiros-Beltrones (2002), they may be influenced by methodologies, their structure, management of theoretical foundations, as well as data and statistics management. In their training, the scientist must acquire conceptual clarity of what is the methodology for the development of productive research in all its context. In this regard, Redondo (2020) includes information on the work developed by NASA on the evolution of the ozone hole, for which studies had been conducted, but were not published until 1985 due to inadequate data management -a cognitive bias-. Finally, it was established that there was ozone depletion and a hole in the South Pole.

Lack of knowledge to work with the community: It can lead to the persistence of inappropriate behaviors; it is essential to know the processes, guidelines and documents that strengthen the intervention processes to promote "the well-being of each individual,

family, group or community and of the human species as a whole" (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2005, p. 6).

The Diagnosis of training needs in EIBIC reports that researchers in the basic sciences lack experience and knowledge, and that they have difficulties in "developing projects with communities, where the context and the socioeconomic situation that influences the problems are not recognized" (Useda et al., 2021, p. 149); it also highlights the need for researchers to be aware of the reality in a non-fragmented way and to consider and reflect on the effects of the projects on the social dimension (Useda et al., 2021).

Lack of knowledge of research guidelines in protocols, principles and processes: Not only the methodological, but also the ethical aspects must be considered, taking into account its background and maintaining a self-critical stance, since, as Villarruel-Fuentes (2019, p. 66) mentions, "when it comes to research, it is convenient to change questions, so as to change answers" and not to follow the trend of approaching different phenomena in the same way.

Data processing: One of the aspects that can generate systematic errors and false results in research reports are errors in the recording and handling of data. As stated by Redondo,

> many important decisions about which experiments are conducted (and which are not), as well as which results are published (or kept in a drawer), do not really respond to an objective method, but to various forces, such as interaction with our peers or confidence in our intuitions and interpretations. (Redondo, 2020, p. 18)

Statistical analysis is fundamental in scientific activity and its application depends on the researcher. It is necessary for the researcher to deepen the knowledge for the collection and analysis of research results and to maintain a critical view of its scope and limitations. In addition, adherence to certain statistical procedures can facilitate their use, even on occasions when they are not the best. According to Villaruel,

> the human brain likes to apply known solutions, since trying new things, through trial and error, implies a new investment in time and effort: the brain, if it already knows a solution, becomes "blind" to other possible solutions. (Villarruel-Fuentes, 2019, p. 40)

Availability bias: It includes the lack of knowledge of ethical aspects in researchers, which they have manifested in the area of basic sciences, according to the work done by Minciencias on training needs in EIBIC: they referred not only to the lack of training in

the subject, but considered as justification that their research does not influence human beings (Useda et al., 2021). The traditional vision of science based fundamentally on positivism tends to be raised far from the values and ethical dimension of the human being; however, as Salazar (2018) manifests, subjectivity, ethics, and axiology have been retaking in scientific activity to understand the relationship between society, culture and the construction of knowledge. Additionally, new advances establish the need for ethics in scientific action, such as in artificial intelligence (AI), for which the office of the Presidency of the Republic of Colombia published the Ethical Framework for AI (Presidency of the Republic, 2021).

Loss of researcher's goals: According to Siqueiros-Beltrones and Jaime (2015), it implies establishing the importance of demanding high standards of professional behavior from researchers, given their social commitment and responsibility, in order to develop scientific research that solves the needs of the population, in coherence with political and economic components of the environment.

Preconceived ideas about the importance of ethics and bioethics: We can identify its existence by considering the intuition biases evidenced in the study conducted by Minciencias (2021). According to this, for the area of Basic Sciences, it was found a lack of knowledge about ethics in research, concepts such as bioethics, and additionally, the conception that it is not related to the area of knowledge (Useda et al., 2021). This implies not recognizing that science has ethical implications, and that scientific activity is not independent of the possibility of lack of neutrality due to methodological, political, economic or transmission factors of scientific information (Romero Fernández, 2016).

Lack of knowledge of research projects as part of lines of research: At the end of the 20th century, epistemological positions appeared to elucidate how scientific knowledge grows, starting from the notion established by Imre Lakatos of research programs, which establish scientific research as a programmatic and transindividual process; although a research can be analyzed individually, it acquires meaning when its value is considered among a sequence of research processes, supporting the concept of lines of research and its importance (Padrón, 2007). Additionally, the selection and work in lines of research established by non-scientific, but rather economic interests, has a negative impact (Siqueiros-Beltrones, 2002).

Anthropocentric approach: It is important to note that "the moral ethical framework of the West has considered man as a superior creature and divine predilection to dominate over other species, which, in any case, have been considered inferior and instrumentally used for exclusively human interests" (Cardozo and de Osorio, 2008, p. 48), which contributes to their deterioration and destruction. It is important to bear in mind that the acts performed by man are in themselves moral acts.

Regarding research with animals: The debate generated by the abolitionist position establishes that they should not be used to manipulate workers' decisions. Their use has not been replaced in its entirety, so other positions have been put forward, such as the dilemmatic position, which considers the justification of their use when there is a lack of alternatives, while the unrestricted position justifies the use of animals in research if they generate a benefit for human beings (Vega Ángeles and Ortiz Millán, 2021). The researcher should be clear about the ethical conditions for the development of animal research, considering established guidelines such as the recognition of the 3 Rs (Barrios et al., 2011).

Omission of interdisciplinary research: Interdisciplinarity "states that several scientific disciplines can collaborate mutually to produce scientific development and thus the construction of knowledge" (López, 2012, p. 370), and avoid their fragmentation. This movement developed in the last two decades as a need for the participation of various disciplines in the development of research, so that a look from various perspectives was reached. On the other hand, in the group of so-called applied ethics, among which are bioethics, ecoethics, information ethics, among others, there has been a need for interdisciplinary dialogue (García, 2011).

3.3.2 Cognitive Biases and Environmental Science

Egocentric biases in which the lack of training in values is identified. The World Declaration on Higher Education recognizes that society is experiencing a crisis of values:

> This would be one of the crises of ethos and probably the one that has the strongest impact on social-political structures, which is not a "crisis of values" as it is often called, but a loss of the legitimacy of acting in accordance with values, in fact putting the very meaning of validity in crisis, in a world that lies under the reign of strategic rationality. (De Zan, 1993; cited by UNESCO, 2012, p. 19)

This leads us to reconsider values and human action under common and shared ontological, epistemological, and conceptual premises in relation to natural entities and the possible ethical, environmental and social consequences. Undoubtedly, "we live in a plural, secular and free world, and in it we accept to coexist with others who have different values" (UNESCO, 2012, p. 20). In the face of the crisis, different positions are evident in the light of the realities of the world. Therefore, researchers face the challenge of having a critical, initiative-taking and coherent position in terms of ethics and scientific integrity.

Lack of training in Research Ethics, Bioethics and Scientific Integrity: According to the reality of the territories, the State, the society, the academy, and the contents with their own characteristics, it is a challenge for higher education institutions. In this regard, Guerrero and Gómez (2013; cited by Briones and Lara, 2016, p. 100) "confirmed this absence of ethical and moral education of the person in the Ibero-American region", highlighting its impact on the development of the members of society.

Lack of interdisciplinarity in training and research: Gonzalez-Escobar considers, for the approach to the environment,

> Both the context of nature and the sociocultural relations, in which human subjects inhabit in a conditioned way; but, at the same time, conditioners of the system. This systemic characteristic allows us to understand that environmental problems are assumed interdisciplinary to understand their complexity, their constitution as an organized totality in which any change in one of its parts affects the others. (González-Escobar, 2017, p. 6)

In training, in addition to disciplinary, technical and methodological competence, the researcher must be able to move through the different areas of knowledge in order to consider the different aspects of environmental sciences. According to Faralli, "bioethics is really configured as an ideal field to realize a relationship of interface [*sic*] between natural sciences and human sciences..." (2014, p. 18).

Culture and traditional knowledge are not considered: Some research ignores cosmologies, knowledge, community needs and community resource management. According to UNESCO (2021),

> knowledge and uses related to nature and the universe encompass a series of knowledge, techniques, skills, practices and representations that communities have created in their interaction with the natural environment. These ways of thinking about the universe, which are expressed in language, oral tradition, sense of attachment to a place, memory, spirituality and worldview, have a significant influence on values and beliefs and form the basis for many social practices and cultural traditions.

Ethical and bioethical dilemmas in environmental issues: For Sarukhán (2019) there are three issues that must be understood in an integral way. The first is responsibility towards nature, the second is responsibility towards present and future human beings, and the third refers to the context of our behavior towards nature for the benefit of our species.

Availability bias. They include the anthropocentric approach of researchers. According to Vallejo, "when scholars argue that humans are the only beings worthy of moral

considerability, their ethical position can undoubtedly be categorized within the realm of anthropocentrism" (2019, p. 15); moral considerability is a challenge for ethics relevant to training processes in EIBIC.

According to Márquez-Vargas, "the environmental dimension of bioethics was structured from the founding ideas of Jahr, Leopold and Potter, which mark a conceptual line that establishes an abandonment of anthropocentric ethics, to move towards an ecocentric model" (2020, p. 1).

Regarding research funding, Leopold wrote in the essay The Land Ethic, that "a system of conservation based solely on economic interest is hopelessly unbalanced" (1949, p. 251 cited by Kwiatkowska, p. 52); on many occasions decisions guided by monetary values do not foresee the environmental effects and risks that in some cases are irreversible, "it was Leopold who defined the environmental crisis as a failure rooted in economic activity, with an ethical basis" (Sarmiento, 2000, p. 33 cited by Márquez-Vargas, 2020, p. 9).

The ontological approach in which the researcher is formed: For Levinas, the ontology of egoism privileges possession, and is the "form par excellence through which the other becomes the self by becoming mine" and displacing the other (Levinas, 1977, p. 70; cited by Montero, 2010, p. 92). The fact that the researcher assumes this type of position leads to a practice of power, domination, exclusion, denial of the rights of the other, which diminishes the possibilities of communities, groups and society.

Montero considers "knowledge as praxis; knowledge as dialogue; the inseparability of the Self and the Other; the relationship as the true locus of being; the ethical imperatives of overcoming exclusion and transforming the living conditions that produce it" (Montero, 2010, p. 84), and proposes a dialogic, horizontal relationship between the different actors of the research system in which one can accept another with different ways of knowing each other. The training does not have methodologies or pedagogical strategies, active or practical in situated contexts, which leads to the need to recognize the meaning of educating, with "the contribution from higher educational instances to the training of professionals with strong ethical convictions" (Briones and Lara, 2016, p. 100). In this regard, Pasmanik and Winkler (2009; cited by Briones and Lara, 2016, p. 100) "argue that this trend is due to the ethical training during the university years, characterized by being scarce, theoretical and decontextualized, neglecting in turn the reflection and discussion". Research training has challenges in the implementation of innovative pedagogical strategies.

Intuition biases: These include a lack of critical thinking. According to UNESCO, "reality calls for a reflective and critical attitude towards the environmental situation and climate change" (2012, p. 11) in our continent. "The subject of action was never free, nor was everyone granted the opportunity to build a critical reason, because freedom

and criticality are only achieved through a comprehensive education" (Rusconi and Cubillos, n. d., p. 2), so 'it is essential that higher education, in addition to focusing on professional preparation, considers the development of personal skills such as critical reasoning' (Rusconi and Cubillos, n. d., p. 2). (Nussbaum, 2005; cited by Briones y Lara, 2016, p. 100).

Lack of clear guidelines for environmental damage prevention: It is necessary to have a well-founded debate on the production and application of scientific knowledge, based on the proposal of Potter (1988), who states that this state of affairs:

> leads world leaders and decision-makers in local or regional public administrations to understand the urgency of environmental bioethics in the face of events that lead to the destruction of the natural environment, on which, of course, the life of all beings depends. (cited by Márquez-Vargas, 2020, p. 14)

Principles, values and beliefs González-Escobar, (2017)

> the ethical discussion is centered on values, it is necessary to discuss more than an environmental ethics, but rather to move towards an ethics of development, under the influence of a new relevant discourse based on integrative values, which define systemic thinking and the complexities of the interactions between the ecosystem and the cultural and social systems. (p. 12)

In the ethical field, by proposing that nature is subject to intrinsic value, we are not accepting an exchange value; we are referring to its ecosubstantiality as a living system, from which we derive a vital importance for the ecosystem. We coexist with new situations generated by the cultural and the scientific, which influence our worldview on environmental problems, as a result of human decisions in research practices, and in turn influenced by techno-scientific, political, economic and aesthetic aspects (Márquez-Vargas, 2020).

Lack of dialogue of knowledge: Cuadros-Contreras (2019) quotes Habermas (2000), who states that "it is a matter of basing moral imperatives, no longer from an individual rationality assumed in all humanity and based on a priori concepts, but in the intersubjective exercise of dialogue". Dialogue should, as Montero (Montero, 2010, p. 85) states, "recognize the Other as a social actor and respect his/her condition as a constructor of knowledge, as a producer of a history". In this dialogue new forms of knowledge are built; "with the incorporation of an integrative and respectful ethical perspective of nature and its harmonious relationship of scientific bodies, leaders and other human subjects will be contributing to promote an inclusive social paradigm" (Gonzalez-Escobar, 2017, p. 15).

Figure 8. Cognitive Biases in Research Ethics, Bioethics and Scientific Integrity in basic and environmental sciences.
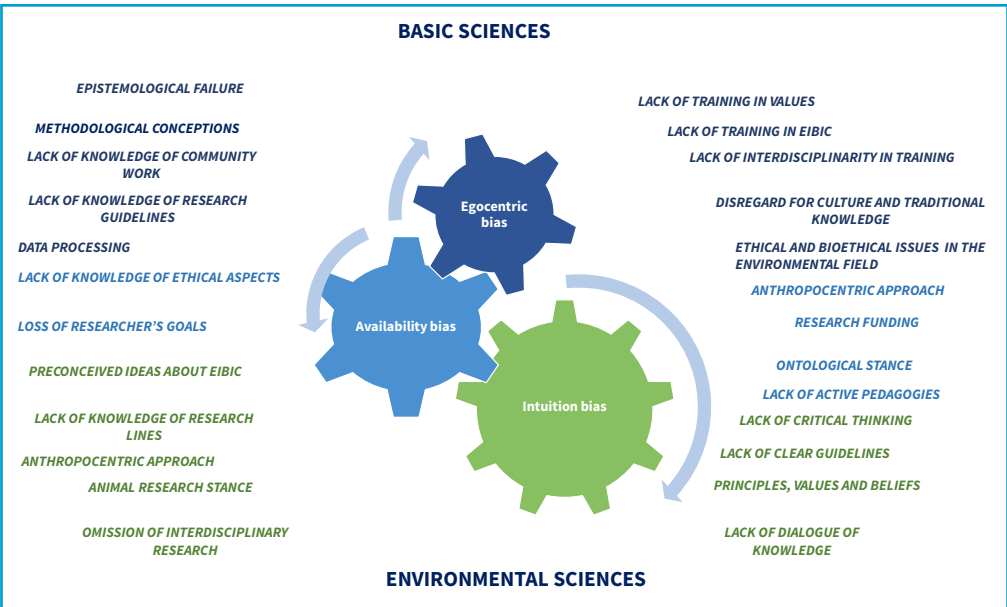
Source: Author's preparation (2023)

3.4 Training towards the appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity

In relation to the traditions of ethical thought, it is worth mentioning *consequentialism* and *deontologism* as the strongest ones. The first considers that the moral fit of our actions depends on the consequences of them; it understands an action as morally correct if the things it produces are good. In the case of deontologism, this proposes that the morally correct action is that one that is done based on a moral norm; thus, the right takes precedence over the good (Cuadros-Contreras, 2019). It is relevant the categorical imperative of Katian ethics that reads as follows: "act only according to such a maxim that you can at the same time will that it becomes universal law" (Kant, 1995, p. 39, cited by Malishev, 2014, p. 13), and also desirable, hence moral action is expressed in well-defined norms by a universal criterion.

Deontologism and consequentialism defensively pose research ethics. It would be a reductionist conception, more so considering that ethics is not only a matter of codes and regulations, and should be much more open, more so when thinking about the relations between the search for knowledge and ethics (Cuadros-Contreras, 2019).

The tradition of virtues as a fundamental position for the ethical training of the researcher: according to Romero, "virtue ethics is the basis of the good, Aristotle pointed out that cultivating a good character implies developing certain virtues" (2016, p. 49). And it is a knowledge that serves as a guide to conduct life, a relevant position for the training of those who conduct research, as Cuadros-Contreras states:

> The approach of virtues advocates an affirmative conception of ethics, it is not content with maintaining an attitude of responsibility or care, it is not satisfied with acting cautiously to reduce the risk of harm, it goes much further: it considers that what essentially defines ethics, and this is decisive for training researchers, is its effort to help the full realization of subjects and communities, in this lies all its commitment. Thus, it connects with politics, as it was originally thought of in antiquity. (2019, p. 240)

Although scientific technical development has generated advances and benefits, there have also appeared ways of aggression to the dignity of the human being, and ethics in research and bioethics propose a rethinking of the way of doing science responsibly, focused on the care of the human condition and dignity, nature and all the contexts involved with the development of science (Fuentes and Corral, 2018).

Currently, it is the responsibility of university entities to produce knowledge through research activities, the training of human talent; but also, to form opinions and trends, which establishes a social responsibility: these scientific advances and responsibilities establish new problems, including those related to ethics (Colina Vargas and Vargas De Carrasquero, 2018).

Mogollón (2007) states that professionals and researchers must have training in values that allow them to solve problems sustained by several components: academic, scientific, ethical, competencies and community. A research culture must be established that includes attitudes, values, objects, methods, techniques and organizations, and establishes the need to consider, among others, researching according to the standards of the scientific community; it must work with methodological rigor, systematically, use appropriate methods and assume an ethical attitude (Fuentes and Corral, 2018).

Ethics in research regulates the morality of the researcher, and epistemology studies scientific research and its product, i.e., scientific knowledge. Additionally, research

methodology is essential in the process of knowledge construction. Currently, other dimensions are considered, as established by Colinas and Vargas (2018):

> Now, it is necessary to consider other dimensions besides the epistemological, gnoseological, methodological, but also the axiological dimension, which imprints a series of actions, including an act of decision and intellectual honesty around the scientific, humanistic, philosophical and educational value. (p. 18)

Additionally, the professor and researcher play an essential role as generators of knowledge in the technical-scientific training, as well as in ethics and values of the student, and their attitude, behavior and worldview play an essential role.

Scientific work is done for the development of knowledge and the search for truth, the scientist must consider the factors that may interfere with the achievement of his goals. In relation to the ethical problems present in the research process, Colina and Vargas (2017) approach them from four edges in a general way.

- Researcher's own aspects:

    - those related to their clarity about their responsibilities as researcher and trainer, including the incorporation of ethical and moral aspects in research,

    - those related to the research subject participant and the need to consider all aspects related to this interaction.

- Aspects of the research process:

    - related to planning, methods, results management, and their dissemination and impact on society,

    - related to other researchers or research groups.

As a factor that is inherent to the researcher, it should be considered that there are cognitive biases that, as Redondo mentions, "they affect especially critical capacities in the scientific world: the ability to decide correctly, to make fair estimates, to make objective value judgments, to attribute causal relationships or to establish hypotheses" (2020, p. 18). It is necessary then that the researcher, "no matter how much scientific attachment he shows, must pay attention to all these behavioral phenomena, which, although they are psychological in nature, are also, to a large extent, biological and social" (Villarruel-Fuentes, 2019, p. 65). Thus, the researcher must know and control the risk or presence of cognitive biases, considering that they are inherent to cognitive processes; highlight the importance of self-criticism in their work; encourage the use of work methods, and make decisions more rationally (Redondo, 2020). In addition,

the recognition of collaborative work and dialogue, as well as interdisciplinary work in scientific activity, allows broadening the vision and the development of a research activity with contributions from various perspectives that facilitate the reduction of biases and better knowledge of the subject.

The scientist is prepared by means of three basic components: education, training and qualification, which must include the ethical component that governs scientific activity. Although ethics is based on the researcher's honesty and education in values, no one is born knowing research ethics and bioethics, and this knowledge must be considered by the scientist and in the training of professionals in the field of science (Siqueiros-Beltrones and Jaime, 2015).

Regarding training in EIBIC, according to Casado (2011), it is important to distinguish between education-training and information:

> Through information, data and knowledge are transferred, without evaluation or orientation. Education and training, on the other hand, go a step further and can be considered as similar, since they transmit values and teach how to prioritize and evaluate them. (p. 67)

The process of education in research ethics and bioethics should encourage critical and reflective thinking and the recognition that there are different moral models, as well as the coexistence of values and principles on which democratic society is based; it should be based on the plurality of values and principles, which require a multidisciplinary and pluralistic view for their analysis. Pulido et al. (2019) state that

> ethical education and also bioethics in universities has been characterized by the transmission of philosophical trends, norms or codes, aimed at being a guide for action in the form of maxims that are to guide professional conduct and excellence. (p. 34)

Referring to education in basic and environmental sciences, it can be defined as "the interdisciplinary process to develop citizens who are aware and informed about nature as a whole… with the capacity to assume the commitment to participate in problem solving, make decisions and act to ensure environmental quality" (Rick Mrazek, 1996; cited by Flores, 2012, p. 1021).

Cognitive biases, the researcher's metacognitive skills and the processes of research in basic and environmental sciences have a close relationship that can be addressed through the didactics of research, in order to promote a comprehensive training, considering the training in research ethics and bioethics in the areas of basic and environmental sciences.

Based on the approach of the virtues of ethical thinking, Jofre's (2019) discussions on didactics become relevant when he quotes Camilloni (2007), who states that the differentiation of didactics depends on different parameters and serve the purposes of different teaching configurations. For example, specific didactics: according to the different levels of the educational system, depending on the ages of the students, according to the discipline, depending on the type of institution, according to the characteristics of the subjects (p. 34).

One of the aspects in EIBIC training is the alignment of didactics with the pedagogical component. The Universal Declaration on Bioethics and Human Rights (UDBHR) indicates that there must be

> the interconnection between human beings and other forms of life, the importance of appropriate access to and use of biological and genetic resources, respect for traditional knowledge, and the role of human beings in the protection of the environment, the biosphere and biodiversity. (UNESCO, 2005; cited by Abellán Salort and Maluf, 2014, p. 57)

Hence, the subjects should combine inductive and deductive pedagogy, so that they are practical in all sessions, adapting to the level of knowledge and academic maturity of the group. The training for collaborating with communities should promote argumentative strategies:

Yepes, Rodríguez and Montoya (2006; cited by Briones and Lara, 2016, p. 101) state that this strategy is an event of thought in which the laws of reasoning are involved (logic); the rules to prove or refute (dialectics), and the use of verbal resources in order to persuade, alluding to affections, emotions and suggestions (rhetoric). These characteristics of argumentation are linked to the training in values.

For Sanches and De Siqueira (2017), contemporary education seeks to

- more democratic educational institutions committed to social and cultural contexts

- teachers open to dialogue and train in educational methodologies,

- autonomous teachers, committed to their own learning process, and equipped with social responsibility,

- more community participation in education.

Education is based on an open and clear dialogue between the student and the teacher, on the respect for the dignity of the human being, highlighting values.

Ethics education is a learning process and cannot be just a collection of knowledge:

Based on three reflective dimensions-phenomenal, hermeneutic and teleological, we develop the idea that education in scientific culture involves a

> "learning to learn"; a proposal that concludes thus in the need to make an attitudinal change from the interest in transmitting only encyclopedic and instrumental knowledge to a meta-knowledge that interrogates ethical-cognitive skills in the new contexts generated by scientific and technological advances. (Lahitte and Sánchez Vázquez, 2014, p. 5)

According to Pulido *et al.* (2019),

> it has been demonstrated that didactic strategies in themselves, such as case studies, ethical matrices, critical incidents, video analysis, films, etc., can contribute, roughly speaking, to the promotion of competencies that allow for discussion around dilemmatic situations in academic and professional practice. (p. 36)

In this process it is also important to keep in mind that "the teaching of bioethics, as proposed by UNESCO, should introduce the student in three areas of cognitive domain, such as knowledge, skills and new attitudes" (Sanches and De Siqueira, 2017, p. 83), to generate an ethical conscience and with integrity on the application of scientific knowledge.

In ethical training at the higher education level, some authors have contributed research on ethical training focused on personal and professional values. This is the case of Briones and Lara's (2016) proposal on "ethical training through the development of dialogic methodology, and the use of new communication technologies to allow contact between students from diverse cultures and degrees" (p. 100).

Another experience on the development of research training courses is the one cited by Opazo (2011), called sensemaking or construction of ethical sense, proposed by Mumford et al. (2008); this model presents characteristics that can be generalized and adapted to different fields of science, the investigation of ethical problems in situated contexts, to generate changes in the structure of the mental model of researchers in training.

Figure 9. Dimensions for the construction of scientific knowledge in basic and environmental sciences.
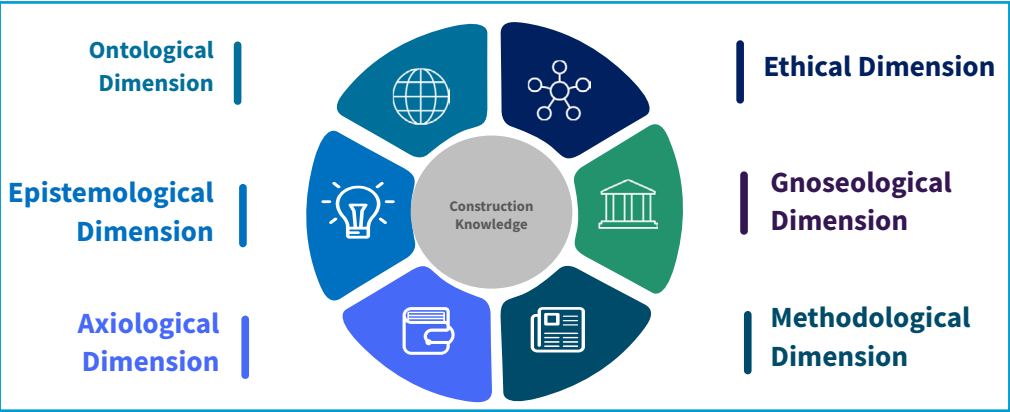
Conclusions

As has been shown, in the field of higher education there are deficiencies or shortcomings in the ethical training and scientific integrity of the researcher, in the process of knowledge generation in the area of basic and environmental research. Therefore, today's realities demand integral training, especially in the ethical dimension and integrity of researchers, in order to face and solve the demands and challenges of today's world in a responsible and committed manner.

Considering resizing the production of scientific knowledge, including axiology and strengthening other aspects such as epistemology, methodology and ethics, will facilitate a research culture that generates reliable results with social impact. Additionally, for the training of the scientist it is important to consider the cognitive biases that may appear at any time during the course of the research; what is relevant is our attitude towards these biases, it is to know them in order to avoid them.

In general, experts in education in research ethics and scientific integrity propose an innovative training that goes beyond the teaching and learning of codes and norms of the profession, to generate critical thinking, ontological and epistemological positions of the relationship based on specific pedagogies and didactics. These training processes

require a great commitment on the part of all the agents involved in the CTeI system, in order to overcome the two traditions of ethical thinking - consequentialism and deontologism -, to give priority to the tradition of virtues and to promote virtues for the training of the ethical character of the researcher and the transformation of his conscience in decision making. This will allow a more affirmative stance that not only establishes the prevention of risks, but also promotes the development of the researcher and society in the production of scientific knowledge in a reliable way in basic and environmental sciences.

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Chapter 4

Theoretical framework: importance of training for the creation and adoption of a culture of Research Ethics, Bioethics and Scientific Integrity in Colombia Social Sciences, Humanities, Arts and Education

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Abstract

The objective of this conceptual theoretical framework is to understand how to move towards new educational, social, economic, political, cultural, artistic and sports models; the use of information and scientific approaches by and for intercultural communication, in order to recognize life from a new ontology focused on learning to look systemically and act in harmony with their care, within the framework of the importance of training for the generation and appropriation of the culture of Research Ethics, Bioethics and

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Scientific Integrity. To achieve this purpose, it is essential to address the biases that prevent progress in the challenge of protecting and enjoying existence in our common home. Thus, the increase and quality in the developments that must be worked on in science, technology and innovation increase capacities for being and staying in the territories. It was identified that intellectuals in these areas, in Latin America, propose to strengthen the love of life, as the force that continues beyond existence. They recognize prudence, humility and respect as principles for creating, innovating and producing knowledge, based on responsibility for life.

Keywords: Right to information, educational model, scientific approach, ontology, intercultural communication.

Resumen

El objetivo de este marco teórico conceptual es comprender cómo se puede avanzar para lograr nuevos modelos educacionales, sociales, económicos, políticos, culturales, artísticos y deportivos; el uso de la información y los enfoques científicos por y para la comunicación intercultural, con el fin de reconocer la vida desde una nueva ontología centrada en el aprender a mirar sistémicamente y obrar en armonía con su cuidado, en el marco de la importancia de la formación para la generación y apropiación de la cultura de la Ética de la Investigación, Bioética e Integridad Científica. Para alcanzar el propósito, surge como imperativo atender los sesgos por ser condicionantes que impiden avanzar en el reto de proteger y disfrutar la existencia en la casa común. Así, el incremento y la calidad en los desarrollos que se deben trabajar en ciencia, tecnología e innovación aumentan capacidades para poder ser y estar en los territorios. Se identificó que los intelectuales de estas áreas, en América Latina, proponen trabajar en potenciar el amor a la vida, como la fuerza que continúa más allá de la existencia. Reconocen la prudencia, humildad y respeto como principios para crear, innovar y producir conocimiento, desde la responsabilidad con la vida.

Palabras clave: Derecho a la información, modelo educacional, enfoque científico, ontología, comunicación intercultural.

Resumo

O objetivo desta estrutura teórica conceitual é entender como avançar para alcançar novos modelos educacionais, sociais, econômicos, políticos, culturais, artísticos e esportivos; o uso de informações e abordagens científicas por e para a comunicação intercultural, a fim de reconhecer a vida a partir de uma nova ontologia centrada na aprendizagem de olhar sistemicamente e agir em harmonia com seus cuidados, dentro da estrutura da importância da formação para a geração e apropriação da cultura da ética da pesquisa, da bioética e da integridade científica. Para atingir este objetivo, é

imperativo enfrentar os preconceitos que impedem o progresso no desafio de proteger e desfrutar a existência em nossa casa comum. Assim, o aumento e a qualidade dos desenvolvimentos que devem ser trabalhados em ciência, tecnologia e inovação aumentam as capacidades para poder estar e estar nos territórios. Foi identificado que os intelectuais destas áreas na América Latina se propõem trabalhar para fortalecer o amor à vida, como a força que continua além da existência. Eles reconhecem a prudência, a humildade e o respeito como princípios para criar, inovar e produzir conhecimento, baseado na responsabilidade pela vida.

Palabras chave: Direito à informação, modelo educacional, abordagem científica, ontologia, comunicação transcultural.

4.1 Introduction

The conceptual theoretical development is performed in three movements that are constitutive and become a route to present the importance of training in the generation and appropriation of the culture of Research Ethics, Bioethics and Scientific Integrity (EIBIC) in Colombia:

- **Movement one:** This is a general framework that develops arguments to promote principles for action and to canalize the biases that obstruct the adequate development of science, technology and innovation.

- **Movement three:** It points out the main biases that influence action, i.e., the purposes, since they influence action in one way or another.

- **Movement three:** It addresses the action and defines orientations to impact the "technique of doing" and not to neglect any process.

These, when intertwined, synchronize to creatively generate new knowledge and attitudes that favor the systemic view for a new ontology of being. This dynamic confirms that the raison d'être of the humanities, social sciences, arts and education is the action of governing the scopes, challenges and issues in science, technology and innovation, since they establish common "elements" that communicate, transform and permanently re-signify life and its meaning in communities, societies and nations; in this way, the incidence of cognitive biases, attitudes and behaviors to develop with quality the CTeI processes in these areas is recognized.

It arises the need for an education with conditions to discuss how to integrate the sciences and the arts for and to discover who we are in a society that has an unbridled

eagerness for egomaniacal self-improvement to the detriment of the recovery of the communitarian sense. Thus, training must strengthen the way of thinking about life, attitudes and behaviors for ethical acting, as a vocation with others in and for research (Gramsci, 2018). In this way, the mission of the institutions is established from the conscious obligatory nature to make efficient the policy of ethics in research, bioethics and scientific integrity, due to the fact that it is imperative to promote a holistic view, which facilitates the environments, resources, spaces and times to generate necessary attitudes and sufficient capacities (Sen, 1999), between perspectives of the totality of human knowledge and the use of knowledge to act in freedom in accordance, from respect as a principle, beyond doing science without incurring in the detriment of the general diversity of life.

It is proposed that life needs to be recovered as the axis of the dynamics of knowledge in order to know how to be and do. This implies strengthening the systemic view in order to recognize that we are part of the whole. This is the new challenge for the areas indicated by the OECD that seek to promote policies that improve economic and social well-being, which implicitly indicates that science is at the service of life, and not the sense of doing in order to have and accumulate in an overflowing way, from a consumerist logic. This should be the training for the understanding of life in its diversity towards the transcendence of the ethical being.

4.2 Importance of training for culture in Research Ethics, Bioethics and Scientific Integrity

Developing a new ontology of Being requires learning to act in the key to principles, it requires recognizing that the arts are the main element to enhance them, from the sensitivity and human capabilities, because these are necessary (Eisner, 2000) to know how to do science, technology and innovation from learning to live valuing life and its meaning.

> **The training should strengthen the way of thinking about life, attitudes and behaviors for ethical action.**

Figure 10. Self's capabilities
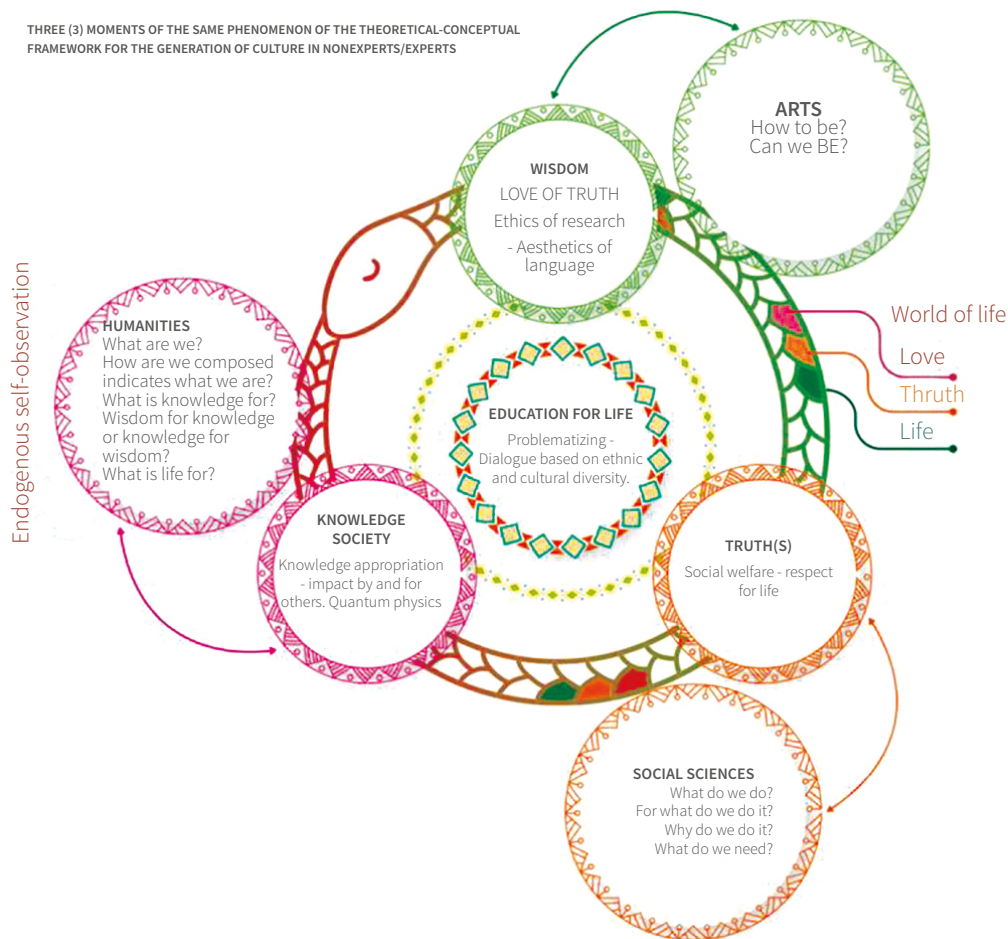
Figure 10 explains the questions that need to be addressed to enhance the capacities of the Being, in order to establish an ethics of research based on dignity as a principle.

Currently, the contexts of Colombia and the world in general are pointing out the need for a total revolution of consciousness that allows transiting from the strong influence of the hegemonic anthropocentric paradigm to give space for complementarity to new paradigms, such as, biocentrism (Toro Araneda, 2014), spiral thinking (Gavilán, 2012). This issue facilitates the transition towards a new ontology of being. For what is emerging globally and, particularly, not in America is the need to generate interepistemic dialogues, among knowledge and wisdom, from the perspectives of thinkers such as José Martí, Paulo Freire, Gros- foguel, Silvia Rivera Cusicanqui, Elvira Espejo Ayca, Aníbal Quijano,

Marco Raúl Mejía, Eduardo Restrepo, among others. These are substantial contributions to the understanding of experiencing and intending, from the common sense (Schütz, 2004), to reach the new ontology.

Therefore, it should be considered that the animal species, rational, interdependent (Macin-tyre, 1999), with the passing of time, from its contexts and roles, create different routes to value and enjoy what life and being alive means. In the perspective of a bioethical mind, in its full sense, what is emerging is to learn how to strengthen a new ontology of being that allows us to transit and protect the new generations in order to take care of our *common home*.

This is how current researches converge in pointing out that this *new ontology* of being is imminent, since it allows, gradually, in science, technology and innovation, to learn to understand the new dynamic things between the categories *truth, love and life*, and when merged they affect the intentions of being, doing and having, which in their maximum developments demand that culturally issues ranging from "What are we?" to "What is life for?" are considered, built and linked. In key of respect and care for its majesty, beyond, of the scientific-technical advances that the species have created to recognize above the blinding for considering that science and its interests have priority over the care of life (Rodríguez González, 2016). This issue has repercussions for recognizing the importance of addressing the biases pointed out in these areas in the following section.

This approach in a bioethical key points out the need to recognize what we are as a species in order to enhance that strength, starting from acting with others. Indeed, it is the world of life and the scientific world that in hybridization (Rorty, 1991) can point out that fulfillment is achieved by putting in tension all the dimensions of being in order to obtain *eudaimonia* and achieve *enkrateia* and *ataraxia*... happiness understood as balance, peace and serenity. Therefore, the need for a state of being present so that consciousness can help to channel emotionality and, thus, enter into a true look of clean observation that allows us to remain united and acting as part of a whole; this essential look admits that the center is the care of life, where it is confirmed that it is from the body (Planella, 2006) how the manifestation of it is achieved. It is to assume all the dimensions of our Being in life as a principle (Toro Araneda, 2014).

In other words, if all are connected, everything is interrelated; as quantum physics makes it understandable, everything somehow returns. It depends on what is emitted, as we move or see some things to the point of changing the physical frequency in "us" (Bohm & Peat, 2000). This is connected with the attitude, that is, how you position yourself in front of a reality, be it frustration, resentment, despair; this leads to decisions that generate entanglements, from the micro to the macro in personal and community life. It is important to remember that attack, blockage, flight, love, forgiveness, reconciliation allow a state of alertness that is activated as a great torrent of potentialities to learn to

live, to coexist and to help new generations to live in attitudes of service. In this sense, the perception of error allows us to focus, from a systemic point of view; to activate creativity and the capacity of analysis in connection with the emotional world and helps to act with firmness and discipline when it is required. Therefore, the best of a human being is only given in him as a person when he is able to choose freely, thus, to give himself self-recognition and part of this is obtained by feeling part of something that in his world deserves to be lived.

As a consequence, the cultivation of sentient intelligence (Zubiri, 1983) is essential to activate the capacity of *discussion-intuition* that we possess as a human species; this action is essential, in order to enhance the primary act of empathy; in this way, the capacity to conquer the transference of one's experiences to the other is increased and an action with *otherness* is achieved. In other words, *learning to think of others* is strengthened and developed when one thinks of how one is being in here and now in the role in which one finds oneself, be it parent, sibling, professional, layperson, etc. Thus, from the reflective act and acting, *intentionality* is active. And being in this condition awakens the conscience and motivates us to *act wisely*.

In bioethical perspective, what becomes visible is the constitutive relationship of epistemology with the view of what ethics implies, which is evident when, for example, a young person is required to *reconstruct an ethical conception based* on the act empowered by his human intelligence-sentient. This is because life is conceived from the knowledge of the world and the knowledge of oneself anchored in reality. This leads the young person to acquire a commitment to his environment, since he himself is reality and, therefore, is responsible for what happens. Hence, the importance of canalizing the biases of intuition, egocentrism and availability.

In this regard, Gómez Floro (2014) analyzes the *tendency* to a human life divided into bios life and zoé life; that is, a bare life would be that of the deprivation of identity, character and human being, which leads to a life *unworthy of being lived*, since it is exempted from belonging to any status, be it ontological, legal or even moral. Similarly, Pfeiffer (2009) argues that dignity, being a relational term, implies freedom and equality, and this is what makes it intersubjective. It is established and assumed that being inherent to life in community, it is a right, which is elevated to law when in ethical perspective it is based on respect for dignity. That is why, once dignity is established as a matter that emerges when making use of freedom and equality, it is understood that it is an end in itself, since the other is present as recognized and acknowledged: as a being that respects and respects itself, and even manages to recognize it beyond its own individual existence.

Therefore, it is important to educate with and in a *bioethical perspective*. To achieve this, according to León Correa (2008), it is necessary to meet three objectives which, in turn, become challenges for educators and adults in general: to provide knowledge

from an interdisciplinary viewpoint on an increasingly broad and complex field of topics, to modify attitudes and behaviors, and to influence the professional relationship. For example, health professionals: health-patient, this requires adjustments and wise changes in health care models; transmitting the most appropriate and necessary ethical values for these professionals and for society in general because they interact with it.

As a result of this requirement, both the methodology in the educational act and the attitude and evaluation are vital for the management of biases and for being conditioning factors to create knowledge, qualities and values; this requires educating from a broad and interdisciplinary bioethical viewpoint to achieve a new epistemological status, where global and environmental ethics issues can be included; to consider the problems of ethics of institutions and health systems in a pluralistic and complex world (Solomon, 2007, p.45; Belinguer, 2002). In this regard, the most important challenge of an educator-mediator is to reach the innermost part of the moral training of young people and help them to incorporate, improve or prioritize in a better way the ethical values and those that they will acquire throughout their career, moving from a duty to do to a desire to do.

How to meet the educational needs of young people? From the training of an ethics of emotions, in order to enhance their *moral development* and, therefore, their *ability to do justice* in their actions; it is necessary that young people learn to recognize that "we live in and through our emotions" (Solomon, 2007, p. 45), they are "constituted based on judgments, ways of perceiving, conceiving and evaluating" the world (Solomon, 2007, p. 45). In this purpose, it is necessary to cultivate the faculty of prudence, and, therefore, to assume it as a principle, because it enhances the capabilities and the will in front of what is decided and required, as, for example, in order not to do with knowledge actions that deteriorate the future of others. It is a moral-ethical attitude of the citizen that everyone can self-enable as a characteristic to act harmoniously in community, a consubstantial issue that is related to and affects the biases and what they raise when doing science, technology and innovation.

All this indicates an authentic and current approach to the Aristotelian idea that invites us to recognize as possible a citizenship where the public is revalued as everyone's business, because we can learn to live assuming life in society as a community of friends engaged in a collective project that avoids injustice and seeks happiness, the good for the community. In this regard, Habermas (1999) states that "ethical questions cannot be judged, from the moral point of view of whether something is good, equally for all" (p.23); the impartial judgment of these questions is adjusted, rather, on the basis of strong valuations, self-understanding and perspectival life project; taking into account the totality, "is good for us" (p.23). Moreover, it is an essential issue for the training of the citizens of the street: a role that everyone must fulfill, a determining factor in the ethical-moral aspect to work for sustainable social progress in favor of life and the planet.

It must be recognized that, at present, the vision of science, technique (technology) and society is due to certain defects and adherences that disfigure the panorama; this leads to biased interpretations; therefore, it is the praxis of power and the place of reason that prevents us from easily understanding what is being done, making it difficult to act according to what is "naively" thought. What has been generated is a partial thinking of the events that circumscribe the life of the human being on earth. Now it is understood that it is not possible to respond in a single (simple) and exclusively disciplinary way; interdisciplinarity is required. In this regard, Ospina-Ramírez and Ospina-Alvarado (2017) establish criteria for possible futures, where it is essential to favor the creative potential of children as the foundation for the construction of peace, an aspect that favors their capacities to do science, technology and innovation.

Therefore, interdisciplinary cooperation is important and allows recognizing that managing these processes requires unprecedented creativity (Ríos Alvarado et al., 2009) in all fields of social life, which requires finding ways to support young people in the development of a strengthened identity based on self-knowledge. This, in order to meet the need to build a cultural and material autonomy that allows to protect the collective from various structural risks, but without stopping the change. Now, the recognition of principles to act is influenced by the dispositions that are cultivated to decide how to act before what is needed in the contexts and generate conditioning factors; therefore, understanding the biases to eradicate them is part of the development that is presented in movement two.

4.2.1 Cognitive biases, attitudes and behaviors in Science, Technology and Innovation.

Research Ethics, Bioethics and Scientific Integrity (EIBIC) in social sciences, humanities and arts (Belén, 2019) is based on the principles of truthfulness, justice and welfare; on its ethical commitment to social welfare; on the irreducible respect for life; on the recognition and appropriation of diverse knowledge and wisdom, and on the strict moral integrity in each of its processes.

Figure 11. Training in respect for life in science, technology and innovation

THREE (3) MOMENTS OF THE SAME PHENOMENON OF THE THEORETICAL-CONCEPTUAL
FRAMEWORK FOR THE GENERATION OF THE CULTURE OF LAY/EXPERTS

ARTS
Language
aesthetics - cultural
representation

LOVE OF TRUTH
Research ethics -
language aesthetics

World of life

Love
Thruth
Life

HUMANITIES
Moral Neutrality

EDUCATION
FOR LIFE
Problematizing - Dialogue
based on ethnic and
cultural diversity

KNOWLEDGE
SOCIETY
Knowledge
appropriation -
impact by and for
others. Quantum
physics

TRUTH(S)
Social wellbeing -
respect for life

Endogenous self-observation

SOCIAL SCIENCES
Vulnerability
Significant/ symbolic
damage

Source: Katherine Rojas Montaña - Graphic Designer.

In this graph, the social sciences, humanities, arts and education, fields of knowledge
that share perspectives, methodologies and research techniques, but above all, inte-
rests and concerns for the human condition and the ecosystem of which they are part,
must strongly insist on the need to rethink the training in Research Ethics, Bioethics
and Scientific Integrity in their curricula, as an unpostponable purpose within the
educational and research commitment towards inclusion, the common good, respect
for diversity, divergent thinking and the search for social justice in a systemic view, as
its epistemological and axiological disciplinary principle and foundation.

According to the above, it is necessary to propose roadmaps in the face of the bad prac-
tices that emerge in research activity. More discussion and decision-making processes

are required in the EIBIC methods to identify and act on the possible biases that are characteristic of these areas and their incidence both in the research results and in their collateral effects in the communities, especially in those with differential characteristics and contexts crossed by special situations for the people involved. Therefore, urgent progress is needed in the analysis of the discussion on the impact of social research practices, since in the last decade it has become evident the enormous responsibility that qualitative social research (QSR) represents for life, privacy and rights: the sensitive balance of communities and people (Hall, 2013; Maraví Mesía, 2007).

In view of the above, the most notorious biases in these areas and that require permanent work in the curricula to support intersubjective social research (ISI) are the biases of intuition, which reveal the integrity of the researcher; the biases of egocentrism, which undermine the appropriateness in the research processes; and the biases of availability, which intervene in the quality of accessibility in the contexts of the research.

4.2.2 Intuition biases

The following are related to intuition biases:

- **Prejudice:** Condition, perception, characteristic or malpractice that affects the optimal development or distorts the research by becoming in a trend or inclination that influences the way of perceiving a phenomenon. It is a predisposition to judge from previous assessments or to interpret from stereotypes (Hall, 2013).

- **Conditioning:** Towards the "reproduction of system positions" (Bachelard, 2000; Bourdieu and Passeron, 1996).

- **Tendency to perpetuate:** The current situations of the system in correspondence with the creation of symbolic capitals and pre-established hegemonic fields of power that determine the possibilities, which limit the knowledge and importance of the impact of the research results and the recognition of those who are in them.

- **Lack of autonomy:** It is understood as a restriction of personal decision and creativity in the resolution of emerging problems and in decisions on contingent situations to be adopted in the field.

- Intellectual narcissism: Understood as non-respectful intervention or tendency to disqualify other colleagues or research participants (Bachelard, 2000), this prevents the fair interpretation of all participants in a research (Bourdieu, 2003). Likewise, there is the difficulty of generating otherness/reflexivity/empathy/mirroring as

fundamental elements of the encounter and recognition of others in the sense of "care" (Heidegger, 2009). Additionally, the lack of commitment understood as failures in the strict fulfillment of responsibilities of all the members of the research team and of the collaborative sense of "caring" (Heidegger, 2009).

4.2.3 Self-centeredness biases

Regarding the egocentric biases that affect the suitability of researchers, managers and seed science research, the following are the most important ones:

Epistemological obstacles: The tendency to maintain atavistic learning, neglecting the "learning to unlearn" (Bachelard, 2000). Furthermore, the lack of updating in the training with respect to the epistemological/philosophical foundations of the permanent changes and adjustments of contemporary qualitative approaches and methods, which evidences the lack of knowledge of the "epistemic shift" (Bachelard, 2000).»[14]. Likewise, the instrumentalization of the methodologies by which the techniques for obtaining information are reduced to positivist, determinist and generalist thinking, giving priority to measurable phenomena, to quantifiable data, and leaving aside interpretations to the point of loss and distortion of the construction of meaning.[15]. Thus, the conservative instinct is represented in the remarkable subtlety of looking for what confirms the assumptions of a given knowledge. Together with this, the limitation to think new epistemic perspectives that allow dialogue with other paradigms of thought, such as "Spiral" thinking (Gavilán, 2012) and not only in linear terms. Consequently, emphasis is given to the search for precision, for rigor understood as accuracy, and not as ethical and interpretative fidelity of the sources, which is what should be proper of scientific veracity in research.

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[14] The Social Sciences need to be at the forefront in this aspect, since this prevents us from knowing new paradigms and epistemes that are in force in our America and that favor the integration of knowledge, expertise and practices for the construction of diversity and pluralism in the face of the realities of the country.

[15] In this sense, managers, researchers and seed science research need to address the gap due to lack of knowledge in their training and willingness for permanent updating, together with the absence of timely praxis in training processes, in order to transcend the disarticulation between theory and practice that leads to reduced and univocal interpretations. This points out the need to advance in the educational logics on the historical incidence of the hegemonic position that the basic sciences have had, with respect to the other areas of knowledge that lead science to a production centered on measurement and competitiveness among researchers, over the use and application in contexts of the findings achieved.

4.2.4 Availability bias

Among the availability biases that have an impact on the contexts are the following: institutional pressure characterized by insufficient time and resource assignment processes without considering the particular realities of each research project, researcher and field of action[16], and thus the social projection and impacts of these processes are neglected. Additionally, the particular interests in certain results generate a lack of transparency of the founding principles of CSI, such as the search for the common good, social responsibility, equity, recognition of the other and the other, the attitude of dialogue, respect for the diversity of ways of being and being in the world. Principles that are under tension due to the exercises of power in the hegemonic paradigms that ignore the thinking of those who are considered subaltern. This happens due to the ignorance of the particular historical and socio-political-cultural conditions of each context, of the uniqueness of territories and identities, and the tendency to create standardized models and homogenize territories-identities.

This causes the indiscriminate use of informed consent and requires prior knowledge for optimal adequacy, planning and management. It is important to clarify that we try to have criteria to know at what moment the omission of informed consent predominates due to the sociopolitical difficulties of each research, the context and the participants to safeguard their integrity and achieve the adequate application of this instrument.

Therefore, the biases are conditioning factors that affect the methodological application, mainly its data collection techniques, among other aspects, have been the subject of extensive discussions when questioning the impact they have on the privacy of individuals and the preservation of their integrity due to the instrumental nature of their exercise, as they do not take into account the epistemological and ethical frameworks that precede them. Above all, because of their indiscriminate application to populations and subjects in a state of vulnerability, in situations of economic fragility, exposed to structural or bond violence or in different cultural conditions that make them susceptible to possible related damages. An inadequate application of these practices produces negative impacts on individuals, their domestic group or the community in general (Martínez and Castillo, 2019), which is conducive to an increase in their state of vulnerability in said population, "as, for example, in social studies conducted with ethnic minorities, victims of violence and refugees" (Santi, 2015, p.55)

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[16]   In Colombia, the territories demand precise displacements and protocols, located according to geographic and cultural characteristics, in order to reach adequate approaches with the communities that will participate in each research. This must be considered at all times, both in the design, implementation and closing phases of the project work and in the processes of socialization and appropriation of the results, return of the word, in the research, and must be covered in an efficient, timely, pertinent and sufficient manner by means of the assigned budgets.

Currently, the range of what is considered bias, harm, violation or harmful effect has been broadened; but, also from another angle, current discussions point to the analysis and visibility of the effects of prolonged fieldwork on the researcher's mental, emotional and physical health. Therefore, it is essential to understand that the permanent and imminent confrontation with ethical problems demands immediate responses, where both scientific rigor and moral cleanliness are put in tension, which is owed to the research participants in a kind of greater demand that constitutes a permanent personal challenge. Méich (2010) states in this regard that

> Ethics [...] is not born of a question, but of a radical anthropological situation in which an interpellation opens up, a demand, a strange, unforeseeable, unprogrammable, implantable demand. Ethics arises in a situation in which a demand-event breaks all foresight, and all calculation is born in a situation in which an appeal (from something or someone) demands an urgent response, without mitigation, a response that cannot be established beforehand, a response that cannot be found in any code, in any legal, juridical or moral framework. Ethics disfigures and dislocates every normative framework, calls it into question. It breaks it. (Méich, 2010, p.317)

Certainly, biases in ISI must consider a wide range of biases, from the subjective pre-dispositions of the researchers to the institutional characteristics from where research is designed and the particularities of the communities and contexts where it is developed. Thus, the epistemological turns made in these fields of knowledge at the end of the 20th century allowed for the revitalization of critical thinking and interepistemic dialogue arising from intellectuality and original thinking in Latin America, among other factors. Furthermore, the need for an openness to debate on the articulation of other paradigms of knowledge, expertise and philosophical frameworks through not only interdisciplinary but also intercultural dialogues, with the purpose of eliminating biases in the interpretation of sociocultural phenomena, due to the effects that a radical hegemonic position of knowledge may produce.

Therefore, it is urgent to broaden the perspectives on the concepts and categories that have framed classical ethics in intersubjective research, from the demands of the same communities and people, from their particular contexts and dynamics, such as their symbolic structures, cosmogonies and valuations related to cultural matrices and differential axiological frameworks: ancestral or traditional thinking, native thinking (Gavilán, 2012), popular cultures (García Canclini, 2005), cultural configurations (Grimson, 2013), emerging youth identities (Reguillo, 2017), own thinking (Restrepo, 2015), among many others. This broad spectrum deserves a change of representation towards interlocution, interpellation, interpretation and horizontal and interepistemic dialogue, as a constitutive of an ethical horizon and bioethical requirement in the 21st century.

In this regard, Santi (2016) proposes three hypotheses with which he emphasizes the special characteristics of the contexts of qualitative social research, from which these new approaches that are not always sufficiently addressed in traditional social research ethics are derived:

- Ethical issues that arise in the context of social science research have particular and specific characteristics compared to other ethical issues in human research.

- Social research involving individuals and groups in vulnerable situations raises ethical issues of greater magnitude than research that does not involve these individuals and groups and has the potential to cause significant harm to these participants.

- A great part of current concepts of vulnerability are inadequate for application to the field of social science research ethics (Santi, 2016, p. 18)

It should be noted that the ethics of research in the social sciences, humanities and arts share from a general framework the ethical approaches of biomedical research, prioritizing the welfare of the participants in such research practices. However, regarding the considerations and regulatory frameworks for specific ethical problems, it is clear that in each of the countries they are divergent (Santi and Righetti, 2007). The ethical dilemmas and problems throughout the development of each research require to be approached from a situated and shared perspective by those persons, communities, groups, collectives concerned in each research practice, in order to rework the basic concepts that have been used in a generalized way and that imply risk, collateral damage, violation, confidentiality, which weakens the principles of justice, beneficence and truthfulness, proper of their deontology.

It is necessary to understand the impact of biases, from vulnerability, susceptibility, fragility or low resilience to imminent risks or attacks and the impossibility of defense and replication. Therefore, more recent approaches emphasize "the structural dimensions of socio-demographic and environmental vulnerability as a product of a social construction generated from social inequalities, lack of opportunities, empowerment and access to social protection" (Sánchez-González and Egea-Jiménez, 2011, p.5). Moreover, at the end of the 20th century, the notion of vulnerability acquired new dimensions adjusted to the consideration of sociocultural situations that are now made visible, because they lead the human condition to dehumanizing situations and intense suffering, caused by external conditions that, if left unattended, affect the delicate warp of the socio-cultural fabric and the uniqueness of people.

Likewise, the theoretical and methodological progress of research has allowed the resignification of the concept of vulnerability to the extent that new approaches and demands promote intercultural dialogue, so that there is increasingly greater depth in comparative studies on identity/subjectivity, studies that point to the need to offer greater openness to intercultural research from principles such as "dialogue, reciprocity, complementarity, parity, respect, equality" (Gavilán, 2012, p.23), which makes possible greater dialogic processes of reflexivity and empathy where "epistemology thus becomes an ethic" (Rivera Cusicanqui, 2018, p.8).

Particularly in Latin America, these advances have started from different aspects, thanks to which they have made possible transformative processes of their practices, understood as collective construction of knowledge and wisdom through the weaving of their own divergences and polyphonies of their diverse idiosyncrasies (Espejo and Arnold, 2019), in an action aimed at avoiding biases, risks and damages related to research practice and which are added to the conditions of historical structural vulnerability of inequity, exclusion and conflict (Sánchez-González and Egea-Jiménez, 2011).

Therefore, the most important principle of research is the irreducible purpose of not producing harm or putting people at risk. It is clear that social research presents meanings that go far beyond its conventional meaning referred to the economic and physical dimensions, and presents intangible or immaterial dimensions, but no less devastating for that reason:

> Damage is a fact: it is any offense against the integrity of a person, an activity or a situation [...]. The damage is constituted by the set of elements that appear as the various consequences that derive from the damage for the victim thereof [*sic*]. While damage is a fact that is established, harm is, on the contrary, a subjective notion appreciated in relation to [*sic*] a specific person. (Henao, 1998, p. 76)

Consequently, Koteich Kathib (2013) warns that the delicate valuation of a type of existential damage does not allow the application of objective criteria, given that the damage to the psychophysical integrity produces alterations in the daily agenda of the victim and produces effects on the individual and family existence of the person concerned referred by it, as a dynamic component.

In this perspective, the moral damage derived from the affectation of a situation and the alteration, serious or not, of the conditions of existence or life project is highlighted, as determined by the Inter-American Court of Human Rights, taking into account that the Colombian Council of State has placed this type of damage within the category of "immaterial damages assimilated to the concept of damage to life" (Judgment 2007 of 2007 Colombia, 2007).
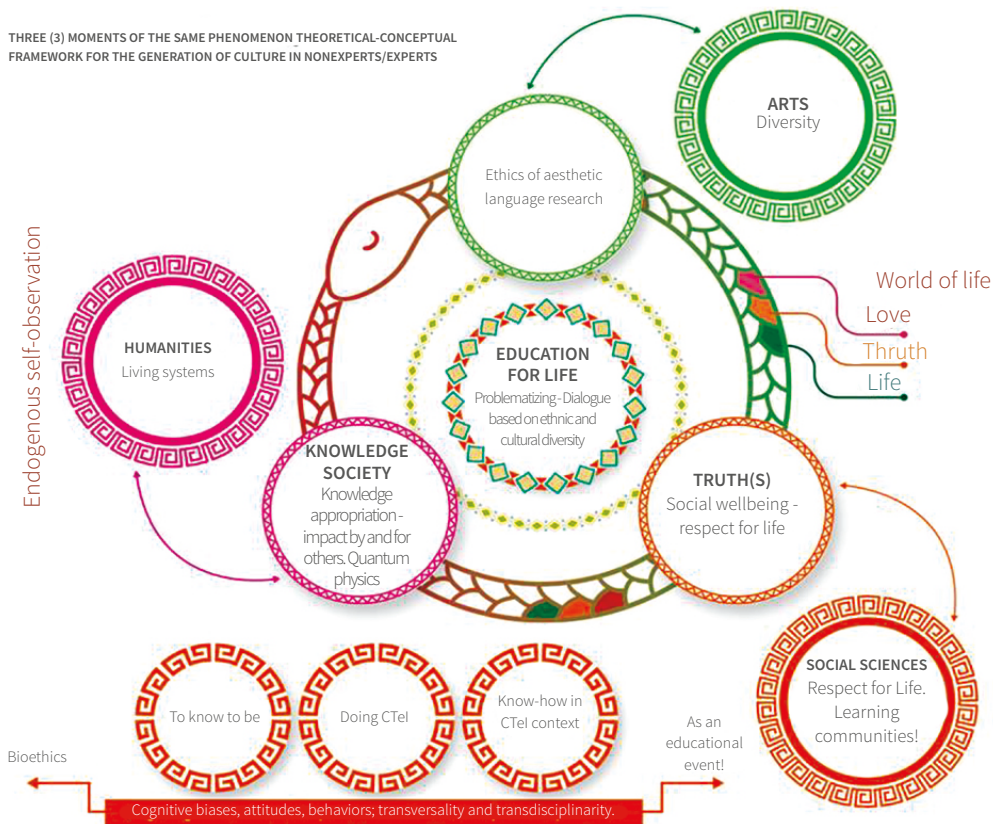
Finally, the damage to the life project emerges as a new dimension of immaterial damage, which is necessary to measure from notions such as otherness and empathy, from a renewed phenomenology/hermeneutics (Heidegger, 2009), as a way of approaching the human singularity immersed in a systemic whole: the being-in-the-world, from its own place of enunciation and in constant synergy with other epistemes and sensitivities. Then, in these areas the incidence of education around the overcoming of biases, damages, violations or harmful effects, requires processes such as those indicated in movement three.

4.3 Training for the appropriation of a culture of Research Ethics, Bioethics and Scientific Integrity

The new paradigm of education integrates the context as the place of statement that derives from a project with arguments that address why, what for, how and where research is conducted. It is pertinent to propose to students, teachers and research managers to discover the possibilities offered by art according to each research need, since the epistemological and methodological value of formative research is the autonomy activated by practices related to the cultural artistic (Lucas, 2022). Art creates realities that impact ways of living.

This graph can address diversity as the greatest achievement of the species and respect for life is shown. Knowledge must always be in favor of it. Therefore, it is necessary to learn to be and let be for a more harmonious way of doing. Research in social sciences, humanities, arts and education should produce valuable knowledge to guide training in Research Ethics, Bioethics and Scientific Integrity. The processes that are achieved from pedagogy, through questioning and dialogue, allow interventions of individuals and human groups by and for the creation of alternatives to ethical problems that are present in research. This demands learning to recognize the specificities regarding the characterization of communities and individuals in order to preserve the common good through the selection of actions that protect from possible damages; thus, human dignity is safeguarded.

Figure 12. Education for life

THREE (3) MOMENTS OF THE SAME PHENOMENON THEORETICAL-CONCEPTUAL
FRAMEWORK FOR THE GENERATION OF CULTURE IN NONEXPERTS/EXPERTS

ARTS
Diversity

Ethics of aesthetic
language research

Endogenous self-observation

HUMANITIES
Living systems

World of life
Love
Thruth
Life

EDUCATION
FOR LIFE
Problematizing - Dialogue
based on ethnic and
cultural diversity

KNOWLEDGE
SOCIETY
Knowledge
appropriation -
impact by and for
others. Quantum
physics

TRUTH(S)
Social wellbeing -
respect for life

To know to be

Doing CTeI

Know-how in
CTeI context

As an
educational
event!

SOCIAL SCIENCES
Respect for Life.
Learning
communities!

Bioethics

Cognitive biases, attitudes, behaviors; transversality and transdisciplinarity.

Source: Katherine Rojas Montaña - Graphic Designer.

For this reason, reflection, discovering who we are, allows personal improvement, the elimination of behaviors, such as those grouped in the above-mentioned biases. Indeed, it is a defense of self-knowledge towards a sense of community, from a holistic view based on respect for attitudes and skills necessary and sufficient for coexistence. In these areas, pedagogy as a science interacts to give and motivate to value as an active learning process. They converge, therefore, respect for others, for oneself; this requires considering the plurality of knowledge that each subject possesses. Its central objective is to emphasize the participatory work that allows evidencing the Being in order to know how to do it. In this regard, Freire refers that "to exist humanly is to pronounce the world, it is to transform it. Men are not made in silence, but in words, in work, in action and in discussion" (1972, p.104). It is important to establish the need to consider the other, to address the area of social sciences, humanities, arts and education. This situation

requires creating activities to learn to eradicate the biases of egocentrism, intuition and availability. It is important to remember that

> the Other asks me to open up to his otherness, to the recognition that I am in need of something. The Other makes it possible to address his need since I by myself, for myself, cannot do good, since goodness is a matter, at least, of two. The Other requires me to put myself in tune with my responsibility, that is, in the very harmony of what is human. (Levinas, 1982, p.91)

Therefore, education has as a principle the recognition of the other, in order to consolidate scientific integrity. For these areas "the ethics of care and compassion for the earth (…) reconsiders the western view of anthropocentrism as the core of all relationships and postulates a biocentrism, from our conditions of mega diversity, which means a new ethos" (Boff, 1998, p.25). In this sense, the ethics of care must be the transversal axis of all research to respect life and the strengthening of educational action in a community; thus, pedagogy in formative processes requires focusing on analyzing the needs that populations are expressing: that is, university practices, being investigative, need to have concrete approaches to communities.

In this regard, Bauman (2015, p. 33) expresses that "the challenges of education are very strong, since we must compete with a liquid modernity. The impact of novelty wears off quickly (…) learning is condemned to be an endless search for ever elusive objects". In this order of ideas, in the educational field and when doing CTeI, the needs of the context must be considered, and reality must be read in order to identify the continuous social, economic and political change of a society. It is important to consider that

> the role of education must be an education that echoes our history, artistic and cultural values, practices such as minga, bartering, traditional indigenous medicine, knowledge about nature, the practical situations we live in today and from there enrich our survival as a people. (Consejo Regional Indígena del Cauca [CRIC], 2012)

In this way, know-how is acquired in practice and requires knowing how to Be in order to know how to find the theoretical components, to recognize the biases that arise in the research process with the pretension of scientific language, because in social relations they are present and often do not allow learning from and to favor the educators themselves. Mejía (2011) points out how "pedagogy needs to be understood as the discussion on the educational fact and on the universe of relationships that are built to guarantee the teaching and learning processes" (p.38). As such, it needs to be sufficiently developed in these areas. In other words, pedagogy is the guarantor of social impact and should not be limited to the praxis method. It is necessary to stop isolating the school by reducing pedagogy to processes "of instruction and teaching and, to the relationships that are established within the framework of school institutionality as

part of the control project" (Mejía, 2011, p.47). It should be noted that the essence of pedagogy lies in human relations, since it is from different perspectives that one's own knowledge is constructed, and that is why it is necessary to revitalize and recognize cultural tradition in order to replant knowledge based on the epistemes of practice. Moreover, UNESCO highlights the relevance of "the wide dissemination of culture and the education of humanity for justice, freedom and peace are indispensable to the dignity of man and constitute a sacred duty for all nations" (2010, p.279).

Likewise, in these processes of doing for Being and knowing how to do, the strength of learning to ask questions needs to be strengthened. According to Hernández and Guárate (2017, p.62), "questioning is a method and a technique" that generates an impact on motivational activities to initiate a training process in Research Ethics, Bioethics and Scientific Integrity. Similarly, the circular discussion and case studies guide the reading of previously selected texts, according to the subject matter presented. In this sense, the teacher should stimulate the students with positive aspects in the development of learning, especially from the study of ethical dilemmas. The method used will be expository-dialogical and theoretical-empirical. The teacher will introduce the basic concepts through abundant exemplification from first-hand data collected in different sources. The presentation will be in dialogical form, so that the students will have to actively intervene with respect to the topics developed in class; likewise, the readings prior to the classes (referring to the basic text) will stimulate discussion (Cabrera Díaz and Rodríguez González, 2020).

For example, each class will contain three moments: theoretical and methodological exposition of the day's topic, discussion of one or several research papers on research ethics, and orientation of students around eventual or in-process research on the issues studied. In this sense, it is suggested that participants consider possible research topics in general prior to the class, and keep in mind the ethical, bioethical or scientific integrity perspective, knowing that the depth for discussion is often given by the school level or the achievement of joint projects by cycles. The more time shared between different perspectives, the greater the elimination of biases. For each topic, complementary readings related to specific published research are suggested, such as film forums, panel discussions on biases in series and film cases, scientific articles, papers or conferences in specialized events. The reading of these works fulfills a double function: to inform about the development of ethics in research in social sciences, humanities, arts and education, and, at the same time, to show a methodological perspective on the approach and resolution of research.

> Cooperative work is essential for these training processes in EIB, due to the fact that the micro circumstances demand personal and collective attention to the biases that are possessed and manifested in those who interact. For this, the revision and adjustment of the ludic activities must be related to research lines, besides

being articulated to research ethics; its main objective will be, through cooperative work, to allow the evaluation and self-evaluation of the techniques used in the activities, which the participants must recognize in the short and medium term as part of a project or as a project in itself. Thus, this pedagogical action, besides being reflective, gives "shape to the ways in which society is conceived, the world is organized, and the future of humanity is proposed." (Mejía, 2001, p.6)

It is important to guarantee an in-context education in order to increase its meaning, since "education, being practical, builds educational social relations with its devices and methods" (Mejía, 2001, p.7). Now, power and knowledge bring into play investigative actions so that the social options take shape in the life of those who are participating in the educational act, in order to give strength to what the institution proposes through the curriculum. In this way, the forms of interaction in training start from the research processes that require to be and make visible the communication through the results, or the comprehensions achieved according to the educational exercise developed. Therefore, "pedagogy as a communicative process (in the Habermasian sense) is necessary for the appropriation and development of academic culture" (Mejía, 2001, p.7).

Similarly, in order to promote EIBIC, it is necessary to consider the cultural dynamics of Colombia and to organize didactics and methodologies to learn to develop a systemic perspective, based on five issues:

- *praxis*,

- diversity,

- dialogue and question,

- life,

- love.

Praxis: It is related to the production of knowledge as a strategy in the methodological design and, in turn, in the need to dimension the research from the questions, guidelines, instructions, different stimuli (verbal or visual) that are part of any recording instrument, as well as in the importance of the theoretical referents that are identified in the concepts-variables or as theoretical dimensions that are the referent for the validity and reliability of the research instrument (Cohen and Gómez Rojas, 2019).

Diversity: In the use of new paradigms and qualitative and quantitative methods, leading to the relationship of criteria for thinking and acting in science without reducing or simplifying the importance of accepting the combination of methods to integrate and enhance the social sciences.

Dialogue: As a central axis of knowing how to be and knowing how to do science, technology and innovation from listening, respect and correlations in the ethical actions of those who research and actively participate in research.

Life: It is established in the attitude of assuming the decisions in research ethics from the complexity of the research problem.

Love: Relates the willingness to do good without causing harm to the participants.

Finally, it is important not to neglect and strengthen the processes of accompaniment required by the students, participating in the research processes in an active and sequential manner when they have previously completed and rigorously assumed the ethical foundations and scientific integrity of the research activities.

Conclusions

This academic exercise recognizes the importance of building dynamic theoretical frameworks from the different Colombian territories for the areas of social sciences, humanities, arts and education, where directors, managers, teachers and researchers dedicated to educate to do research, innovation and science assume, from a conscious commitment, the challenge for the country to direct its learning results by creating pedagogical, communicative and investigative strategies that promote and speed up the commitment to Research Ethics, Bioethics and Scientific Integrity, through attitudes of permanent improvement in the different school levels. Thus, the expertise is deepened and becomes a reality in the regions with the necessary actions to generate the appropriation of the culture, from the good practices of the Research Ethics, Bioethics and Scientific Integrity policy developed in favor of the care of life at the level of the State, academia, business and society in general.

In this sense, it is imperative to strengthen educational models, from the organizational culture in educational institutions, where, among other principles and actions, are the recognition of what we are as a species, respect, solidarity, social justice, reciprocity, systemic view and dialogue, in order to conquer synergies for a true transdisciplinary work that interacts with those who do not think like "us", especially at the time of doing science, technology and innovation. That is to say, it is pertinent to consider cultural knowledge from complementarity, parity and reciprocity to assume dissent, starting from collective work in an ethical and bioethical perspective for and to develop research always considering the other and the other, and, above all, the majesty of life. All of the above, recognizing more and more precisely the incidence of biases and, therefore, the need to address them in order to channel them to favor actions in EIBIC.

Therefore, it is necessary to strengthen the training of professionals with vocation, from their dynamics and ways of projecting themselves in the communities, through their roles and professional profiles, in order to mobilize a new ontology of being, where principles, processes and procedures contribute to enrich the humanistic theme and, thus, meet the need to train, always in a systemic perspective. Moreover, with the purpose of moving with an aesthetic, creative and loving look towards the understanding of research practices, placing life as the most precious value, as promoted by the native peoples and, thus, directing the scientific approaches to establish respect for all living systems by modifying the methodologies of the sciences, so that they are visibly interconnected with the training processes of the human species, overcoming the ideologization of science, so that new reference systems are generated over the current regulations and the right to information and intercultural communication is enhanced. Therefore, how does learning in and for life allow the overcoming of biases for the realization of the Self in its completeness?

Ethical and bioethical imperatives:

It is an honor to belong to life. To understand ourselves as its creative extension. It is an honor to discover the life of so many of our own in ourselves. It is an honor to be an element of change, of advancing our own system. It is an honor to exercise the choice to love. (Firace, 2018, p. 5)

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Chapter 5

Importance of training for the generation and appropriation of culture in Research Ethics, Bioethics and Scientific Integrity

Biomedical sciences and engineering

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Abstract

The following chapter presents the theoretical framework of the importance of training for the generation and appropriation of culture in research ethics, bioethics and the scientific apparatus, as it is for the Biomedical and Engineering areas, from the identification of cognitive biases, understood as that pattern of conduct in the exercise and what to do investigative. Therefore, the central objective of this chapter was the analysis of research from the evidence-based scientific literature, describing the cognitive biases, attitudes and behaviors related to ethical, bioethical elements and scientific apparatus in the two previously mentioned areas of knowledge. and raising the need for training in the change of attitudes and behaviors that counteract everything that opposes the ethics of research, bioethics, and scientific apparatus —EIBIC—.

Keywords: Training, Bias, Biomedical, Engineering, Research, Education.

Resumen

En el siguiente capítulo se presenta el marco teórico de la importancia de la formación para la generación y apropiación de la cultura en Ética de la Investigación, Bioética e Integridad Científica en las áreas biomédicas e ingenierías, desde la identificación de sesgos cognitivos, entendidos como patrón de conducta en el ejercicio y quehacer

investigativo. Por lo anterior, el objetivo central de este capítulo fue el análisis de investigaciones, desde la literatura científica basada en la evidencia; primero, describiendo los sesgos cognitivos, actitudes y comportamientos relacionados con elementos éticos, bioéticos y de integridad científica en las dos áreas del conocimiento anteriormente mencionadas; y, luego, planteando la necesidad de la formación en el cambio de actitudes y comportamientos que contrarrestan todo lo que se opone a la Ética de la Investigación, Bioética e Integridad Científica —EIBIC—.

Palabras clave: Formación, Sesgos, Biomédicas, Ingenierías, Investigación, Educación.

Resumo

O capítulo seguinte apresenta o referencial teórico da importância da formação para a geração e apropriação de cultura em ética em pesquisa, bioética e integridade científica, como é para as áreas Biomédica e de Engenharia, a partir da identificação de vieses cognitivos. conduta no exercício e o que fazer investigativo. Portanto, o objetivo central deste capítulo foi a análise de autores da literatura científica baseada em evidências, descrevendo os vieses cognitivos, atitudes e comportamentos relacionados aos elementos éticos, bioéticos e de integridade científica nas duas áreas do conhecimento mencionadas anteriormente e levantando as questões necessidade de formação na mudança de atitudes e comportamentos que contrariem tudo o que se opõe à ética da pesquisa, à bioética e à integridade científica—EIBIC—.

Palavras-chave: Treinamento, Viés, Biomedicina, Engenharia, Pesquisa, Educação

5.1 Introduction

The increasing globalization of commerce, education and research has resulted in greater collaboration between institutions and countries, at the academic level, with an increase in scientific projects and publications, both in the biomedical and engineering areas. Consequently, in the last decades, the number of scientific articles published in journals monitored by platforms such as SCOPUS increased from around 1.1 million to almost 2.2 million publications. Similarly, during this same period, researchers from low- and middle-income countries increased their percentage of scientific and technical knowledge, with an increase in their publications from around 9.5% to 13.7%. This led to an analysis against the process of the method and scientific rigor of research, identifying possible biases arising from it (National Science Foundation [NSF], 2016).

Similarly, in the last 30 years, the co-authorship of authors from more than one country increased from 8% to 19%, in relation to countries such as the United States and China;

and researchers have increased their scientific production in health sciences by about 18.8% and in engineering by 18.2% (Balz, 2022). With this increase in publications, there have been more and more reports of irregularities in scientific conduct, both at the formative and strict research level. This is why, currently, attention has been focused on how institutions monitor the conduct of tutors or mentors in relation to research misconduct at all levels of training. Role models have been provided through training in responsible research, both at the educational and strict research levels. This, with the objective of reducing cognitive biases, as well as misconduct, both among trainees and research tutors, especially in institutions that have limitations in infrastructure and software technologies to detect, investigate or penalize research misconduct (Altman & Broad, 2005).

Therefore, the objective of this paper was to review the literature based on scientific evidence currently published, to identify cognitive biases, attitudes and behaviors related to ethical, bioethical and scientific integrity elements in the area of biomedical sciences and engineering, in relation to the generation and contribution to knowledge from science, technology and innovation. When analyzing the results of this process, the need for training in the change of attitudes and behaviors that threaten ethics, bioethics and scientific integrity -EIBIC- in Colombia and in the practice of research arises.

That is why, from the Training Roundtable Discussion, the conceptual development group has worked in recent years on documents that provide SNCTI actors, at a transversal basis, with information on the development of a framework of ethics, bioethics and scientific integrity with standards for the conduct of research practices and activities. This is especially relevant in the multidisciplinary sphere, where it is essential to ensure that research results are reliable, that the training of future researchers is carried out ethically and that research improves our understanding of the world and its inhabitants, in an integral manner, respecting and protecting the subjects of study (both humans and animals), in biomedical science research, used to contribute to or generate new knowledge.

Likewise, the responsible conduct of research is based on the ethical behavior of the researchers towards the processes and subjects of the research, as well as their conduct with their collaborators or co-researchers. Therefore, it is essential to generate a culture related to the activities of supervision of scientific integrity at the level of the institutions or entities that conduct research, so that they include in their process of self-evaluation and quality of science, technology and innovation activities the supervision of each of the stages of development of the research process; As well as training in identification and implementation of activation of routes to control or minimize cognitive biases, bad practices or attitudes of researchers with impact on the reliability of the processes or results of research in the biomedical and engineering areas. The U.S. National Academy of Sciences, Engineering, and Medicine, in its report Advancing Research Integrity, states,

"Practicing research integrity means planning, proposing, conducting, reporting, and reviewing research in accordance with the following values: objectivity, honesty, openness, accountability, fairness, stewardship" (Committee on Responsible Science et al., 2017).

On the same way, it is important for the practice of research integrity to provide a route or structure through which misconduct, praxis or bias in scientific activities can be identified, reported and addressed, both formatively and strictly, in any discipline or area of knowledge. Therefore, the International Academic Council, a multinational organization of academic science, states: "Academic institutions are necessary to effectively denounce irresponsible procedures in research and their efforts should be oriented to reduce the number of irresponsible behaviors and practices by researchers and their collaborators" (InterAcademy Council [IAC] & The Global Network of Science Academies [IAP], 2012).

According to the above, when conducting research there are many ways to undermine the integrity of the research process or generate biases in science, technology and innovation activities. Some of these practices involve activities in terms of behaviors that undermine the quality and reliability of the data or results of the studies and even affect the health and life of populations and other living beings, as well as air quality, among many other variables in biomedical sciences or engineering. These activities or behaviors include, for example, making data for studies (Kornfeld, 2012), as well as performing experiments with protocols that are not standardized or approved by the corresponding entities on humans or animals, without informed consent (Dubois et al., 2013). Although these types of behaviors may be uncommon - as they could lead to actions such as dismissal, withdrawal of investigators or even withdrawal of research funding - there is another subset of more frequent behaviors that, although they include less serious actions related to biases in the research development process, can cause significant problems for researchers, institutions and human participants or animal study subjects, because they compromise the integrity of the experimental data.

Such behaviors include, but are not limited to:

- Failure to adequately develop the informed consent process for the performance of research practices.

- Misuse or omission of research protocols.

- Neglecting to monitor processes within the training process (therefore, may increase the risk of falsification of data).

Such behaviors may reflect bias and lack of rigor, rather than an intention to commit irregularities within the research process or phases; however, they may lead to serious

disciplinary actions by the regulators of the integrity of the research process within the institutions that conduct or finance the projects. In this regard, among the penalties that can be implemented in relation to malpractice or behavior by researchers, scientific literature reports their suspension, which can be temporary or definitive, depending on the seriousness of the action. Therefore, the institutions seek that this type of behavior is not repeated in the scientific and research community.

In its initial part, the following text presents -from a bibliographic review- a conceptual development on the importance of training for a change in the EIBIC culture. As a second element, it addresses the cognitive biases that can impact the accuracy or veracity of a phenomenon under study, as well as influence attitudes and behaviors in the EIBIC. Finally, the need for training on attitudes and behaviors that counteract anything that goes against EIBIC in both biomedical and environmental areas is proposed.

From historical perspectives, the World Medical Association developed the Declaration of Helsinki, adopted by its assembly in Helsinki in 1964 (World Medical Association, 2013). This guidance was intended specifically for physicians, regarding the participation of their patients in research. Subsequently (in 1982), the Council for International Organizations of Medical Sciences, using the Declaration of Helsinki as a reference, provided guidelines for conducting biomedical research on human subjects.

By the 1980s, few institutions had adopted institutional reviews to evaluate and monitor conduct and practices in human or animal research in response to concerns about scientific misconduct; instead, independent monitoring and regulation of scientific activities had been adopted. During the same period, cases of scientific misconduct began to be reported, resulting in international institutional standards to reduce scientific misconduct (Steneck, 1994). In 1989, to ensure that attention was focused on scientific integrity in the conduct of research, institutional training grants began to be offered at the international level, with the aim of demanding the implementation of a program on principles of scientific integrity that would be an integral part of the proposals made to strengthen research in all its stages (National Institutes of Health [NIH], 1989). Since these proposals, updates of guidelines for good research practices have been implemented; but experts suggest that, despite these guidelines, transgressions to scientific integrity continue to occur and there is still a lack of consensus on how to teach the importance of training for the generation of a culture of Research Ethics, Bioethics and Scientific Integrity.

In accordance with the above and considering the duties of caring for a good practice in research, given the need to promote and observe scientific integrity as a standard of conduct, the ethical and deontological principles that inspire and guarantee a rigorous and responsible praxis are necessary. For this purpose, the Low Countries Code of Conduct for Research Integrity specifies 61 standards for conducting good research. A unique feature of the code is that it also contains a chapter on duties of institutions conducting

research, with the aim of enhancing and reinforcing good practice around the practice of research, and researchers to steer away from malpractice. This is articulated in the following words: "Research institutions should create and maintain conditions that promote integrity through education, clear policies and reasonable standards for the progress of research, while fostering a working environment that embraces integrity" (Singapore Declaration, 2010).

In that sense, implementing strategies to promote research integrity across institutions will contribute to good research practices. The plan should cover a set of mandatory topics and normally describe a combination of educational programs, codes, manuals, policy measures, regulations, facilities, auditing schemes and support systems to have the necessary tools for quality procedures articulated with guidelines that can help research institutions formulate their research integrity promotion. Therefore, the initiative of global research institutions and other interested parties - from the academic component or systems interested in improving research quality, such as the continuous process of quality assurance and research integrity - is a responsibility of all interested parties.

One of the factors that can generate biases in research is the variable related to economic incentives. It could be argued that one of the most important things that research institutions must do is to avoid implementing harmful incentives in the evaluation of researchers for career advancement. Currently, the prevailing focus on bibliometric indicators derived from publication and citation counts send a strong message that only these things really matter when doing research (Núñez, 2022). In recent years research in the biomedical sciences has increased significantly both in practice and in publication, therefore, there have been recurrent calls to improve the rigor and quality in research both formatively and strictly, each of the members of the academic community sharing the responsibility to ensure the rigor of the research processes, either as researchers in the design and implementation of research processes, as manuscript reviewers who evaluate the results of scientific activity. The process of generating or contributing to knowledge must be solid, rigorous and transparent at all stages of design, execution and reporting in order for knowledge to benefit research and society. Thus, evaluations of researchers rarely include considerations related to the reliability, rigor and transparency of the process. Therefore, the Hong Kong Principles (HKP) were developed as part of the 6th World Conference on Research Integrity with a specific focus on the need to foster research improvement by ensuring that researchers are explicitly recognized and rewarded for behaviors that strengthen research integrity. The five principles are introduced: responsible research practices; transparent reporting; open science (open research); valuing a diversity of research types; and recognizing all contributions to research and scholarly activity (Moher, 2020).

The Hong Kong principles are chosen with a view towards explicitly recognizing and rewarding researchers for behavior that leads to reliable research, so as to avoid malpractice in research. The principles have been developed with the belief that their implementation could help define how researchers and career advancement are evaluated, with a focus on behaviors that strengthen research integrity. Five principles were identified:

1. Evaluate research practices and responsible parties.

2. Assess the submission of complete research reports.

3. Reward open science practice.

4. Recognize a wide range of research activities.

5. Recognize other essential tasks, such as peer review and mentoring.

Research institutions should make their research integrity policies based on scientific evidence, to the extent possible, to avoid bias. Evaluation of research processes is a focal point of decisions regarding the hiring, promotion, and tenure of research process leaders, to build, write, present, evaluate, prioritize, and select curriculum vitae. Institutions must make decisions in a constrained environment (e.g., limited time and budgets) (Moher, 2018). However, even for easily measurable aspects, the criteria used for assessment and decisions vary across settings and institutions and are not necessarily applied consistently, even within the same institution (Meursinge Reynders, 2022). For example, there is a large literature related to the impact factor of the journal to evaluate the scope of bibliographic citations, in that sense some institutions use to evaluate the literature published by their professors as well as the monetary rewards of the publication process (Tijdink, 2016).

According to the above, there are few evaluations of scientists that focus on the analysis of good or bad research practices, nor do the measures that are currently implemented tell us much about the contribution that researchers have to society, as is the final result of each process with impact on the population, which is the objective of most applied research. In the applied and life sciences, the replicability of findings by others or the productivity of a research finding is rarely systematically evaluated, despite documented problems with the published scientific record and its reproducibility across published domains (Kleinert, 2014).

That said, there is still much we do not know about research integrity in research institutions. Which is why institutions have made the decision to validate research and its results, for example, to rigorously examine the effects of a health intervention,

trial participants (human or animal) are usually required to be randomized among the intervention being studied, which is why some researchers advocate protocol registration as a way to ensure transparency and reduce bias. This has in some percentage provided insights to research institutions to improve their policies and fulfill their duties of care in promoting research integrity (Al-Shahi Salman, 2014).

Similarly, it is important to keep in mind that there are many interested parties in fostering a responsibility in research integrity. First, researchers themselves are accountable for their behavior in every part of the research process. Researchers are a role model for students, in terms of behavior; therefore, ideally, they should be a good role model. Secondly, research institutions must generate the conditions for responsible behavior, among others, by training researchers to act in accordance with the highest standards of quality and social responsibility.

Also, funding agencies and scientific journals have a role within the system and a responsibility. But there is no magic pill or quick fix: the dilemmas and distractions facing researchers are real and universal. Therefore, we must as a society collaborate and do all we can to prevent malpractice and foster research integrity (Kretser, 2019)

5.2 Importance of training for culture in Research Ethics, Bioethics and Scientific Integrity

The results of the systematic search of the available literature related to the importance of training for the appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity in biomedical sciences and engineering allowed the identification of studies in full text. These were independently selected by two reviewers, using the databases of health, biomedical and multidisciplinary sciences (including engineering), by combining the following keywords: Research Ethics, Bioethics, Bioethics and Scientific Integrity, biomedical and engineering. In the second evaluation stage, the articles were obtained in full text and evaluated by the two authors, who agreed by consensus on the final inclusion of the selected articles. The first reviewer extracted and sorted each full-text article by database, while the second reviewer independently verified the extracted data and resolved differences generated in this phase of the conceptual literature review.

The following lines present an analysis of results, from the theoretical and conceptual framework of the discussion on the importance of training in Research Ethics, Bioethics and Scientific Integrity: biomedical sciences and engineering.

As a result of the analysis of the documents selected in the theoretical framework, we have the book Bioethics, bridge to the future (Potter, 1971), in which the need for what the author calls the new science of survival is raised and justified, in these words: "We have a great need for an ethics of the earth, an ethics of wildlife, an ethics of population, an ethics of consumption, an urban ethics, an international ethics and the others". Potter's original idea was to create a new discipline that would bring together the realm of facts and the realm of values, the domain of the sciences and the humanities, in order to find ways out or, at least, road maps that could serve as a guide in the complex labyrinth formed by contemporary society, the product of the fusion between the scientific and industrial revolutions.

Similarly, Singer explains the importance of ethics by contextualizing that, if we observe carefully enough, we can discover that most decisions are related to ethics. Similarly, the beliefs and habits with which we were raised can exert a great influence on us; but, once we begin to reflect on them, we can decide to act in accordance with them or against them (Singer, 1994). On the other hand, Garrafa states in his research results that there is currently a growing visibility and enforceability of bioethics, not only in the scientific and educational fields (Garrafa, 2010), but in all activities involving science, technology and innovation. Similarly, for Adela Cortina, ethics must be understood as a unique fact irreducible to others, so that our human world is incomprehensible if we eliminate that dimension which we call moral. Therefore, ethics is applied when there is an effort to provide grounded answers to the moral problems that arise in the concrete fields of human action, not as far as eternal and predetermined principles are applied to particular disciplines (Cortina, 2000).

Accordingly, in the study conducted by García and others, the training processes in the ethics area describe the achievements and repercussions of training in research ethics, as well as the didactic strategies that serve as stimulus, motivation and orientation for courses in the discipline. Garcia, in his article, concludes that:

> The training in research ethics provided by the CIEB (Interdisciplinary Center for Studies on Bioethics) under the auspices of the Fogarty International Center, was an experience of incorporation of knowledge and skills that can be applied in a practical way in teaching and institutional settings, as well as in the ethics committee and in research in this discipline. The training received had its expression in the various aspects outlined above, but above all in the ethical and bioethical view that gives a new way of situating oneself personally and professionally. (García Rupaya, 2012, p. 80)

According to the above, the main reasons for the bioethical training of health professionals lie in the ethical problems raised by the progress of science, technology and innovation; the context transformations; the changes in health systems; the ethical crisis of students

during their training; the responsibility to safeguard the welfare and quality of life of patients; the need to strengthen the principles and values related to professionalism; and other competencies, such as the identification of moral issues, moral reasoning, decision making and moral activity.

Consequently, universities have a leading role in society, since their duty is to educate citizens; that is, people, not only with a solid professional education, but also civic, cultural, social, environmental and ethical. Therefore, it is necessary for these institutions to have policies that translate into a social and ethical commitment to development. As universities demonstrate that the ethical education of their students is a priority, faculties will be able to implement strategies to achieve this goal, both from the official curriculum as well as from the hidden curriculum. In the particular case of the training of engineers in multidisciplinary subjects, this is a complex task, since it requires the development of competencies from several well-established disciplines; this is the case of electromechanical, mechatronic and biomedical engineering, in which it is necessary to work on integrating subjects in order to achieve the training objectives (Pannucci, 2010).

In particular, engineering faculties in Colombia need to provide their students with an ethical education that allows them to understand that they should not only be prepared to apply the latest in technoscience, but also to apply ethics to their professional performance (Estrada, 2008). In this way, they will be able to assume the challenges that engineering - as a profession of high social risk - presents them and decide between the good and bad of their decisions. Likewise, they will be trained and motivated to contribute to the equitable development of the country and will avoid corruption or irresponsibility, among others. This education is required from the official curriculum with at least one subject that deals with specific topics of ethics for engineers and the code of ethics of engineering. Additionally, professors in their subjects should set an example of ethical behavior for their students. From the hidden curriculum, faculties can implement a series of strategies to overcome the resistance of some professors and students to the ethical discourse in the exercise of research, both formative and strict, thus allowing the strengthening in the areas of ethics, bioethics and Scientific Integrity.

To cite a case, we have the ethics of technology, which should be included within the new values. This dimension, which is conceived as a process or a capacity to transform or combine something already existing to build something new, cannot be done without a principle of shared responsibility. Research has shown that the exponential growth of data and information in the world of the system, as an interpretation of the world of life, poses an important challenge to the disciplinary view: it establishes the need to establish connections with other knowledge that will allow it to define points of reference and curatorship to face the current times of crisis of knowledge. Part of this effort is related, but not limited, to the incursion into the interdisciplinary (Henao, 2017).

Transdisciplinarity provides holistic schemes that subordinate disciplines, inquiring into the dynamics of systems in contexts and planes of reality; it seeks an opening of disciplines towards other objects of study. From the perspective and interests of knowledge, it is related to the threefold intersection between the technical interest, the practical interest and the emancipatory interest since it contemplates the possibility of subjectivity in relation to the interpretation of the world of life and its interconnections with the world of the system. For this reason, this text addresses the influence of the transdisciplinary approach in the research processes of the faculty.

Given the interdisciplinary nature of bioethics, it implies the need to integrate a set of diverse disciplinary and professional fields, bringing together anthropological, philosophical and technical knowledge from different branches (including engineering) for decision making. Santilli (2010) states that technology is the one that highlights such interdisciplinary character; hence they expose technology as the "central node". Unfortunately, current bioethics education is still highly focused and biased towards the training of health-related professionals. For this reason, the main bioethics institutions are still located in medical schools. Consequently, there is a vacuum in the teaching of bioethics for professionals and students from other careers; from this it can be inferred that it is not only important, but necessary, to formulate bioethics training projects for students from other areas, such as engineering.

In this regard, Develaki (2008) states that the study of bioethics should be proposed as a bridge between science, technology and humanities. In addition, the new applications of engineering to biological systems require the incorporation of human sciences in the training of engineers, since they are developed within a framework governed by ethics (Castaño, 2007). Bioethics can be, then, the starting point to access an integral ethical training in future engineering professionals, centered on the notion of responsibility; it can also contribute so that this technological area considers principles and values, and so that the ethical-social is the reference that guides the development of the discipline.

5.3 Cognitive biases, attitudes and behaviors in science, technology and innovation.

Decision-making in the biomedical sciences and engineering is based on technical knowledge and evidence regarding the options to be considered in a defined scenario and in a given population. Thus, the success of any intervention is based on obtaining

quality information about the problem to be addressed. This is usually acquired from previous experiences and studies conducted in more or less similar scenarios and populations, which may have been influenced, to a greater or lesser extent, by possible errors (Stenson, 2019).

Mistakes in research can originate randomly, by chance. Therefore, they can have an impact on a lower precision of the subsequent results (random errors); or, systematically, they can have an impact on the accuracy or veracity of the phenomenon under study. Such are known as biases, and their importance lies in the fact that they affect the internal validity of a study and, in some way, also invalidate the results of the research. Thus, biases can be represented as the difference between what is being assessed and what is believed to be assessed (Ayorinde, 2020). Therefore, unlike random error, systematized error is not compensated for by increasing the sample size of the study. However, although its importance is vital in the development of research, it is relevant to mention that none is exempt from them; therefore, it is essential to know them and, thus, try to avoid, minimize or correct them (Pollock, 2020).

Biases can occur at any stage of the research process, i.e., in the planning, conduct, analysis, presentation of results and their subsequent publication. The risk of bias is intrinsically related to clinical research, where its high frequency is assumed, since it involves variables with individual and population dimensions that are difficult to control. However, they also occur in basic sciences and engineering, contexts in which the experimental scenarios present conditions in which biases adopt peculiar characteristics that are less complex to minimize, since a series or a large part of the variables can be controlled.

The objective of this section is to identify the biases inherent to the biomedical and engineering sciences, which, when intervened, are expected to have an impact on the change of attitudes and behaviors in Research Ethics, Bioethics and Scientific Integrity. To achieve this objective, two processes have been carried out: first, the elaboration of a theoretical framework on the importance of training for the appropriation of culture in Research Ethics, Bioethics and Scientific Integrity in biomedical sciences and engineering; and second, the identification of cognitive biases, attitudes and behaviors related to ethical, bioethical and scientific integrity elements in biomedical sciences and engineering. Following the analysis of categories of cognitive biases in CTeI, three categories of biases were identified in biomedical sciences and engineering: availability bias, egocentric bias and intuition bias.

5.3.1 Introduction of research bias in biomedical sciences and engineering research

Bias is increasingly recognized as a serious problem in many areas of scientific research. Of particular concern are cases where research results appear to directly reflect the preferences and interests of certain stakeholders involved in the research process. Worrying examples of this have been identified, especially in privately funded research and in policy-related areas. Intuitively (and traditionally) it seems clear that the kind of bias suggested constitutes an outright epistemic failure. But philosophers of science have begun to identify that the ideal of pure, value-free science is, at best, just that: an ideal; and that all scientific practice involves all sorts of value judgments. While some philosophers have tried to distinguish acceptable from unacceptable value influences in science, efforts to draw this distinction in a principled manner have proved immensely difficult

Accordingly, in the theoretical framework analyzed, biases related to availability were found to impact science, technology, and innovation activities in the biomedical and engineering fields. These are listed below:

Frequency: Corresponds to variability in observation; that is, what is observed is not a pattern.

Measurement nature: Sometimes there may be difficulty in measuring the magnitude or value of a qualitative or quantitative variable. This situation may occur because the magnitude of the values is small, or due to the nature of the phenomenon under study.

Errors in the classification of certain events: They can be generated as a result of modifications in the nomenclature used, a fact that should be noticed by the researcher.

Selection bias: This type of bias, particularly common in case-control studies (events that occurred in the past may influence the probability of being selected in the study), occurs when there is a systematic error in the procedures used to select study subjects (Restrepo Sarmiento, Gómez-Restrepo, 2004). Therefore, this bias leads to an estimate of the effect different from that obtainable for the population under study.

Non-response bias: This occurs when the degree of motivation of a subject who voluntarily participates in an investigation may vary significantly in relation to other subjects, either by over- or under-reporting.

Membership bias: Occurs when among the subjects under study there are subgroups of individuals who share some particular attribute related positively or negatively to the variable under study.

Loss-to-follow-up bias: It can occur, especially in cohort studies, when the subjects of one of the cohorts in the study are totally or partially lost from the research, which generates that the pre-established follow-up cannot be completed and there is a relevant alteration in the results (Biele, 2019).

Egocentrics Biases

Due to neglect: The time factor is an important aspect, which affects different events in different ways.

Due to subjectivity: Regardless of forgetfulness, we can obtain answers that do not correspond to reality when a question is limited to a period of time. If there are no records, or if they are of poor quality, we will obtain an approximate answer that may reflect more or less what happened in the period under study. Over-reporting and underestimation of events should also be considered.

Confusion and ignorance: Occurs when the role of certain variables, exposures or events of interest is confused. This phenomenon may occur due to ignorance or lack of foresight on the part of the researcher. However, they are sometimes unavoidable.

Dropout: This can occur in the course of longitudinal studies, either by abandoning the study (ceasing to participate or refusing to continue collaborating) or by the disappearance of the subject under study.

Errors in the measurement instrument: This is generated by the incorrect choice of the measurement instrument or by subjective estimates of the measurement.

Conceptual biases: This type of error is committed when certain variables that may function as confounding factors are not taken into consideration, or when the duration of the study is inadequate. In other words, conducting studies that are not in line with the problem statement.

Lack of knowledge: in operability due to confusion between the differences between scientific committee, research ethics committee and bioethics committees.

5.3.2 Intuition Biases

During the analysis stage: Once the data collected are available, they are analyzed. Systematic errors may occur at this stage due to incorrect transcription of information into the database (wrong coding or values not accepted by a database field).

Publication bias: This can be considered a type of selection bias that occurs when the researcher thinks that the published studies are all those actually performed. It is known that many studies are never published for various reasons, such as that they are not concluded, the author considers the results to be irrelevant, they are not accepted for publication, etc. On the other hand, there is duplicate publication of some studies.

Biases in the initial evaluation of the project: These are due to the use of erroneous information or to the deformation of the initial information, which orients it towards certain aspects. In short, it is the existence of prejudices or erroneous data that condition the research approach.

During data collection: These occur during the process of collecting information, either by obtaining incomplete or erroneous information, or by modifying the sample (or part of it) during the execution of the research.

Bias due to the respondent: The information provided by the respondent may be incorrect, due to forgetfulness, subjectivity, confusion, distrust, ignorance, misunderstanding or modification of the response by the survey itself, or incorrect measurement of parameters.

5.3.3 Bias control

As has been mentioned throughout this chapter, biases can appear at any time during a survey and can be prevented and controlled at the time of design or during analysis. Some ways to control biases are:

Randomization: The random assignment of patients to each group in clinical experiments allows them to be balanced by chance and thus to be comparable.

Blinding: This tool is very useful, especially in clinical experiments, to avoid the introduction of bias on the part of the patient or the observer. It can also be useful in case-control studies to avoid observer bias. This masking can be one of the research hypothesis.

Standardization: Standardization of the measurement procedure-as well as staff training with the instrument, with the interview, and with data collection-reduces the presence of measurement error.

Operational definitions: Having clear definitions of disease and non-disease or exposed and non-exposed persons reduces misclassification bias.

Define possible confusion variables: Possible confounding variables should be foreseen from the time of study design in order to establish adequate control of these variables. For example: by restriction (inclusion and exclusion criteria), stratification or matching (rarely used, because of the possibility of greater bias).

Losses: From the moment of the design, it should be anticipated what percentage of possible losses will be tolerated, so as not to affect the results, and this estimate should be included in the sample size calculation. Usually, 10% of the sample is overestimated.

Within the context of science and values, a phenomenon of preference bias is of particular interest. It occurs when a research result improperly reflects the researchers' preference for it over other possible outcomes. It should be noted that this is a special type of bias, as the term "bias" is also often applied to cases of systematic error, which need not relate to researchers' preferences for one outcome or another. A classic example is the type of bias in clinical trials introduced by randomization, which tends to reconfirm, if anything, the investigators' preconceived beliefs, rather than their preferences. An important warning is that preference bias must be distinguished from outright falsification or fabrication of results. Preference bias works in a more subtle way: by increasing the probability of the preferred outcome, rather than by bluntly fabricating it. Before turning to the task of giving a more precise idea and satisfactory characterization of preference bias, some examples of the phenomenon that has recently raised concern in biomedical literature are presented. They illustrate the variety of mechanisms by which investigator preferences can come to exert a kind of problematic influence on the outcome of research. In particular, cases of preference bias are almost always controversial.

Accordingly, preference bias consists of the infringement of standard conventional rights established by the respective research community, whether in the biomedical or engineering area. This analysis captures the intuition that bias of preference constitutes an epistemic deficiency, as the conventional norms themselves are adopted by the community in an effort to enable and preserve epistemic trust and to ensure the ability to fulfill their epistemological roles. It also explains why the diagnosis of preference bias is often not a clear-cut case, as the conventional standards in question come in varying degrees of both explicitness and universality.

Similarly, we should point out that an analysis of preference bias as an epistemic deficiency was only possible when considered from the perspective of social epistemology. The different frameworks of individual rationality considered were informative with respect to the connection between inductive risk and certain concepts of bias, but they did not offer any definitive and realistic definitions. These were constraints for the purpose of drawing a line between the inevitable burden of science value and unacceptable preference bias. The domain of standards is limited to certain procedures and aspects of the research process that are particularly susceptible to regulation by implicit rules.

But, as the examples discussed in this paper show, these limited aspects can sometimes be of vital importance. Although the critique of the traditional conception of value-free science has provided important insights, an image of science as an open playing field for individual value judgments may therefore be exaggerated.

5.4 Training aimed towards the appropriation of a culture of Research Ethics, Bioethics and Scientific Integrity.

In order to illustrate this third element, we present Derek Book's widely cited 1976 article, in which he defends the idea that university students, regardless of the careers they study, should receive ethics instruction throughout their professional training, since this has the important function of "helping students to develop a clearer and more consistent network of ethical principles that carefully accounts for the needs and interests of others" (Bok, 1976, p. 29). The teaching of ethics aids the moral development of the individual, because "students in these courses will be more aware of the reasons underlying moral principles and will be better equipped to reason adequately about the application of these principles to concrete cases" (Bok, 1976, p. 30). According to Derek, the transversal curriculum of ethics is necessary for students to have the minimum foundations that will help them to resolve with better chances of success the moral dilemmas that, as professionals, they will face in their future activities.

In this sense, Miller and collaborators suggest that integrity in research is linked to the moral identity of professionals (Miller, 1998). In this regard, Aldo Leopold -forest engineer, precursor of environmental ethics-, as early as 1887, suggested the extension of the moral frontier to grant nature the category of a subject of law. Leopold's writings at the University of Wisconsin involve ecosystem problems and environmental conflicts with human health issues. With this, he substantiates his idea of human belonging to an ecosystemic biotic community; that is, the need for an ethics-bioethics, not only in the field of human relations, but also in the field of engineering.

Because, although it is true that one of the purposes of biomedical and engineering studies is to obtain new generalizable knowledge about a given aspect, it cannot be ignored that such studies should not go against the condition of end in itself that the human being presents; that is, that only those that respect and serve the integral development of the person and his environment are ethically lawful, and this is achieved with a solid training of the researcher (Marañón Cardonne and León Robaina, 2015).

The health sciences researcher today knows that they have to reconcile two positions: on one side, they are aware that they must advance in the search for new knowledge to put it at the service of man; but, at the same time, they must be careful to defend that man who is not an object of research, but the end and the meaning of it, reaffirming the Kantian categorical imperative "work in such a way that you use humanity, both in your person and in the person of any other, always as an end at the same time and never only as a means" (Kant, 1995, pp. 44-45).

Training in ethics, bioethics and integrity in the biomedical and engineering areas will allow us to consider a minimum of ethical requirements for research. This will lead to reducing to the maximum the possibility of exploitation, in order to ensure that research subjects are not only used but treated with respect and responsibility while contributing to social good.

Conclusions

The effectiveness of research results can be affected by systematic error or random error. Such errors can appear at any time during the research. Therefore, both the researcher and the interested reader must be aware of their existence, in order to control and prevent them (in the case of the researcher) or to determine to what extent to believe in them (for the reader). Biases are the researcher's greatest disadvantage, and it must be clearly understood that they can appear at any time during the course of the research. It should be borne in mind that biases are committed in any study; our attitude towards them should be to try to minimize the degree of this type of behavior in the research process. The purpose of knowing them is, in a broad sense, to be able to determine whether they influence the results by excess or by defect; and, more specifically, to take them into account when interpreting them. Although the issue of breaching research integrity is still uncommon, either because the researcher may be suspended or have funding withdrawn upon detection, there is another subset of more frequent behaviors. These include less serious actions, such as those related to bias, which can cause significant problems for researchers, institutions and participants by compromising the integrity of the research process. The responsibility for safeguarding the integrity of the entire research process should be that of society in general; however, universities have a primordial role, since they should form, before being professionals, people with a solid ethical, cultural, social and environmental education.

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Conclusions

The challenges raised in the implementation of the public policy required "rethinking" the approach to define the importance of training in the development and appropriation of a culture of Research Ethics, Bioethics and Scientific Integrity of the CTeI processes that encompasses and represents the different areas of knowledge and different processes, so that this implementation becomes the driving force for the emergence of new approaches that allow the convergence of different thoughts, beliefs and actions on the EIBIC issue.

For the proposed conceptual transformation of cognitive-attitude-behavioral biases, training processes play a fundamental role in the generation of EIBIC culture. They are the path that achieves the appropriation of this culture, the value of training; they enable adaptation to the contexts, disciplines and challenges that, over time, must be faced in the development of science, technology and innovation activities, in an increasingly complex and uncertain context.

It is fundamental, in the identification and transformation of cognitive-attitude-behavioral biases, to find common points in the processes of science, technology and innovation: it is part of a system (SNCTeI) and, therefore, the impact of one element necessarily influences the other interrelated elements. Thus, it is identified that, although science, technology and innovation processes have their own characteristics, they share elements, which are translated into similar phases and stages. Thus, it is possible to assume that cognitive biases-attitudes-behaviors are also shared in EIBIC, and that there may be common elements in the transformation processes that have an impact on the generation and appropriation of a culture.

Final discussions

It is necessary to work together, through exchange networks, in order to assume a new ontology of being in the light of what it implies to do science, technology and innovation. This requires educational, social, economic, political, cultural, artistic and sports models, committed to a systemic, complex, transdisciplinary paradigm, where respect for life itself leads to the recognition that it is greater and must be contained in the ways of proceeding, in the political action to be conducted. This means assuming, as an interdependent rational animal species, that the creative evolution achieved so far considers that life must have priority over the interests of the sciences, which means moving science away from commercialized knowledge; in other words, returning to dignity based on principles such as humility, social justice, precaution and prevention. In this way, the methodological routes commit practices where the Being is strengthened over the having without neglecting the knowing; thus, the educational models focus on understanding the doing in, with and for respect, love and generosity through a conscience that connects us, since we are nature, life itself.

Therefore, it is necessary to guarantee real spaces and times in the different daily dynamics for the areas of knowledge called humanities, social sciences, arts and education, since they are the ones that can enhance this way of relating to what is known and to be known. This allows all generations, according to their contexts and development of capacities, to mediate in the face of cognitive, attitudinal and procedural biases that arise. In this sense, a culture of living is consolidated where science, knowledge and wisdom are harmonized in the service of life from the cultural, educational, social, political and economic point of view.
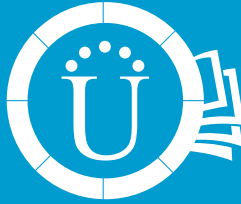
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