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The value of applied ethics in engineering studies in a horizon of reliable artificial intelligence

El valor de la ética aplicada en los estudios de ingeniería en un horizonte de inteligencia artificial confiable

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Abstract

Political institutions such as the European Commission and the Government of Spain have expressed their interest and willingness to lay the foundations for ethical governance of Artificial Intelligence (AI). In particular, they have proposed the promotion of reliable Artificial Intelligence through a set of guidelines and strategies. Despite the benefit provided by these political initiatives, it is not possible to fully appreciate a specific educational strategy that contributes to the generation of an ethical AI ecosystem based on trust. In this sense, the main objective of this work is to demonstrate that the teaching of applied ethics in engineering studies constitutes a commitment to professional strengthening, ethical governance and responsible research and innovation. To achieve this objective, some of the essential aspects that give significant value to the teaching of applied ethics will be detailed, highlighting the social responsibility that universities present in this field. Secondly, a classification of ethics subjects related to engineering in the environment of Spanish public universities will be shown. And, thirdly, a theoretical framework rooted in discursive ethics will be offered, promoting a civic perspective in the educational context of the professions.

Keywords

Ethics, engineering, artificial intelligence, education, civic responsibility, university.

Resumen

Instituciones políticas como la Comisión Europea y el Gobierno de España han manifestado su interés y predisposición para sentar las bases de una gobernanza ética de la Inteligencia Artificial (IA). En particular, han planteado el impulso de una Inteligencia Artificial confiable a través de un conjunto de directrices y estrategias. A pesar del beneficio que reportan estas iniciativas políticas, no es posible apreciar en su conjunto una estrategia educativa específica que contribuya a la generación de un ecosistema ético de IA fundamentado en la confianza. En ese sentido, el objetivo principal de este trabajo consiste en explicar que la enseñanza de la ética aplicada en los estudios de ingeniería constituye una apuesta para el fortalecimiento profesional, la gobernanza ética y una investigación e innovación responsables. Para alcanzar este objetivo, en primer lugar, serán detallados algunos de los aspectos esenciales que dotan de un valor significativo a la enseñanza de la ética aplicada, subrayando la responsabilidad social que presentan las universidades en este terreno. En segundo lugar, se mostrará una clasificación de las asignaturas de ética relacionadas con la ingeniería en el entorno de las universidades públicas españolas. Y, en tercer lugar, se ofrecerá un marco teórico enraizado en la ética discursiva, promoviendo una mirada cívica en el contexto educativo de las profesiones.

Palabras clave

Ética, ingeniería, inteligencia artificial, educación, civismo, universidad.

Introduction

Artificial intelligence (AI) is a technology that brings important benefits, although it triggers numerous problems and controversies, for example, in terms of algorithmic biases (Angwin *et al.*, 2016; Eubanks, 2018), opacity of systems (Larsson and Heintz, 2020), sustainability (Crawford, 2023), etc. This ambivalence has motivated the European Commission and the Spanish Government to promote reliable AI, based on a *humanocentric perspective*, through a series of initiatives. While these proposals

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are a worthy response, they lack a specific educational strategy that can contribute to the development of AI aligned with the wishes and needs of citizens. Therefore, the main objective of this paper is to explain the value that applied ethics can transmit to technical studies, especially to engineering, in terms of professional strengthening, ethical governance and responsible research and innovation.

The methodology used to achieve this objective consists mainly in the bibliographic analysis of European and Spanish initiatives focused on a reliable AI ecosystem, various experiences that have favored the moral development of students and the cultivation of professional responsibility, as well as a set of essential references of civic ethics. In addition, a quantitative exploration of academic engineering curricula related to AI has been carried out in the context of Spanish public universities.

As for the structure, this paper is divided into four parts. Firstly, some elements that contribute to the European vision for reliable AI are detailed; secondly, a series of activities that emphasize the importance of teaching ethics are presented; in the third part it is possible to see a relationship of subjects linked to ethics and engineering; finally, a framework based on civic ethics is proposed to project a procedural, hermeneutic, dialogic and critical perspective in the engineering profession, through education, underlining the social character of professions in plural societies (Conill and Arenas Dolz, 2010).

Institutional Interest in Reliable AI

During the last decade, the European Commission and the Spanish Government have presented several initiatives that express their interest and will to pursue an ethical development of AI, especially through the conceptualization of a reliable AI. In the former case, this inclination has been expressed more prominently, as attested by the *Ethics Guidelines for Trustworthy AI* and *White Paper On Artificial Intelligence: a European approach to excellence and trust*. Regarding Spain, the various resolutions on AI point to the need to ensure an ethical future for this technology. However, the set of proposed guidelines to promote ethics do not detail specific educational mechanisms, as will be argued below.

Before analyzing some elements of the initiatives of the European Commission and the Spanish Government, a reliable approach to AI is necessary. Almost seven decades have passed since the Dartmouth Summer Research Project on Artificial Intelligence, an event symbolizing the

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genesis of synthetic intellects (McCorduck, 1991, pp. 95-96). Over the years, it has become increasingly clear that artificial systems not only provide important benefits, but also carry worrying ethical, legal, social, environmental challenges, etc. (Floridi, 2021). As a response to these challenges, a large number of calls have been formulated for a beneficial AI (Future of Life Institute, 2017), a responsible AI (Dignum, 2019; Université de Montréal, 2017), an AI for the common good (AI4SG) (Monasterio Astobiza, 2021), an ethical AI (Floridi *et al*., 2018), among others.

Beyond the complement used for AI, all of these manifestations emphasize essentially the same objectives – i.e., the need to maximize benefits and reduce or prevent risks and hazards. Within the European Commission, the Independent High Level Expert Group on Artificial Intelligence developed the *Ethics Guidelines for Trustworthy AI* (Comisión Europea, 2018) to provide a basis for reliable AI through the proposal of a set of principled ethical guidelines. The concept of reliable AI initially presented assumes that trust is an essential element for the constitution and strengthening of European society. However, the conceptualization of trust and the strategies that should be considered to promote it represent very complex tasks that are currently being discussed.

Later, in 2020, the European Commission launched *White Paper On Artificial Intelligence: a European approach to excellence*, another initiative that expresses the intention to make the European political community a global leader in AI innovation. The basic pillars of the *White Paper* are, on the one hand, a policy framework for establishing an environment of excellence through research and innovation driven by public-private partnerships; on the other hand, an environment of trust as an essential element for a future normative and respectful of the EU political project and a humanocentric development of AI.

Regarding the Spanish context, there are fundamental resolutions. Firstly, the National Strategy of Artificial Intelligence (Gobierno de España, 2020a), the most important bet to promote the development of AI as an engine of change and strengthening of institutions. The Government of Spain has expressed the desire to integrate ethics into AI research and innovation, with the aim of striking a balance between technical opportunities and social welfare through a set of actions, such as the design of GobTechLab, the ethical and legal evaluation of automated systems, the creation of citizen forums such as Digital Future Society, the elaboration of a "Digital Bill of Rights", among other activities.

Secondly, the Digital 2025 Spain Plan (Gobierno de España, 2020b) projects the digital transformation scheduled in the coming years.

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 213-235.

Its main objectives are to promote economic growth, reduce inequalities, improve and increase productivity and exploit the potential of new technologies. This plan consists of a set of ten strategic axes, among which is "Data Economics and Artificial Intelligence". Finally, in the Recovery, Transformation and Resilience Plan (Gobierno de España, 2021) it is also possible to appreciate a reference to AI in component no.16 of the 6th lever, entitled "Pact for science and innovation: strengthening the capacities of the National Health System". This component is articulated through the National Strategy for Artificial Intelligence, mentioned above.

The above initiatives are a worthwhile way to promote trust, however, they are limited by the rapid advance of technology and the risk of obsolescence of regulatory and self-regulatory frameworks. It is essential to emphasize the value of teaching applied ethics as a response to the challenges of AI. The challenges of this technology constitute a call to address central questions about the role of those affected by synthetic intellects, the principles that guide their development, the mechanisms that facilitate the generation of trust, the criteria that should be considered for evaluating the impacts, how to involve society in the changes, etc. (González Esteban and Calvo, 2022, p. 4). For these purposes, it is essential to encourage the adaptation of research and innovation to the needs of citizens. Therefore, it is desirable to base the education of the professional in a procedural, hermeneutic, dialogic and critical framework such as that offered by the civic ethical tradition. The lack of a specific educational strategy on applied ethics makes it difficult to cultivate moral reflexivity for fair and responsible management within pluralistic societies. Therefore, it is necessary to demand a greater role of applied ethics, particularly in the Spanish context, in order to pave the way to the generation of a reliable environment and cultivate a cordial, dialogic, inclusive and critical *ethos* in engineering professionals who are immersed in the universe of synthetic intellects.

The Educational Value of Ethics for Engineering

As technological innovation evolves at an increasingly accelerated pace, the ability and opportunity to reflect on the ethical aspects involved in engineering has become a reasonable demand (Bengoetxea and Mitcham, 2010). It is essential that professionals can identify ethical issues in their workplace, since AI represents a conglomerate of ideologies, practices, materials, energy flows, institutions, etc., that make up a complex sociote-

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chnical unit. Economic *accelerationism* has imposed a work rhythm that demands the availability of results in a short period of time, hindering ethical reflexivity. Additionally, the ideology of *technological solutionism* has permeated the engine of research and innovation, weakening critical judgment (Morozov, 2015). Consequently, this situation requires the promotion of the teaching of ethics as a vital activity that impacts on sensitivity and stimulates a significant improvement in moral reasoning skills (Clarkeburn *et al.*, 2002). The need to carry out ethical decisions has increased its importance in the environment of all professions, especially in engineering, in view of its social impact.

In response to this need, there are some proposals aimed at estimating the teaching of ethics. The Accreditation Board for Engineering and Technology (ABET) promoted, in 1998, a set of criteria contained in the *Engineering Criteria 2000* (EC2000), to encourage ethical commitment in American engineering education programs (Volkwein *et al.*, 2004). A few years later, in 2004, UNESCO launched the Ethics Education Program, which focused on providing information to policymakers, teachers and researchers through the exchange of experiences, training in teaching skills to promote the teaching of ethics and the development of a proposal for a basic curriculum for the area of bioethics, in line with the *Universal Declaration on Bioethics and Human Rights* (UNESCO, 2006). The success of this program in the area of bioethics invites a similar effort in other areas, especially in ethics applied to AI. Finally, another experience that illustrates the importance of the estimation of ethics in the professional environment and that deserves special attention is Ethos Living Lab (ELL), a project conducted at the end of 2018 by teachers and researchers in the area of moral, political and social philosophy of the Faculty of Philosophy and Education Sciences of the University of Valencia. The ELL links the university community with the Valencian professional colleges, with the aim of promoting and strengthening ethical skills, encouraging commitment and increasing moral sensitivity, both of the professionals and the academic collective (Terrones Rodríguez, 2023). In short, these initiatives point to the relevance of the estimation of ethics and an opportunity to identify the moral relevance of the most outstanding issues, which undoubtedly includes AI.

The experiences mentioned above suggest that the search for a place for ethics in the educational context stands out for its difficulty. In any case, it is important to emphasize the substance of education, in moral terms, with respect to instruction. While the former introduces ethical factors that shape *ethos* and personality, the latter deals with the transfer

Sophia 36: 2024.

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 213-235.

of technical knowledge and aspires to different epistemological interests (Gracia Calandín, 2018, p. 76). This consideration entails the recognition of the peculiarity of the teaching of ethics (Ortiz, 2008), since it is not a philosophical branch especially linked to knowledge and technical skills, but to attitude and character, as Diego Gracia points out (2016, p. 7). After this clarification, it is necessary to underline that the main purpose of ethics in educational action responds to moral development through intellectual instruments, such as reflection, and interaction skills, such as dialogue or deliberation (Terrones Rodríguez, 2017). In this way, an education that values ethics sufficiently recognizes the role of critical judgment, the influence of moral sensitivity and social commitment (Lönngren, 2020). However, it is appropriate to point out the lack of consensus regarding the definition of ethics and its teaching in the context of engineering (Hess and Fore, 2018). However, Joseph R. Herkert (2001, 2005) establishes a distinction between microethics and macroethics that constitutes an essential reference for this work. The North American ethicist states that microethics deals with ethical issues that engineers face from an individual level; while macroethics is oriented to the reflection of the social impacts of technological development and the responsibility of professionals. Although the microethical perspective is fundamental for professional performance, given the socio-technical complexity of AI, it is understood that it is necessary to invest more educational efforts in the macroethical field.

AI professionals are continually faced with the difficulty of making decisions that require ethical competence that involves much more than simply understanding theories. Ann Gallagher (2006) defines this competence as the possession of ethical knowledge along with the ability to appreciate the moral relevance of a situation (ethical perception); to reflect critically on what professionals know, are and do (ethical reflection); to highlight the importance of ethical practice (ethical behavior); and to be ethical. Although Gallagher brings together these five ethical skills with the intention of improving nursing education, it is possible to move his proposal to the field of engineering (Barry and Ohland, 2013). The area of care provides numerous *examples to highlight the substantial implications of integrating ethics into training plans (Byrne et al.*, 2015).

Likewise, understanding the significance of responsibility stands as a fundamental element. Its importance originates in globalization as a stimulant for generating questions about existing standards of excellence and current conceptions of internal engineering goods. The work conducted by Alejandra Boni and her colleagues (2019) at the Universitat Politèc-

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nica de València highlights the scope of establishing practical links with real contexts to stimulate the flourishing of professional responsibility.

The significance of professional responsibility and the deterioration of character caused by the capitalist machinery (Sennet, 2000), require a greater involvement of universities in ethical education. Agustín Domingo Moratalla (2010, pp. 104-106) argues that universities concerned with professional ethics must offer three models of responsibility: first, a responsibility aimed at mechanistic professionalization through a pragmatic economic commitment; second, the university has to be involved in civic modernization through civilizing professionalism, since it is convenient to understand professional responsibility as public co-responsibility; finally, the cultivation of responsibility can also be expressed in identifying professionalization, i.e., that involved in personal religion, complication and commitment.

Engineering is closely linked to AI, which gained its notoriety in the Fourth Industrial Revolution (Chen and Shen, 2019). As substantial changes are emerging in the political, economic and cultural spheres, as subsystems that integrate social reality, as a result of the evolution of artificial systems, the responsibility of engineering needs to be emphasized. In any case, with the interest of clarifying the reflexive task of this work, it is appropriate to direct attention to those engineering areas related to AI research and innovation, among which can be found specialties such as computer science, computing, *software*, robotics, data science, among others. These engineering projects offer an indispensable service to society and contribute to the strengthening of economic and social systems.

The peculiarity of engineering and the social commitment expected from it, are two fundamental elements that motivate the recognition of the substantial value of ethics and its teaching. Highlighting this value means betting on the social responsibility of universities, emphasizing their mediating vocation in promoting such important values as justice or solidarity (Domingo Moratalla 2005). In this framework, the integration of applied ethics in engineering university studies related to AI can contribute: first, to link strategic rationality with discursive rationality, considering not only subject-object rationality, but subject-subject rationality, where there is an important axiological contribution; second, to promote symmetry between interest groups affected by collective decisions, in order to legitimize decision-making processes; finally, to insist on a critical understanding of the ends (Lozano Aguilar, 2010, pp. 271-272).

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 213-235.

Ethics and its teaching in Spanish higher education

The most widespread strategy in Spanish public universities that offer undergraduate and master's degrees in engineering committed to AI knowledge and try to integrate an ethical perspective, consists in the use of an ethical approach. This approach has permeated some institutions and organizations, encouraging self-regulation and compliance with regulatory codes. Although ethics improves professional development, it is appropriate to stimulate moral reflexivity, in macroethical terms, especially on issues related to equal opportunities, transparency, explanability, the digital divide, sustainability, etc. Therefore, it is essential to call for an increase in the teaching of ethics, in order that it is not reduced to an optional and decorative element of training (Gracia, 2016, p. 170).

The review of the academic engineering programs linked to the study of AI shows a rough knowledge of the trends that arouse more interest. In the context of public Spanish universities, a general inclination towards the technical-professional perspective predominates. Out of a total of fifty universities, 19 offer subjects in undergraduate and master's studies that suggest an ethical reflection in their degree. However, after analyzing the programs, the majority, i.e., 30 out of 44, address ethics from a deontological point of view; followed by seven subjects in which the term "ethics" is used to refer to their denomination, although in their development issues specific to moral philosophy; are not addressed, ultimately, there are seven subjects that deepen the problems and social challenges of AI, and that could be located in the wake of applied ethics.

Table 1
List of subjects suggesting an ethical reflection in their degree

Degree	Subject
1. Applied ethics	
Autonomous University of Barcelona	
Degree in Computer Engineering	Ethics for Engineering
Degree in Artificial Intelligence	Ethics for Engineering
Carlos III University of Madrid	
Degree in Robotic Engineering	Ethics and social involvement of robotics
University of Barcelona	
Master of Fundamentals of Data Science	Ethics for Data Science

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 213-235.

University of Girona	
Master in Intelligent Field Robotic Systems	Ethics and technology
University of Granada	
Degree in Computer Engineering	Computer ethics and the information society
Universitat Jaume I	
Master in Marine and Maritime Intelligent Robotics	Fairness, Accountability and Transparency in AI
2. Ethics	
Carlos III University of Madrid	
Double Degree in Data Science and Engineering, and Engineering in Telecommunications Technologies	Legal and Ethical Aspects in Data Engineering
Bachelor in Data Engineering	Legal and Ethical Aspects of Data Engineering
Master in Computer Engineering	Legal and ethical aspects of engineering
Master in Applied Artificial Intelligence	Ethical and Legal Implications of AI
Double Master in Computer Engineering	Legal and Ethical Aspects in Data Engineering
Complutense University of Madrid	
Bachelor's Degree in Computer Engineering	Ethics, legislation and profession
Bachelor in Software Engineering	Ethics, legislation and profession
Degree in Computer Engineering	Ethics, legislation and profession
University of Barcelona	
Master of Biomedical Data Science	Ethics, legislation and privacy
University of Cantabria	
Degree in Computer Engineering	Values, ethics and the computer profession
University of Girona	
Bachelor's Degree in Video Game Design and Development	Legislation and professional ethics
Degree in Computer Engineering	Legislation and professional ethics
University of Granada	
Master in Software Development	Usability Engineering and Computer Ethics
University of La Laguna	
Degree in Computer Engineering	Code of ethics and legal aspects

Sophia 36: 2024.

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 213-235.

University of Oviedo	
Bachelor in Software Engineering	Social, legal, ethical and professional aspects
University of Valencia	
Degree in Computer Engineering	Ethics, legislation and IT
University of Barcelona	
Degree in Computer Engineering Services and Applications and Degree in Mathematics	Legal, ethical and professional aspects
Polytechnic University of Barcelona	
Degree in Artificial Intelligence: Ethical and Social Aspects of Artificial Intelligence	Ethical and Social Aspects of Artificial Intelligence
Polytechnic University of Madrid	
Double Degree in Computer Engineering and Technologies for the Information Society	Ethical and social aspects
Degree in Data Science and Artificial Intelligence	Ethical and social aspects
Bachelor's Degree in Computer Engineering	Ethical and social aspects
Bachelor of Engineering and Data Systems	Ethical and legal framework
Bachelor in Software Engineering	Ethical and social aspects
Degree in Technologies for the Information Society	Ethical and social aspects
Master in Data Science	Ethic/legal/social aspects in Data Science
Master in Artificial Intelligence	Ethical and legal aspects of Artificial Intelligence
University of Valencia	
Double Degree in Business Administration and Management + Computer Engineering	Ethics and professionalism
Universitat Pompeu Fabra	
Degree in Computer Engineering	Fairness, accountability, transparency and ethics in IT
Rey Juan Carlos University	
Degree Artificial Intelligence	Ethics and legislation in artificial intelligence
Universitat Rovira and Virgili	
Interuniversity Master in Biomedical Data Science	Ethics, regulation and privacy

Sophia 36: 2024.

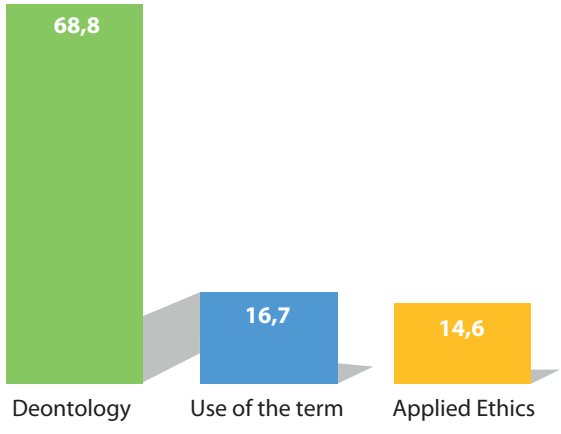
Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 213-235.

3. Use of the term	
University of Jaén	
Double Master in Computer Science and Computer Security	Ethical Hacking
University of La Laguna	
Master's Degree in Cybersecurity and Data Intelligence	Ethical Hacking and Forensic Analysis
National University of Distance Education	
Degree in Computer Engineering	Ethics and legislation
Master in Cybersecurity	Ethical Hacking Ethics and legislation
Master in Computer Engineering	Ethics and legislation
University of Valencia	
Degree in Computer Engineering	Ethics and professionalism Ethical Hacking
Master's Degree in Cybersecurity and Cyberintelligence	Pentesting and Ethical Hacking

Source: Curricula and syllabuses of the subjects of Spanish public universities.

The following figure shows the percentage values of the distribution of these subjects:

Figure 1
Percentage distribution of subjects



Source: Curricula and syllabuses for the subjects indicated in the table above.

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 213-235.

As seen in the graph, there is more inclination towards the integration of deontological elements to respond to the challenges of AI. Joakim Sandberg (2013) defines ethics as an ethical approach responsible for judging the morality of actions based on their adherence to a series of principles or rules, which usually divide moral actions according to three categories: mandatory, prohibited and permissible. The main value of ethics lies in its application to the environment of the professions, designating the particular ethics of a given profession (Ten Have and Patrão Neves, 2021).

In the path of ethics, it is appropriate to emphasize the presence of instruments and procedures for self-regulation of professional practice called "codes of ethics" (CE), formed by a set of guidelines expressed in documents of a regulatory nature (Bilbao *et al*., 2006). These codes are intended to provide guidance to professionals who, in the performance of their work, encounter moral problems and to provide a description of those values and principles that are desirable. In the field of engineering, Michael Davis (1998, p. 43) states that the main objectives of these codes are to guide the professional and help prevent bad behavior; to serve as a reference for other agents to judge his behavior, favoring the reputation of the profession as a whole; and to contribute to the definition of the image that a professional has of himself. In conclusion, it is possible to affirm that the deontological approach is mainly located in a technical-professional perspective.

Due to the complexity of the current challenges of AI and the exacerbation of certain problems, although they are necessary and are a useful element to satisfy the operability of responsibility, deontological self-regulation initiatives are insufficient to configure development alternatives that are based on dynamics of moral reflexivity and ethical inculturation sensitized with civic values (Davis, 2020).

First, as Adela Cortina points out (1996), applied ethics, by virtue of its critical hermeneutic nature, points out as an essential objective the discovery of those moral aspects committed in human activities. It also reflects on the adequacy of the means for the approach to the internal good, in harmony with the civic morality shared within a pluralist society. And it emphasizes the collaboration between the various parties affected by the implementation of the activities.

Secondly, the lack of interest in the deepening of moral reflexivity is another reason to point out the limits of deontology. The mere mechanical compliance with the codes does not imply normative questioning or motivate a critical hermeneutic perspective of human activities

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 213-235.

(Domingo Moratalla, 2018, p. 77). Moreover, strict compliance with the rules induced by ethics is insufficient, first and foremost, because the regulations indicate the legality or illegality of actions, but do not motivate the questioning of the good and the best actions, i.e., on what foundations are those that make it possible for a society to be better. Consequently, the strategy adopted by Spanish public universities to promote ethics in the AI environment is insufficient due to the limitations of the deontological procedure and the complexity of this sociotechnical system and the ambivalence of its results. Therefore, it is necessary to promote mechanisms of educational innovation to promote a sustained ethical inculturation in a procedural, hermeneutic, dialogic and critical framework such as that offered by the discursive tradition.

Despite the characteristics of his research, which has not had as its object the Spanish case, the work carried out by Byron Newberry (2004) contributes to identifying the possible causes that motivate the lack of recognition of the value of ethics in the engineering academic space. The apparent superficiality characteristic of the subjects hinders emotional commitment to ethics. The essentially technical environment does not favor the dialogic encounter with other knowledge, diminishing moral reflection. Likewise, the rigidity of the study plans to integrate ethics induces in the students a dogmatic vision about the technique and the underestimation of other knowledge, mostly humanistic.

To offer solutions to the many challenges of AI and its multiple natures, central problems that condition its development should be addressed by asking questions about the role of those affected by this technology, what mechanisms to undertake to promote transparency and explanability, what principles should guide its design and implementation, what criteria should be incorporated for the assessment of impacts, how to facilitate the generation of trust, how to include society to make it participate in these changes, etc. These types of questions stimulate civic awareness that can enrich the study of engineering and, therefore, professional practice through a strengthening of moral reflexivity, by integrating alternative sapiential elements to the technical dogma. The drift that research has adopted in the field of AI, reducing the understanding of systems to strictly technical aspects, causes an epistemological gap that hinders analyzes of the moral and political implications of artificial systems (Dahlin, 2021). Therefore, it is essential to conduct an encounter with the ethical-civic tradition, with the purpose of strengthening and complementing self-regulation and, at the same time, develop educational dynamics that lay the foundations of an ethical governance of AI, based

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 213-235.

on more participatory and deliberative processes, in order to achieve fair and responsible management that recognizes those affected in the context of technological societies.

Civic ethics as a normative framework for education

The discursive tradition initiated by Karl Otto Apel (1985a, 1985b) and Jürgen Habermas (1989, 2000) in the 1980s, and later extended by Adela Cortina (1986, 1990, 2007, 2010), Jesús Conill (2006) and Domingo García Marzá (1992, 1997, 2004), establishes that the process of the moral action of norms must result from the participatory discourse of all those affected by these norms. This idea consolidates in the discursive tradition as a regulatory idea or transcendental process of foundation that contains two essential implications: first, that all those affected by the rules must be considered valid and included in the dialogue, and second, that ideal conditions for a true rational dialogue must be established.

The ethical-discursive proposal is deployed in a moral horizon where the purpose of the discourse consists in searching common needs of all those affected by a conflict of interests. According to that assessment, it is possible to establish common interests so that all people concerned may have their subjective considerations recognized. In this sense, the correctness or fairness of a rule depends on the possibility of finding a general agreement among those affected (García Marzá, 1992, pp. 60-61). This discursive assessment establishes a common thread between moral questions and ethical questions, since subjective interests affect, to a greater or lesser extent, the rest of those involved in norms, considering that life is a common space that calls for a broader exercise of moral reflexivity, with an aspiration to the universal validity of norms or their legitimacy (Habermas, 2000, pp. 114-115). Therefore, the *factum* of discursive reason requires the participants of the discourse to assume, previously, the possibility of reaching a rational consensus that expresses the common interest of all those affected as a maximum of universal validity.

The discursive approach has motivated criticisms that revolve around an alleged idealization and abstraction. On the one hand, Horst Steinmann and Albert Löhr (1994), resorting to a philosophical postulate of Paul Lorenzen (1987), argued that the beginning of dialogue is the experience of conflict and a universal aspiration to peace, and according to this consideration, the transcendental foundation of communication proposed by the ethical-discursive tradition can be idealistic. On the

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other hand, Steinmann and Löhr (1994) insist on the impossibility of a rational dialogue between all those affected under symmetrical conditions. An additional criticism is formulated by Cortina and is directed to the excessive abstraction of the procedural approach of Apel (1985a, 1985b) and Habermas (1989, 2000), and to a position of reason too focused on logic. The position of the Spanish philosopher responds to the need to attend to the emotional dimension and the influence of the historical context, two elements, according to author, that have not been sufficiently addressed by the Germans. Thus, Cortina (1986, 1990, 2007, 2010) tries to overcome the criticisms to the discursive tradition through the presentation of a program of civic ethics that gathers the witness of some elements of hermeneutics. Its program brings together an ethical moment for the foundation of norms, the sense cultivation of the *telos* of human praxis, the assessment of the factual complexity of the real world and responsibility for the future (Cortina, 1986, 1990, 1994, 2001, 2007, 2010). The civic ethics proposed by the author responds to the complexity of a pluralistic society, where there are two levels: the first, formed by various valuative prescriptions that understand morality as an essential element for the design of a congratulatory way of life (ethics of maxims); the second level, referred to a shared civic morality within the framework of moral minima demandable to any person (ethics of minimums) (2001, pp. 202-206). The hermeneutic, critical and dialogic spirit that underpins civic ethics can contribute to the moral development of engineering professionals, with the intention of adapting research and innovation to the needs of citizens and, therefore, promote the generation of an European AI ecosystem inspired by trust.

Ethics applied to professions must honor the moral conscience reached in our time and accept as a reference a shared ethics, therefore, moral education in the space of engineering must assume the influence of an ethical and civic thought that is fundamental for coexistence in modern societies. Such a commitment implies the recognition and commitment to the values that Cortina integrates in civic ethics: freedom, equality, solidarity, active respect[1] and predisposition to dialogue (Cortina, 1994; Cortina *et al.*, 1996, pp. 27-38).

Although civic ethics recognizes the dignity of all professions on equal terms, it should be noted that, depending on their contribution to society, not all occupations have the same degree of responsibility (Martínez Navarro, 2006, p. 12). Especially engineering offers an essential service to society and contributes to its modernization, therefore, its professionals perform a particular task to which special attention must be paid.

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 213-235.

The particularity of engineering lies in the relationship it maintains with the technique, since it is conceived as a means and an end, which is why engineers are considered the preferred technicians (Gómez-Senent, 2000).

In the specific case of engineering involved in AI, it is not enough to have a professional ethic in itself that determines what are the good practices, since the challenges of technological societies require the definition of these practices in an inclusive and participatory way, recognizing the existence of a set of people affected by the profession. This recognition entails the acceptance of those affected as valid partners and attention to their needs, in view of a shared ethical benchmark essential to care for coexistence in pluralistic societies (Martínez Navarro, 2006, p. 7). As soon as the professional ethics of engineering has estimated the set of values of civic ethics and adapted the internal goods of their profession, it is important to explore what means are the most suitable to contribute to the cultivation of trust in the field of AI, and this is where the role of education intervenes to encourage citizen engagement.

A serious commitment to the axiological content of civic ethics will foster the creation of an European AI ecosystem based on trust, thereby involving civil society in research and innovation through practical adaptability mechanisms. The fair and responsible management of artificial systems through a balance between ethical acceptability and social need is possible if the technical professions, in this case engineering, as social institutions, integrate civic ethics as one of the pillars of their education. In a pluralistic society such as Europe, where institutions such as the European Commission and the Spanish government have shown an interest in ensuring responsible AI governance, it is crucial to emphasize the richness of civic ethics.

European and Spanish policy initiatives that express their interest in the generation of an AI ecosystem based on a humanocentric perspective, should invest more educational efforts to ensure that higher education institutions cultivate shared basic values, so that they institute inclusive, innovative and reflective societies.[2] As noted in a previous section, the goal of education regarding instruction is to incorporate ethical variables that model the axiological dimension of character and personality (Gracia Calandín, 2018, p. 76). In this sense, the cultivation and strengthening of civic and democratic skills in the engineering environment constitutes an act of educational responsibility that benefits social cohesion, fosters reliable scientific development and inspires new forms of sensitivity and rationality (Gazmurri Barros, 2022).

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 213-235.

Conclusion

All the initiatives of the European Commission and the Spanish Government represent a commitment to the ethical governance of AI. While most of these institutions' approaches are a worthwhile way to establish a trust-based ecosystem, they lack a concrete educational strategy in the higher education space. In particular, engineering studies do not have sufficient educational elements in the area of applied ethics. This deficiency makes it difficult to understand the controversial and ambivalent effects of sociotechnical systems, while decreasing critical judgment and moral sensitivity to recognize a number of aspects that may be neglected as a result of computational thinking and economic accelerationism.

It is essential that the proposals for the ethical governance of AI, based on a humanocentric perspective, recognize, first, the educational value of ethics for technical knowledge and, second, integrate intellectual tools and interaction skills based on the ethical-civic tradition in the curricula. Digitization has led to the emergence of new vulnerabilities that require increased reflexivity and moral sensitivity. Therefore, the drive for educational innovation to create meeting spaces between technical knowledge and humanities must be very present in policy initiatives aiming at ethical governance of AI and strengthening inclusive, innovative and reflective societies in Europe.

Notes

1 Adela Cortina (1998) argues that active respect consists "not only in stoically enduring that others think differently, have ideals of happy life different from mine, but in the positive interest to understand their projects, to help them carry them forward, provided they represent a respectable moral point of view" (p. 240).

2 To broaden the concept of this type of company, consult the Horizon 2020 Framework Program for Research and Innovation (European Commission, 2014).

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