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Review Article

Research ethics, scientific development and nowadays needs: A reflection to the complex thinking

Ética de la investigación, desarrollo científico y necesidades actuales: una reflexión desde el pensamiento complejo

Juan Carlos Osorio Amaya[1]

ABSTRACT

Introduction: the objective of this article is to expose the necessity of ethics applied to the future and the importance of complex thinking in research practice.

Methodology: the methodology implied was based on documentary research, and the technique was documentary analysis supported by analytic summaries.

Results: the results showed the existence of ethics, always in the present time, in the scientific exercise, and the presence of a research subject alienated from their discoveries and its multiple uses.

Conclusions: the document conclusion shows the need of desacralizing the scientific knowledge to allow its articulation with another kind of understanding and the emergence of complex thinking. Due to that, the ethics' momentum is generated facing the future, the same that combines the discovered impetus with the knowledge adventure, life's care, and the development of a new kind of civility.

Keywords: science, experimental methods, ethics of science, research.

JEL Classification: O31, O33

RESUMEN

Introducción: el objetivo de este artículo fue exponer la necesidad de una ética aplicada al futuro y del pensamiento complejo al interior de la práctica investigativa.

Metodología: la metodología utilizada se basó en la investigación documental y la técnica de análisis documental apoyada por resúmenes analíticos.

Resultados: los resultados mostraron la existencia de una ética siempre en tiempo presente en el ejercicio científico y la existencia de un sujeto investigador enajenado de sus descubrimientos y de los usos que se hacen de estos.

Conclusiones: la conclusión muestra la necesidad de desacralizar el conocimiento científico para articularlo con distintas formas de saber y la emergencia del pensamiento complejo, gracias al cual se genera el momentum de la ética a futuro, mismo que compagina el ímpetu descubridor con la aventura del conocimiento, el cuidado de la vida y el desarrollo de un nuevo tipo de civilidad.

Palabras clave: ciencia, experimentación, ética de la ciencia, investigación.

Clasificación JEL: O31, O33

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INTRODUCTION

Research ethics has historically guided researcher conduct in the planning and implementation phases of research activities and the conduct of experiments, especially when these require subjects for testing. It has played its axiological role in a field where subjectivity has been divorced from the process of understanding reality. In this field, the empty spaces resulting from the exclusion of subjective elements have been filled by rationality, leading to undesirable results such as the emergence of ethnocentric perspectives that have allowed experimentation on humans without their consent and a series of practices that are now considered criminal.

Therefore, this paper assumes the existence of an incomplete ethical exercise within the classical paradigm of science.

By excluding the feelings, emotions, and opinions of the researcher from the reflective process, the notion of relevance and other forms of understanding that are complementary are also lost. Hence, voices in the scientific community, such as that of Edgar Morin, have advocated for the return of subjectivity to scientific endeavor and, with it, the return of human sensitivity through the recursive practice of complex thought within the ethos of the research community.

The focus is on professional reflection on the research profession and the ethical exercise in experimental processes as a means of protecting all discoveries from the unscrupulous use of outsiders pursuing selfish ends. Therefore, exercises such as identifying future risks are proposed to prevent the development of knowledge that could culminate in the creation of weapons of mass destruction.

The methodological approach was based on documentary research techniques. This process began with the selection of ten articles published in nationally and internationally indexed journals, spanning the years 2003 to 2022. In a second phase, another thirty documents were selected, including articles and books, some in English, published between 2020 and 2025. These included texts by Edgar Morin and Carlos Delgado, who, from the perspective of Complex Thought, guided the reading of the documents. Likewise, the document analysis technique was supported by the preparation of thirty analytical summaries that provided access to textual citations and supported the preservation of organized bibliographic information, as well as some reflections on the content of the documents.

Furthermore, pursuing the objective of exposing the need for future ethics and complex thought within research practice, additional tasks were carried out, such as explaining the need to return subjectivity to the research-experimental process. Furthermore, it demonstrates the existence of the present tense in research ethics and also raises the need for research ethics developed in the future, which protects the use of findings and discoveries in the development of weapons of mass destruction.

METHODOLOGY

Regarding the methodological approach, a qualitative approach was chosen by the author due to the need to interpret reality and the interest in expanding the corpus of the theoretical framework. In this sense, the type of research chosen was documentary due to its reconstructive nature, as previously posed questions were used to rework the knowledge previously produced (Revilla Figueroa, 2020).

The area of study was defined as research ethics, and within this, its role within scientific research processes. Academic articles on the topic published in indexed national and international journals were sought by the author. The goal was to gather seventy articles published between 2003 and 2025, which were found in digital repositories of journals such as Scielo, RedALyC, and Google Scholar. Specifically, we worked with a total of thirty-five articles published between 2003 and 2025.

Starting from the traditional definition of ethics as ethos, customs, or habits (Cagñay & Aguirre, 2020), we reflected on the practices of scientists in the experiments they conduct and, more generally, in the process of knowledge construction. This approach is the starting point for the reflection and analysis of the selected texts: in Morin and Delgado, the role of the subject and their subjectivity in science; in Guibert, the notion of good and evil; in Olmos, dogmatism; in Soto, her productivity-performance-game analysis; and, finally, in Mouffe (2022), her notion of agonism.

On the other hand, the processes specific to documentary research were guided by Revilla Figueroa (2020): choosing the topic, selecting variables, searching for documents or document selection, and reading. This final step focused on the construction of Analytical Summaries (RAES) as a strategy to facilitate the comprehension and analysis of the documents (Ciapponi, 2021). This proceeding required a two-level reading to subsequently identify the main ideas and structure of the texts, which the author then used to create conceptual maps. Finally, it is clarified that the RAE template used in the process was our design based on the models of the Catholic University of Colombia, the National Pedagogical University, and the Central University of Colombia.

Likewise, to argue the need for ethics in the future and for complex thinking within research and experimentation, this document is divided into four main sections. The first, entitled “Classical Science and the Researcher’s Work,” presents the arguments of Edgar Morin and Carlos Delgado, who illustrate the disjunctive and reductionist nature of classical science in rendering the researcher’s subjectivity invisible. The second, “Scope of Ethics in Research,” presents a brief state of the art of ethics applied to the processes of scientific research and experimentation.

The third, "Present, Future, and Complex Thinking within Research Ethics," reflects on the potential of complex thinking and its necessity for the development of science due to its recursive capacity to leverage other forms of knowledge and reflection. It also recognizes that the researcher is a being in the world, as there will always be weaknesses in decision-making related to research findings.

Finally, the conclusions section addresses the question: What should be done with science? This sentence is especially true when it requires a different type of citizen due to its involvement in society. It comes to understand that, as a process, it cannot be stopped. However, it is necessary to desacralize it in order to question its discoveries and its capacity to do good or evil without it depending solely on who uses it.

RESULTS AND DISCUSSION

Classical Science and the Researcher's Work

Regarding how classical science has guided the researcher's work, it is necessary to refer to René Descartes' work on the processes of formation and formalization that are now called scientific knowledge. Before the Copernican turn, the way it was thought was a mixture of religion and philosophy (Dopazo, 2022), and doubt was not part of its premises. However, although he was not the first to question the role of the senses in the process of understanding nature, his then-novel four-step method provided a way to understand phenomena with room for verification thanks to mathematics, logic, and analytical geometry (Schelling, 2022).

With Descartes, the pursuit of knowledge was no longer focused on the essence of things but on the method for accessing them, a process that included evidence, analysis, deduction, and revision (Rodríguez & Mundi, 2021). However, his search for an aseptic path to truth had to overcome the constant risk of error because it distanced itself from the data offered by the senses, ultimately eliminating the observer from the activity of observation (Gembrillo, 2020), as it separated all subjectivity from the process of knowledge and gave birth to a virtual being: the scientist-researcher.

This approach required a series of conditions to "unveil" the phenomena since the truth in natural events had to be understandable and straightforward and, therefore, needed to be founded on a basic element: the fundamental units with which everything could be constructed; furthermore, it sought the principles that would allow not only the phenomena to be understood but also to be manipulated.

In this sense, the reductionist ideal of science was protected by the implementation of mathematics, geometry, and logic, inherited from Descartes, Spinoza, and Leibniz, while disjunction eliminated subjectivity in scientific endeavor by decree (allowing human domination over nature), no control mechanism could prevent situations of potential destruction (Delgado, 2021).

Over time, successive successes in understanding and mastering natural phenomena transformed science into a massive and powerful leviathan, an institution funded by society (Morin, 2020), which, despite all its capacity, paradoxically remained trapped under the yoke of taxing powers such as the economy and the state.

Hence, it is worth following Morin (2020) on this point since, by problematizing the massive nature of the scientific apparatus, he demonstrated how science finds itself in a loop in which it affects and is affected by technology, society, and the state. This particular analysis shows how science bows to economic and state powers while at the same time surrendering to its genius, allowing it to produce knowledge that affects production technologies and the development of mass control devices that, under the aegis of social media or apps, have biopolitical reach. That is, managing seemingly playful actions to keep the bodies and minds of the population productive and docile (Soto, 2023).

In this way, science has become the sine qua nonexpression of how the world is (Delgado, 2021), becoming instrumental knowledge, susceptible to being administered, controlled, and reproduced through a series of steps, dismantling productive reflexivity, which depends on the individual's imagination, their experiences, their motivations, and even their biology.

Scope of Ethics in Research

When discussing research ethics, it is worth asking: What would scientific development be without the figure of the experiment? That is, without the activity whose results allow for activities that have brought about human

well-being, but not without incurring some excesses. Therefore, in this process, the function of ethics has been, rather than protective, synonymous with responsibility (Espinoza & Alger, 2020; Goshen & Miteu, 2024) to avoid repeating practices that, while they have led to the rapid advancement of knowledge, have also revealed the danger of a cold and logical, or in other words, non-human, rationality.

As an example, and based on the work of Orozco and Lamberto (2022), this point will be illustrated with three cases that, due to their importance, have permanently changed the way we explain phenomena: the first, which occurred during World War II, corresponds to the period in which experiments were carried out on Jewish prisoners confined in Nazi concentration camps. The second presents a study conducted between 1932 and 1972 on six hundred African-American citizens not medicated with penicillin, assessing the risk of death due to untreated syphilis. The third deals with a study on sexually transmitted diseases conducted in Guatemala between 1946 and 1948 without seeking the consent of the selected patients.

As a result of the multiple cases of experimentation on prisoners and the reprehensible Nazi medical and scientific practices, the Nuremberg Code was created during the Nuremberg trials of 1947, based on five principles: voluntary consent, experimentation only if the benefits outweigh the risks, experimentation on animals before humans, avoiding physical and mental suffering of subjects, and, finally, avoiding disabling injuries and death in the research process.

Subsequent to the Code, other initiatives emerged that, while ratifying some sections, added equally important elements that researchers had not initially considered. Thus, the Declaration of Helsinki was issued in 1964, making contributions in three aspects: first, the mandatory nature of a written research protocol; second, subject care (White, 2020); and third, truthfulness in the publication of results (Sawicka et al., 2022).

Additionally, the Belmont Report was created in 1979, which proposed "three basic principles" aimed at justifying the direction and evaluation of human actions through the ideals of autonomy, beneficence, and justice (Orozco & Lamberto, 2022). This was intended to make scientific progress compatible with values such as human dignity and simultaneously mitigate the risks of the research process (Orozco & Lamberto, 2022). In this sense, for Ontano et al. (2021), experimentation involves principles such as helping others, increasing well-being, and preventing any adverse effects; its thelos are to properly conduct research and do the right thing, seeking the good of those who may directly benefit from it.

In addition to doing good, the principle of non-maleficence, which Ontano considers complementary, includes all those who may be affected by action or omission, supporting the emergence of consequentialist approaches that attempt to address the problem of what is done with what is found and its repercussions (Macnamara, 2025). Furthermore, when addressing rights and how professionals should observe these, Ontano advocates exercising the principle of autonomy, understood as the ability to refrain from acting, and the principle of justice as a social function of research, the generation and dissemination of knowledge, the unrestricted use of resources, and access to acquired knowledge.

Thanks to the establishment of these commitments regarding care, adequate information, and consent to participate, this type of excess has not recurred; in fact, the relationship between ethics and research is understood by scientists, an aspect evidenced in works such as that of Linville et al. (2023), who have empirically verified it.

Likewise, one can find positions such as that of Espinoza Freire (2020), which conceives of research and its findings as tools that, in principle, are neither good nor bad for nature (neutrality). On the contrary, they emphasize that this purpose depends on the use and application that humans make of them (Trust et al., 2023); the researcher's awareness is necessary to ensure the correct use of the findings. A key element, therefore, is that research has brought with it significant advances but also efficient mechanisms of destruction on a planetary scale.

This scenario is why research ethics requires prioritizing the general interest of knowing and understanding for the benefit of humanity, not pride or personal interests that do not benefit research work. This raises a political issue within the ethical problem, as it raises the question of who decides whether a phenomenon or problem is or is not of general interest. In this sense, the fragility of research and scientific knowledge, in particular, can be seen as they are exposed to the influence of power groups, budgets, the media, and social networks.

With regard to disruptive technologies such as artificial intelligence (AI), any advances made in this field require rethinking the ethical practice based on the protection of human beings and their freedoms. This entails assessing the impacts on vital areas, such as work, family, and personal life. In this regard, González and Martínez (2020)

argue that both the uses and products of science and technology must respect and safeguard human life. Rather than protecting AI, the authors emphasize that it should focus on those who design them with despicable intentions.

In other words, if every technological implementation, directly and indirectly, impacts the labor, education, and job training markets (Mendoza & Mendoza, 2022; Granados-Ferreira, 2023), the confrontation between human needs and economic and political objectives will be exacerbated by petty interests that violate fundamental rights or support fraud and misinformation. This is how new mechanisms are created that reconfigure the economy-society-individual relationship, affecting investigative work, first peripherally with data-based AI and, later, with knowledge-based AI (López de Mantaras and Brunet, 2023). Therefore, it is necessary to expand impact assessments, complementing aspects such as efficiency and productivity with the potential to create new forms of power and population control (Ausín, 2021).

If the above is not taken into account, humanity will continue to misuse discoveries and the technologies derived from them. This would broaden the discussion around ethics in research, increasing the scope of procedural codes and informed consent. On this point, Carhuancho (2020) mentions that in research ethics, there are factors beyond the scientist's knowledge: these include personal values and experiences. It must not be forgotten that the researcher is in the world and, therefore, needs to satisfy his or her own needs. Therefore, the researcher's actions will be morally acceptable to the extent that the environment and the strength of his or her moral convictions allow it.

For this reason, Garrido (2020) highlights the need for researcher independence because, by 'being in the world,' he or she is at the mercy of the powers of the State, religion, sponsors, and even the general public. This exposes them to working and writing amid varying degrees of censorship, as experts must constantly remember that their discoveries and developments can also be instruments of intolerance and ignorance, which necessitates complementary regulation and oversight (Vázquez, 2022). In this way, the authors emphasize that both the researcher and their discoveries must exist for the benefit of humanity, both now and in the future.

Present, Future, and Complex Thinking within Research Ethics

As has been demonstrated, ethics is integrated into the research process through the ethos related to the treatment of the research subject and the handling of the results. In other words, it is developed based on the care that must be given to the subject to ensure that they are kept safe from any form of suffering or risk of death. However, once published, there is no mechanism to control the uses and applications of the discoveries made, an aspect addressed by works such as that of Heini et al. (2024) regarding genomics studies and the risk of misuse as the basis for pseudoscientific beliefs such as eugenics, racism, and ableism.

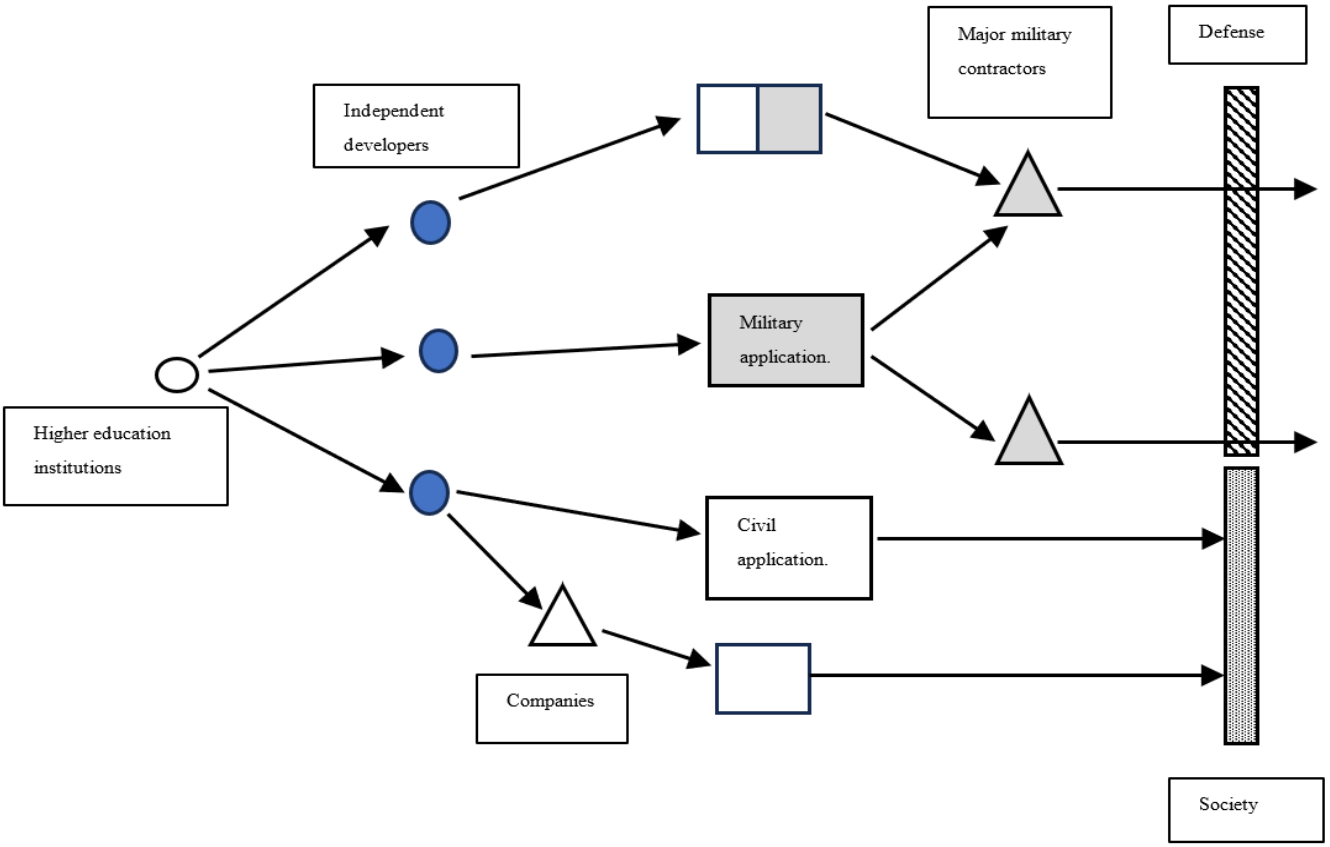
There is, therefore, an ethic in the present tense that is expressed in the processes related to the research protocol and the preparation of consent; however, there is a gap regarding what can and cannot be done with the findings. This has exacerbated the tendency to carelessly popularize discoveries through technological applications (as has happened with AI), reducing them to mere tools, reversing the military-civilian flow, and shifting weapons testing to testing minimum viable products.

As a result, civilian experts around the world take over technologies and, after thousands of iterations (which in the past would have taken decades), end up "innocently" perfecting their military use (Figure 1), only for military engineers to take them back, improving them under the pretext that failure to do so could leave them at a disadvantage in the imminence of new conflicts (Morgan et al., 2020).

For this reason, the emergence of the future tense in research ethics is necessary to consider the application of its results in everyday life, as these do not depend exclusively on the intentions of the researcher; furthermore, the political, social, and environmental context in which they are carried out comes into play (Morin, 2019). This situation is evident in the ongoing reflection on the use of AI in the development of autonomous weapons, showing that one of the aspects to be addressed is the legal one, as existing regulations are no longer sufficient or need to be clearer or supplemented (Vigevano, 2021).

Researchers are limited in their control over how others use what they discover, whether due to compartmentalization (especially in weapons development) or simply because they are alienated from the results of their work (Contakes & Jashinsky, 2021). Thus, how their products are used depends on third parties with the ability to define what is right or wrong, and, in the absence of criteria of altruism and benefit to humanity, they base their decisions on utility or convenience (Guibert, 2021).

Figure 1.
Civil-military development model



Source: own elaboration

This is only possible because of the defenselessness of the research subject. From a Heideggerian perspective, they are a being-in-the-world and are exposed to the same economic and social dynamics as other human beings, these being the ones that ultimately influence their decision-making. It is worth clarifying that there are also cases in which, despite knowing the harmful effects of discovery, scientists have chosen to recommend its use, either out of necessity or professional ego, thereby unleashing dangers and destruction of global scope.

In line with the above, figures such as Thomas Midgley Jr. emerge. He developed the first additives for automobile fuel, allowing for environmental pollution with tetraethyl lead. Later, when he discovered the first gas from the group known as chlorofluorocarbons (CFCs), he directly affected the ozone layer. Both have caused serious problems for the planet for decades. These reasons led historian John McNeill to claim in 2001 that Midgley had had a greater impact on the atmosphere than any other organization in Earth's history (McNeill, 2001, cited by Holý, 2024).

Midgley's example brings to mind Frédéric Bastiat's words regarding how to address a catastrophe of the magnitude caused by tetraethyl lead: a greater effort is required to repair environmental damage than was necessary to create it. In these cases, limiting their effects and banning them has taken decades, but they have recovered some lost well-being and saved an unknown number of lives (Agrand et al., 2022). However, the impacts, especially on children in developing countries, continue to this day, while researchers such as de Olivera et al. (2021) call for changes in public policies and further research to determine how the problem has evolved.

However, even with the capacity to destroy the planet several times over, it is not true that humanity is one step away from annihilation. On the contrary, it is a resilient and adaptable species (Moscona, 2021), ready to support processes such as environmental recovery (Sarkar, 2020). This requires carrying out the largest project humanity has ever undertaken: the construction of the planetary citizen (Morin, 2019), which requires education for global citizenship (Álvarez Monsalve, 2020), far removed from traditional categories of good-bad or right-wrong.

Since, for human beings, living implies a political stake, education for global citizenship must be governed by respect for life itself, an approach in which what is different ceases to be an enemy in an antagonistic relationship (under which it is legitimate to extinguish the other). On the contrary, this must be a deep, respectful, complementary, and multiple connection: an agonistic vision (Mouffe, 2022).

It is worth trusting, then, that the human race will overcome the "great filter" of the species by understanding what underlies its nature; both the desire to know and understand, as well as the promise of a better life, are closely linked to science and technology, which is why an agnostic stance cannot be assumed. While scientific knowledge can develop better weapons, the existence of a planetary citizen will be sufficient insurance to avoid the temptation of entering a new obscurantism plagued by Luddites, for whom every discovery must be hidden (i.e., buried), waiting for the sacred to find harmony on earth (Zweig, 2021).

Indeed, humanity cannot stem the flow of scientific knowledge because it is dependent on it, being intertwined with technology, society, and the state. Therefore, repressing it will only exacerbate the evils that have been attempted to eradicate over the past six centuries. The aggravating factor lies in technology since, thanks to it, more efficient population control tools are available, whether for digital surveillance in dictatorships (Xu, 2021) or, at the microsocial level, for algorithmic control of jobs (Kellogg et al., 2020).

Nor is it possible to expect society to evolve in step with science; in fact, Rathbun and Stein (2020) show that support for the use of nuclear weapons depends on moral issues such as retribution or loyalty to the group. Thus, the proper use of each advance is complicated by fanaticism and dogmatism that can infect even the most brilliant (Olmos, 2022). That is to say; scientists are also susceptible to falling victim to emotions and passions or, ultimately, being forced to participate, stripped of their agency, and, often, becoming a tools without a conscience, unable to see that they are doing something wrong (Rezende, 2022).

So far, the reason for the need for research ethics has not been mentioned. In this regard, it must be said that this has only been possible thanks to the split between human logic and subjectivity. By eliminating the latter to eradicate error, the paradigm of classical science through sympathy supported the absurdity of sociocultural-economic-environmental exclusion, hunger, and the industrialization of war. Therefore, the exercise of complex thinking within scientific endeavor is also necessary, and within this, the emergence of a new paradigm: complexity.

This new worldview is due to the existence of a trans-complex reality (Arcila & Guerra, 2023) between knowledge of the social and human sciences and scientific knowledge, which not only demands a large amount of knowledge but also requires a greater development of consciousness in order to seek better human behavior (Aldana, 2021).

On the other hand, despite the positions against the use of AI, the work of scientists, far from being at risk, has been enriched by the increase in the processing capacity of this technology and its versatility in terms of the functions it can perform; issues ranging from the search for information, the comparison of results and methodologies, to the simulation and creation of scenarios for activities specific to experimentation, leaving more room for the development of what Marx called productive activities specific to human reasoning.

However, the existence of risks associated with the use of AI should not be underestimated, primarily due to a lack of ethical values and the inability to constructively unite scientific knowledge with human nature (González and Martínez, 2020). Complex thinking within scientific practice not only integrates the subject and its subjectivity; it also involves multiple perspectives and dynamic explanations in understanding the infinite complexities that makeup nature (West et al., 2020).

CONCLUSIONS

Humanity finds itself in an unprecedented moment in which politics, science, and society have generated multiple interconnections. The human world depends on science; however, its destiny lies not in the hands of scientists, but in those of government officials and high-level businesspeople. Therefore, a greater commitment from the scientific community is required to find mechanisms that allow for control over discoveries and their potential uses.

Edgar Morin, the planetary citizen, has proposed that a society open to the multiplicity and dialogue of knowledge, based on agonistic interactions that erase the image of the enemy, is possible. However, the cornerstone for building it lies not in technology but in accepting that there is potential in every discovery that is both constructive and destructive since research will be an unfinished process until the risks that accompany it are determined. The recursive practice of complex thinking is necessary to harmonize the progress of scientific development with the growth of the individual and the advancement of society.

Therefore, it is necessary to desacralize scientific knowledge, to question it and examine its multiple interactions with life, society, and the ecosystem. That is, to identify its risks and benefits, stripping it of its cloak of intellectual purity and connecting it with other knowledge and worldviews, unifying the fragments of reality that, even today,

remain unconnected. Here, complex thought allows us to unite episteme and doxa, by reclaiming the subjectivity that sensitizes and tempers, balancing cold logic. This process complements Descartes' Copernican turn and creates a momentum of ethics that is simultaneously human, perceptive, and projected toward the future.

In this sense, the development of weapons derived from research processes reveals the confluence of the multiple forces that intervene, channel, and limit the work of scientists; a procedure that has led to the continuous exploitation of knowledge in favor of the arms market for economic and geostrategic purposes. In turn, this has resulted in the gradual conversion of the scientist's work into an administrative activity in which the human being can be replaced for the benefit of the project and the expected results; the time function of schedules is a tool that supports the sacrifice of reflexivity and awareness in favor of achieving objectives.

For its part, the imminent emergence of artificial general intelligence, thanks to the convergence of different AIs in everyday life, is one of the issues that deserve to be mentioned but is beyond the scope of this article. However, it is worth noting that AI is the best example of the classic paradigm of science: fragmented, aseptic, and devoid of humanity. The next challenge, in this case, will be to teach it the value of life and the imperative to protect it; something contradictory considering that there are times when humankind itself seems not to understand it.

The above makes it barely understandable the fear of an autonomous intelligence devoid of ethical boundaries and whose reasoning is based on achieving objectives, to which human beings can become an obstacle. Hence, for now, there are more questions than answers. The debate on this matter remains open.

REFERENCES

Aldana-Zavala, J. J., Vallejo-Valdivieso, P. A., & Isea-Argüelles, J. (2021). Investigación y aprendizaje: Retos en Latinoamérica hacia el 2030. *ALTERIDAD. Revista de Educación*, *16* (1), 78–91. https://doi.org/10.17163/alt.v16n1.2021.06

Álvarez Monsalve, E. (2020). Educación para la ciudadanía mundial y pensamiento complejo: Una investigación en la localidad de Tunjuelito, Bogotá. En L. Bermúdez (Ed.), *Educación para el siglo XXI: Derechos Humanos, Ciudadanía y Diversidad sexual: Maestros y maestras que inspiran 2020* (pp. 33–42). Instituto para la Investigación Educativa y el Desarrollo Pedagógico (IDEP). https://core.ac.uk/download/pdf/386968519.pdf#page=34

Angrand, R. C., Collins, G., Landrigan, P. J., & Thomas, V. M. (2022). Relation of blood lead levels and lead in gasoline: An updated systematic review. *Environmental Health*, *21* (1), 138. https://doi.org/10.1186/s12940-022-00936-x

Arcila, M. C., & Guerra, P. L. (2023). Formación disciplinaria versus formación transdisciplinar en la era digital. *Observatorio de las Ciencias Sociales en Iberoamérica*, *4* (3), 27–39. https://doi.org/10.51896/ocsi.v4i3.207

Ausín, T. (2021). ¿Por qué ética para la Inteligencia Artificial? Lo viejo, lo nuevo y lo espurio. *Sociología y Tecnociencia*, *11*, 1–16. https://revistas.uva.es/index.php/sociotecno/article/view/5618

Carhuancho Mendoza, I. M., & Nolazco Labajos, F. A. (2020). Factores que influyen en el desarrollo de la investigación universitaria. *Revista Espacios*, *41* (2), 27–31. http://es.revistaespacios.com/a20v41n02/a20v41n02p27.pdf

Ciapponi, A. (2021). La declaración PRISMA 2020: una guía actualizada para reportar revisiones sistemáticas. *Evidencia, Actualizacion en la Práctica Ambulatoria*, *24* (3), e002139. https://pesquisa.bvsalud.org/portal/resource/pt/biblio-1290749

Contakes, S. M., & Jashinsky, T. (2021). Ethical responsibilities in military-related work: The case of napalm. En *Ethics of Chemistry: From Poison Gas to Climate Engineering* (pp. 85–111). World Scientific. https://doi.org/10.1142/9789811233548_0004

de Oliveira Mota, K. C., Pedroso, V. C. M., Rocha, G. H. O., Grotto, D., Barioni, É. D., & de Oliveira, R. T. D. (2021). Effects of lead poisoning in children: A narrative review. *Research, Society and Development*, *10* (7), e37410716616. http://dx.doi.org/10.33448/rsd-v10i7.16616

Delgado, C. (2021). Las cegueras del conocimiento: el error y la ilusión. En L. Carrizo, G. Canela, L. Rodríguez, C. Moraes, T. Salinas, I. Petraglia, E. González, & F. Valleys (Eds.), *Posibles, aún invisibles: Edgar Morin y el realismo de la utopía* (pp. 45–62). UNESCO.

Dopazo, A. (2022). *Descartes: de la duda metódica a la conquista de la certeza*. Bonalletra Alcompás.

Espinoza Freire, E. E. (2020). La investigación cualitativa, una herramienta ética en el ámbito pedagógico. *Conrado*, *16* (75), 103–110. http://scielo.sld.cu/pdf/rc/v16n75/1990-8644-rc-16-75-103.pdf

Espinoza, E., & Alger, J. (2020). Ética y conducta responsable en investigación: Una mirada a través de la Revista Médica Hondureña. *Revista Médica Hondureña*, *88* (1), 33–37. https://revistamedicahondurena.hn/assets/Uploads/Vol88-1-2020.pdf#page=35

Gagñay, L. K. I., Chicaiza, S. L. T., & Aguirre, J. L. (2020). Ética en la investigación científica. *Revista Imaginario Social*, *3* (1), 1–15. https://www.revista-imaginariosocial.com/index.php/es/article/download/10/19

Garrido, J., Espinosa, J. F., & Undurraga, T. (2020). La autonomía de la producción de conocimiento como política de la universidad. *Atenea*, (522), 83–100. https://doi.org/10.29393/at522-97apjg30097

Gembillo, G. (2022). El método del método de Edgar Morin. *Gazeta de Antropología*, *38* (2), Artículo 02. https://dialnet.unirioja.es/ejemplar/614684

González, M., & Martínez, D. (2020). Dilemas éticos en el escenario de la Inteligencia Artificial. *Economía y Sociedad*, *25* (57), 1–17. http://dx.doi.org/10.15359/eys.25-57.5

Granados Ferreira, J. (2023). El impacto de la inteligencia artificial en los trabajadores despedidos por automatización de servicios. *Revista CES Derecho*, *14* (3), 62–81. https://doi.org/10.21615/cesder.7416

Guibert-Elizalde, M. (2021). La transformación de la memoria en la «Genealogía de la moral»: Un acercamiento desde la mala conciencia en la religión. *Anuario Filosófico*, *54* (1), 41–60. https://dialnet.unirioja.es/servlet/articulo?codigo=7863248

Heini, M., Natri, H. M., & Chapman, C. R. (2024). Toward justice and community empowerment in genomics studies on sensitive traits. *Hastings Center Report*, *54* (S1), S56–S65. https://doi.org/10.1002/hast.4930

Holý, P. (2024). Kdo byl Thomas Midgley, Jr. [Who was Thomas Midgley, Jr.]. *Chemické Listy*, *118* (6), 331–341. https://doi.org/10.54779/chl20240331

Kellogg, K. C., Valentine, M. A., & Christin, A. (2018). Algorithms at work: The new contested terrain of control. *Academy of Management Annals*, *14* (1), 366–410. https://doi.org/10.5465/annals.2018.0174

Linville, C. L., Cairns, A. C., Garcia, T., Bridges, B., Herington, J., Laverty, J. T., & Tanona, S. (2023). How do scientists perceive the relationship between ethics and science? A pilot study of scientists' appeals to values. *Science and Engineering Ethics*, *29* (3), 15. https://doi.org/10.1007/s11948-023-00429-1

López de Mantaras, R., & Brunet, P. (2023). ¿Qué es la inteligencia artificial? *PAPELES de Relaciones Ecosociales y Cambio Global*, (164), 13–21. https://dialnet.unirioja.es/servlet/articulo?codigo=9287111

Macnamara, J. (2024). Human research ethics review challenges in the social sciences: A case for review. *Journal of Academic Ethics*. Advance online publication. https://doi.org/10.1007/s10805-024-09532-9

Mendoza, E. C., & Mendoza, M. A. G. (2022). La lucha contra el desempleo tecnológico: Análisis de casos subnacionales en México. *Revista del CLAD Reforma y Democracia*, (82), 225–252. https://revista.clad.org/ryd/article/download/lucha-contra-desempleo-tecnologico-analisis-casos-en-mexico/503

Miteu, G. D. (2024). Ethics in scientific research: A lens into its importance, history, and future. *Annals of Medicine and Surgery*, *86* (5), 2395–2398. https://doi.org/10.69733/clad.ryd.n82.a292

Morgan, F. E., Boudreaux, B., Lohn, A. J., Ashby, M., Curriden, C., Klima, K., & Grossman, D. (2020). *Military*

applications of artificial intelligence. RAND Corporation. https://www.rand.org/content/dam/rand/pubs/research_reports/RR3100/RR3139-1/RAND_RR3139-1.pdf

Morin, E. (2019). Más allá de la globalización y del desarrollo, desesperanzas y esperanzas. *Gazeta de Antropología*, *35* (2), Artículo 05. https://digibug.ugr.es/bitstream/handle/10481/62152/Gazeta-2019-35-2-articulo-05.pdf

Morin, E. (2020). *Festival de incertidumbres*. Institut des sciences complexes. https://www.incomplex.org/wp-content/uploads/2020/05/MORIN-Edgar-2020-Festival-de-incertidumbres.pdf

Moscona, J. (2021). Environmental catastrophe and the direction of invention: Evidence from the American Dust Bowl. *SSRN*. https://doi.org/10.2139/ssrn.3924408

Mouffe, C. (2022). *Agonística: pensar el mundo políticamente*. Fondo de Cultura Económica.

Nicolescu, B. (1994). *La transdisciplinariedad: manifiesto*. Ediciones Du Rocher.

Olmos, Á. P. (2022). La ética de la fraternidad y violencia en Weber y Bonhoeffer. *Sociología Histórica*, *2* (1), 92–137. https://doi.org/10.6018/sh.578481

Ontano, M., Mejía-Velastegui, A. I., & Avilés-Arroyo, M. E. (2021). Principios bioéticos y su aplicación en las investigaciones médico-científicas: Artículo de revisión. *Ciencia Ecuador*, *3* (3), 9–16. https://www.cienciaecuador.com.ec/index.php/ojs/article/download/27/90

Orozco, H., & Lamberto, J. (2022). La ética de la investigación científica: consideraciones desde el área educativa. *Perspectivas: Revista de Historia, Geografía, Arte y Cultura*, *10* (19), 11–21. https://perspectivas.unermb.web.ve/index.php/Perspectivas/article/view/355

Rathbun, B. C., & Stein, R. (2020). Greater goods: Morality and attitudes toward the use of nuclear weapons. *Journal of Conflict Resolution*, *64* (5), 787–816. https://doi.org/10.1177/0022002719879994

Revilla Figueroa, D. M. (2020). *El método de investigación documental: Los métodos de investigación para la elaboración de las tesis de maestría en educación*. Editorial Universitaria.

Rezende, K. F. S. (2022). Pregando resistência em tempos sombrios: responsabilidade como resistência ao nazismo nos sermões de Dietrich Bonhoeffer (1932-1937). [Tesis doctoral, Universidade Federal de Minas Gerais]. Repositório UFMG. https://repositorio.ufmg.br/handle/1843/55728

Rodríguez-Díaz, A., & Mundi, V. (2021). El método científico como proceso sistémico: De la inducción-deducción a su representación. *Revista Visum Mundi*, *5* (1), 9–26. https://www.academiajournals.com/s/Rodriguez-Diaz-VM-V5N-2021-9-26.pdf

Sarkar, C. G. (2020). Tetraethyllead (TEL) in gasoline as a case of contentious science and delayed regulation: A short review. *Oriental Journal of Chemistry*, *36* (1), 86–95. http://dx.doi.org/10.13005/ojc/360111

Sawicka-Gutaj, N., Gruszczyński, D., Guzik, P., Mostowska, A., & Walkowiak, J. (2022). Publication ethics of human studies in the light of the Declaration of Helsinki: A mini-review. *Journal of Medical Science*, *91* (2), e700. https://doi.org/10.20883/medical.e700

Schelling, J., Wilhelm, F., & Díaz, J. (2022). Descartes. *Ideas y Valores*, *71* (180), 281–304. https://doi.org/10.15446/ideasyvalores.v71n180.104679

Soto-Ortigoza, M., Soto, A., & Espinosa, E. (2023). Gamificación laboral, pilar de las organizaciones inteligentes. *Revista Plus Economía*, *12* (1), 74–81. https://revistas.unachi.ac.pa/index.php/pluseconomia/article/download/623/499

Trust, T., Whalen, J., & Mouza, C. (2023). ChatGPT: Challenges, opportunities, and implications for teacher education. *Contemporary Issues in Technology and Teacher Education*, *23* (1), 1–23. https://www.learntechlib.org/primary/p/222408

Vázquez, G. A. (2022). Crónicas del Antropoceno: el siglo del tetraetilo de plomo. *Anales de Química de la RSEQ*, *118* (2), 110. https://analesdequimica.es/index.php/AnalesQuimica/article/download/1712/2321

Vigevano, M. R. (2021). Inteligencia artificial aplicable a los conflictos armados: límites jurídicos y éticos. *Arbor*, *197* (800), a600. https://doi.org/10.3989/arbor.2021.800002

West, S., Haider, L. J., Stålhammar, S., & Woroniecki, S. (2020). A relational turn for sustainability science? Relational thinking, leverage points and transformations. *Ecosystems and People*, 16 (1), 304–325. https://doi.org/10.1080/26395916.2020.1814417

White, M. G. (2020). Why human subjects research protection is important. *Ochsner Journal*, 20 (1), 16–33. https://doi.org/10.31486/toj.20.5012

Xu, X. (2021). To repress or to co-opt? Authoritarian control in the age of digital surveillance. *American Journal of Political Science*, 65 (2), 309–325. https://doi.org/10.1111/ajps.12514

Zweig, S. (2021). *El candelabro enterrado*. Egodot.

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Data curation: Juan Carlos Osorio Amaya.
Formal analysis: Juan Carlos Osorio Amaya.
Research: Juan Carlos Osorio Amaya.
Methodology: Juan Carlos Osorio Amaya.
Project administration: Juan Carlos Osorio Amaya.
Resources: Juan Carlos Osorio Amaya.
Software: Microsoft Office.
Supervision: Juan Carlos Osorio Amaya.
Validation: Juan Carlos Osorio Amaya
Visualization: Juan Carlos Osorio Amaya
Writing – original draft: Juan Carlos Osorio Amaya.
Writing – proofreading and editing: Juan Carlos Osorio Amaya.