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Bioethics and innovation in health: teaching in graduate medical education

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Abstract

Discussions on the teaching of ethics and bioethics in medical schools have mainly focused on the individual in training, with attention differing from that observed in medical and multiprofessional residencies, where the topic is yet to reach the level of regular scientific meetings, as occurs with other aspects of professional training. However, within the curricular structures of health-related programs at graduate level, bioethics teaching has been present for decades. Considering these different contexts, this article aims to report an experience of teaching ethics and bioethics within the health sciences curriculum of graduate programs, directed at professionals involved in the development of dissertations and theses. Graduate-level teaching seeks to bring together experiences using digital tools and pedagogical strategies that promote reflective teaching-learning processes. In this context, the need to integrate science, bioethics, and humanization is emphasized, fostering critical training in the face of contemporary challenges related to innovation in health.

Keywords: Ethics. Bioethics. Education, medical. Health innovation.

Resumo

Bioética e inovação em saúde: ensino na pós-graduação em medicina

Discussões sobre o ensino de ética e bioética em escolas médicas têm se dedicado principalmente ao indivíduo em formação, com atenção diferente daquela observada em residências médicas e multiprofissionais, onde o tema ainda não alcançou o nível de reuniões científicas regulares, como ocorre com outros assuntos da formação profissional. Nas estruturas curriculares de cursos da área da saúde em programas de pós-graduação, entretanto, o ensino da bioética já está presente há décadas. Considerando essas diferentes realidades, este artigo objetiva relatar uma experiência de ensino de ética e bioética na matriz curricular da área da saúde em programas de pós-graduação, voltados a profissionais envolvidos na elaboração de dissertações e teses. O ensino na pós-graduação busca reunir experiências com ferramentas digitais e estratégias pedagógicas que favoreçam processos de ensino-aprendizagem reflexivos. Nesse contexto, destaca-se a necessidade de integrar ciência, bioética e humanização, promovendo formação crítica diante dos desafios contemporâneos da inovação em saúde.

Palavras-chave: Ética. Bioética. Educação médica. Inovação em saúde.

Resumen

Bioética e innovación en salud: enseñanza en el posgrado en medicina

Discusiones sobre la enseñanza de la ética y la bioética en escuelas de medicina se centran principalmente en el individuo en formación, mientras que en las residencias médicas y multiprofesionales el tema aún no alcanzó reuniones científicas regulares, como ocurre con otros asuntos de la formación profesional. Los planes curriculares de los programas de posgrado del área de la salud abarcan la enseñanza de la bioética desde hace décadas. Considerando estas diferentes realidades, este artículo reporta una experiencia de enseñanza de ética y bioética en la matriz curricular del área de la salud en programas de posgrado, dirigida a profesionales involucrados en la elaboración de tesis. La enseñanza en el posgrado busca reunir experiencias con herramientas digitales y estrategias pedagógicas que favorezcan procesos de enseñanza-aprendizaje reflexivos. Se destaca la necesidad de integrar ciencia, bioética y humanización promoviendo una formación crítica ante los desafíos contemporáneos de la innovación en salud.

Palabras clave: Ética. Bioética. Educación médica. Innovación en salud.

The authors declare no conflict of interest.

Research

The teaching of ethics in medical training has been the subject of intense discussions in recent decades, especially since 1970, when medical schools adopted ethics or deontology as an essential course in the program. This fact is motivated by changes that have occurred in the social, cultural, economic, technological, and political fields [1].

The term "bioethics" emerges with technological advancements and innovations in health care and, consequently, the ethical issues derived from the discoveries and applications of biological sciences. Bioethics consists in the systematic and multidisciplinary study of human conduct in the area of life and health sciences, interpreted considering moral values and principles [1].

These changes have a direct impact on the training of medical professionals, both at the undergraduate and postgraduate levels, who must be capable of making prudent decisions when faced with moral dilemmas related to human health. This context has led to discussions on the process of teaching-learning ethics and bioethics as provided for in curricular matrices of medical programs as to the space or emphasis achieved (workload and curricular credits), the reformulation of syllabi, the use of active methodologies and collaborative learning techniques, and the incorporation of feedback and assessments [2,3].

This article systematically seeks to demonstrate a process of teaching-learning bioethics and innovation in health in graduate medical education. This report may support the formulation of didactic and pedagogical strategies aligned with the active and collaborative methodologies of a learning process focused on problematization and critical reflection, in a dialogical and dialectical act, aiming to address the challenges faced by medical professionals in their daily activities [3,4].

Method

This is a report of an experience regarding the process of teaching-learning bioethics and innovation in health associated with the Graduate Program in Parasitic Biology in the Amazon (PPGBPA) at the State University of Pará (UEPA). The experience report is a type of text that addresses a lived experience with relevance to the academic sphere by providing insights into phenomena of intervention possibilities of the area and supporting academic education and professional training [4-6].

The purpose of the module is to reflect on the ethical issues and challenges present in the field of health and research, considering the context of biotechnosciences, human intelligence, and artificial intelligence. The module offering is semestral and it is taught by masters and doctors with expertise in the areas of bioethics and innovation in health.

Additionally, it aims to contribute so professionals working in different areas develop values of innovation and entrepreneurship, especially regarding issues such as economic sustainability and social and environmental responsibility [6]. From an educational point of view, it is interesting to reflect on the ethical issues and challenges present in the field of health and research, considering the context of biosciences, human intelligence, and artificial intelligence, in addition to supporting the problematization of contemporary issues related to health and care, as well as proposing new teaching and learning tools and solutions for sensitive, current, and comprehensive issues, such as the end of life and the care it demands, abortion, terminality and palliative and proportional care, and advance directives [6,7].

The data presented here refer to the experience lived by a student during 2023 in the module named "Bioethics and Innovation in Health", associated with the PPGBPA/UEPA. The scope of this experience report is based on the task of understanding and reflecting on the contemporary time and the construction processes developed throughout the history of science, bioethics, and professional ethics, in various fields of study and experiences, such as sociocultural, technological, economic, and human relations advancements.

Results and discussion

The module was conducted in eight in-person meetings, lasting three hours each, totaling 24 hours of workload. The topics addressed and the teaching-learning strategies and teacher training/ expertise were described in Chart 1.

Chart 1. Description of the topics, teaching-learning strategies used in the educational sessions.

Meeting	Topic	Teaching-learning strategies	Teacher training/*expertise*
Meeting 1	1.1 Presentation of the syllabus; 1.2 Introduction of participants: who are we? What do we expect from bioethics education?; 1.3 Brief history of bioethics.	– Presentation of the syllabus, faculty, and recommended bibliography; – Presentation, using the digital tool Mentimeter, with bioethics topics and assessment of students' prior knowledge; – Proposal for flipped classroom, based on the 2015 *Papal Encyclical*; – Feedback via Google Forms.	Module coordinator; pulmonologist physician; professor at the State University of Pará; PhD in bioethics.
Meeting 2	2.1 Foundations of bioethics for the future; 2.2 Human rights, foundations, and principles of bioethics; 2.3 Autonomy, beneficence, non-maleficence, and justice; 2.4 ESG: Environmental commitment, social commitment, and corporate governance.	– Dialogued discussion, supported by the *Universal Declaration on Bioethics and Human Rights*; – Feedback via Google Forms.	Module coordinator; pulmonologist physician; professor at the State University of Pará; PhD in bioethics.
Meeting 3	3.1 Artificial intelligence: ethical and bioethical challenges of teaching and learning, reflections.	– Use of the digital tool Mentimeter for presenting concepts about artificial intelligence; – Monitored practice on use of ChatGPT tool for development of research projects; – Presentation of European Union regulatory instrument on use of AI; – Discussion and report of student perceptions.	Nurse; Master of Morphological Sciences from the Federal University of Rio de Janeiro; professor in the medical program at Unifamaz University Center.
Meeting 4	4.1 Advances and innovations in bioethics and animal research.	– Dialogued lecture; – Conversation circle; – Simulation in development of methodology for project using animals in research.	Veterinary physician from the Federal Rural University of the Amazon; PhD in animal health and production from UFRA; professor in the medical program at Unifamaz University Center.
Meeting 5	5.1 Dilemmas and challenges of bioethics, vulnerability, and human rights; bioethics, ethics, health and professional practice (studies on professional practice codes – ethics and/or morals); bioethics and the individual – film *The Whale*.	– Dialogued lecture; – Journal club; – Audiovisual resources as a teaching and learning tool (films, videos); – Presentation of the *Papal Encyclical* in a flipped classroom model; – Flipped classroom conversation circle.	Module coordinator; pulmonologist physician; professor at the State University of Pará; PhD in bioethics.

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Chart 1. Continuation

Meeting	Topic	Teaching-learning strategies	Teacher training/*expertise*
Meeting 6	6.1 Bioethics and end of life; 6.2 Human dignity before the end of life: challenges and implications for health education advance directives and living will.	– Debate and presentation of students' experiences with flipped classroom; – Feedback via Google Forms.	Module coordinator; pulmonologist physician; professor at the State University of Pará; PhD in bioethics.
Meeting 7	7.1 Non-violent communication and breaking bad news: reflections on autonomy and the right to truth.	– Audiovisual resources as a teaching and learning tool (films, videos); – Conversation circle.	Module coordinator; pulmonologist physician; professor at the State University of Pará; PhD in bioethics.
Meeting 8	8.1 Palliative care and bereavement.	– Discussion and report of student experience; – Module Summary; – Feedback via Google Forms.	Module coordinator; pulmonologist physician; professor at the State University of Pará; PhD in bioethics.

The first meeting was facilitated by the module coordinator and began with the presentation of the syllabus, suggested references for consultation on the topic, as well as the introduction of the faculty. Each student introduced themself to the group, stating their areas of interest regarding the research objects. It was established that all students would sign a daily attendance sheet and that a product, in the form of a scientific article, related to the topics addressed in the module, should be submitted within 90 days after the end of the meetings. It was also established that, after the module ended, students would receive, by email, module assessment documents, via Google Forms, which would serve as feedback for the teachers and for PPGBPA.

The initial task was the presentation of the *Mentimeter* tool to the students, so they could answer five questions brought by the instructor with the objective of assessing the students' prior knowledge on the topic and, at the same time, promoting a reflective atmosphere and integrative discussion between the students and the teacher, fostering and facilitating the exchange of knowledge and a closer relationship among participants, who were also divided into smaller groups for this purpose.

Next, in a second session, a brief exposition was held in the form of a review of the history of relevant events in humanity's trajectory, such as the two world wars and the establishment of the Nuremberg Trials, in order to elicit the students' conceptual perspectives on ethics and bioethics. In this mode, students were encouraged to build concepts and understand the foundations of bioethics.

To conclude this first day of the meeting, the coordinator presented the concepts and pillars of bioethics and made an association with philosophical expressions of Socrates, Plato, and Kant, among others. In addition, the instructor proposed a flipped classroom model, in which volunteer students would present an expository lecture on bioethics, lasting 20 minutes, based on the *papal encyclical* published in 2015, emphasizing the following aspects: social responsibility, environmental impact, and corporate governance, to be presented at the closing of the third day's program [7,8].

In the second meeting, the discussion was based on the foundations of bioethics for the future, human rights, and the bioethics principles (autonomy, beneficence, non-maleficence, and justice), with a discussion between the smaller groups of students regarding the *Universal Declaration on Bioethics and Human Rights* [9], followed by a dialogued discussion on environmental commitment, social responsibility, and corporate governance. The Google Forms tool was used for student feedback to the instructor.

The third meeting began with the topic "artificial intelligence and bioethics," which addressed topics such as the concept of artificial intelligence, its historical course, and social

impact, especially regarding information security (reliable sources and guarantee of confidentiality), combating plagiarism (protection of intellectual property and authorship), accessibility to tools by economically disadvantaged segments of society, human employability, and the risks of replacing humans with artificial intelligence tools.

The students were divided into smaller groups and challenged to reflect on such issues and to emit an insight that represented a socialized idea from each group, based on the perception of its members, which led to extensive discussion, as well as suggestions for regulating the tools considering the "risks and benefits." The teacher presented a document from the European Union that regulates the use of artificial intelligence on that continent, which was compared to the interventions suggested by the students [7,8].

Next, the student subgroups were challenged to produce a scientific paper using an artificial intelligence tool, ChatGPT, to discuss applicability, safety, reliability, and fairness in the use of this type of instrument, while simultaneously being encouraged to reflect on risks and benefits and to suggest mechanisms that comply with ethical and bioethical precepts [7-9-11].

The fourth meeting addressed the topic "advances and innovations in bioethics and animal research," discussing legislation/regulations, methods for animal selection and maintenance, technical care with anesthesia, analgesia, adjustment of the housing environment, costs, as well as euthanasia techniques and the reuse of animals in more than one research study, and proper disposal of biological material. Continuing, smaller groups of students were challenged to build, in the classroom, a methodology for research on the topic "analgesia in female guinea pigs, after hysterectomy and bilateral salpingectomy." After each group presented their methodological design, the instructor concluded, reinforcing the correct points and making the necessary corrections and adjustments.

In the fifth meeting, the teacher and coordinator of the module presented a discussion on bioethics, vulnerability and human rights; bioethics, ethics, health, and professional practice (studies on professional practice codes—ethics and/or morals); bioethics and the individual [9]. Before concluding the day's program, the students were recommended to watch, in its entirety, the film *The Whale*, based on the play *The Whale*, by Samuel D. Hunter, which would be discussed on the last day of the module, so each student could individually express their understanding of the human, ethical, bioethical, and moral aspects involved in the scenario. The Google Forms tool was also applied for feedback.

The topic of the sixth meeting was "bioethics: dilemmas and challenges," addressing issues such as end-of-life care, advance directives, humanization, and communication. Concepts such as therapeutic obstinacy (dysthanasia), orthothanasia, and euthanasia were discussed. The teacher used videos in the classroom as a teaching and learning resource, more specifically the film *Wit*, by Mike Nichols, in a version edited for specific discussion purposes [8]. Faced with the dilemma of a patient with advanced neoplastic disease, the students expressed their perceptions on how the diagnosis and treatment proposal were presented, as well as on how they were received by the patient, in addition to discussing humanization and communication between the teams that provide care for this type of patient.

In the end, the proposal presented on the first day of the module, the flipped classroom, was implemented by volunteer students and discussed between the other students, with the teacher as mediator and tutor, so the objectives ranged from the understanding to the creation of solutions that complied with and preserved ethical and bioethical processes [7-10].

The seventh meeting, whose topic was "non-violent communication and breaking bad news: reflections on autonomy and the right to truth," discussed aspects of the film *Wit*, which prompted students to reflection, empathy, and understanding as to the need for adequate training of professionals working in this type of scenario [7-10].

The last meeting discussed "palliative care and bereavement." The teacher provided an overview of the program taught since the first day and reviewed the concepts, contexts, reflections, and suggestions of the students. All students had the opportunity to express their degree of understanding, satisfaction, and learning as to the content offered in the module and the techniques applied in the teaching and learning process [8,10,12].

Finally, there was an extensive discussion of the predefined task about the film *The Whale*, in order to reinforce the concepts and enhance the ability to reflect on life, professional, and research dilemmas, always seeking solutions or suggestions that consider and uphold ethical and bioethical principles. It was agreed that, once again, the students would use Google Forms as a *feedback* tool. The last act was the photographic record of the students and module coordinator.

Results and discussion

Bioethics as a course for the curricular structures of health care professionals applying for master's and doctoral degrees has been applied to postgraduate programs for several decades, as is the case in PPGBPA, where it is a mandatory curricular unit.

The report of the student who is one of the authors of this article, currently a doctoral student mentions, initially, a different experience with the bioethics course in the graduate curriculum, even though they already hold a master's degree, obtained in 2015, when they first had contact with bioethics, in a different teaching and learning mode than the one experienced in the PPGBPA. Considering that, the student presents their perception of the module titled "Bioethics and Innovation in Health," associated with the PPGBPA, concerning the meaning and content, also explaining their motivation for developing this document [11,12].

The initial mention by the student concerns the application of active methodologies in the lectures and discussions of the topics contained in the program syllabus. Its noted here the creativity and mastery of teaching and learning techniques of the teachers, who encouraged the students to reflect on the topics and build knowledge as prominent actors, rather than occupying a merely contemplative and little participative condition, such that they remained inert, but were prompted to produce knowledge and contribute to their own growth and to the collective [11-13].

The presentation and use of the *Mentimeter* tool for students to answer questions posed by the teacher aimed to assess the students' prior knowledge on the topic and, at the same time, promote a reflective atmosphere and discussion among them. Its use represented an innovation for most students and enabled knowledge exchange among participants and a closer relationship, as they were divided into smaller groups to share experiences, doubts, and support learning and socialization.

The opportunity to participate in knowledge construction through varied active methodologies provided a challenging, creative environment that supported the assimilation of the target learning content and fostered bonds, as the separation into smaller groups promoted discussions, which were followed by shared decision-making, creating an identity of critical thought and content among participants.

Thus, in the context of bioethics, everyone was guaranteed freedom of expression and proposition, which, in other words, relates to the principle of autonomy or self-governance, in addition to all students being granted the same condition to express their point of view, individually and collectively, thereby preserving justice, another pillar of bioethics. Truly, the opportunity to learn and contribute also being a facilitator or multiplier of acquired knowledge is an experience that transcends the classroom and reaches settings beyond the formal and regular meetings of the module.

Another practice worth mentioning was the employment of assignments for each student's personal setting, that is, outside the standard classroom (extracurricular), which promoted responsibility in the pursuit of knowledge and in the fulfillment of tasks agreed upon in the syllabus and demonstrated each student's level of commitment to the module and to their own scientific production object, in other words, it showed their professional and academic responsibilities.

The so-called flipped classroom (which addressed Francisco's *Papal Encyclical*) was an opportune mode for exercising these responsibilities, in addition to enabling a deeper consideration of the concepts and pillars of bioethics, which were discussed by the entire class, reinforcing knowledge and building student capacity as knowledge facilitators or multipliers [10,11,13].

The topic "artificial intelligence and bioethics" was greatly evocative, as it prompted the students to reflect on conflicting issues, especially about what is legal, what is ethical, and what is moral. The issue raised by the lecturer on how to use artificial intelligence tools in scientific research was reflective and intriguing and prompted the students to consider the need to assess risks and benefits.

Simultaneously, the lecturer determined the use of an artificial intelligence tool, ChatGPT, for the creation, by the smaller groups, of a scientific project with a random theme chosen by the groups (as a simulation), so they would have brief experience with the tool to then express their opinions and suggestions. One of the most significant reflections concerned the possibility that today's students, who experience some ease in producing scientific work using these tools, will be future teachers who supervise or assess the scientific production of others and experience difficulties in assessing the authenticity of these productions.

The students were prompted to provide solutions that would prevent plagiarism, breach of confidentiality, and exposure of human beings, while preserving copyright and the precepts of ethics and bioethics. The several suggestions posed by the student groups include the use of seminars to assess the authenticity of presented content (authorship), verification tools produced by artificial intelligence itself (a tool to be built to track plagiarism), and accountability shared between the advisors and graduate programs to which the author is affiliated, to name just a few. After this task, the teacher presented a document published in the European Union in 2018 on the impact of artificial intelligence on learning, teaching, and education and listed some of the main initiatives to regulate the use of these tools [13].

The topic "advances and innovations in bioethics and animal research" presented to the students experimental research practices, which were mostly new to the students, as only one of them had their research in this area. Photos and videos provided a look into a reality previously not experienced by 19 out of the 20 module participants, leading to discussions on legislation, methodology, and care for research animals, in addition to recommended techniques for handling and preventing mistreatment of experimental animals, observing issues such as acclimatization, preparation, anesthesia, peri- and post-procedure analgesia, protocols for animal reuse in more than one study, euthanasia techniques, and disposal of biological material.

Then, the smaller student groups were challenged to build, as a simulated classroom experiment, a methodology for research on the topic "analgesia in female guinea pigs, after hysterectomy and bilateral salpingectomy." Each subgroup had the opportunity to present their simulated project and propound it for discussion with the other groups, in a healthy exchange of experience and learning. In the end, the teacher responsible for the meeting conducted an intervention, noting correct aspects and suggesting appropriate corrections for methodological mistakes.

The last topic discussed was "bioethics: dilemmas and challenges," using videos in classroom as a teaching and learning resource. The real-life cases reported in films chosen by the module coordinator with the aim of discussing topics that are sensitive and still little explored in our society, even in the academic sphere, led to broad discussions on end of life, terminality, dysthanasia, orthothanasia, and euthanasia, with incorporation of bioethics precepts, such as self-governance, beneficence, non-maleficence, and justice.

From the perspective of the student who is one of the authors of this document, the teaching of bioethics in the module "Bioethics and Innovation in Health", associated with the PPGBPA/UEPA, provided significant learning not only due to the information transmitted, but also to the dynamic, challenging, and inclusive format and the topic presentation and discussion methods, which made students the protagonists in the construction of their own knowledge while contributing to the knowledge of the other students in the module, such that everyone could equally achieve the status of facilitators and multipliers of such knowledge, in addition to prompting broad discussions and reflections on current issues that are intimately related to aspects of their dissertations and theses.

Final considerations

This scientific document, in the format of an experience report on teaching bioethics within the curricular structure of health-related professionals who are building their dissertations and theses, expresses a high degree of satisfaction of the student who is one of the authors of this article, not only due to the importance of the subject for their research scope but also because it prompted reflection on professional practice and lifestyle in society. Clearly, the module "Bioethics and Innovation in Health" had the virtue of not focusing merely on the matter or instructions of the teachers, but equally on the students, which provided each participant autonomy to build and multiply knowledge.

The adopted techniques enabled broad and free debate on issues that were posed by the faculty and that had due reception among the students, such that the students would be participants and protagonists with the faculty in the search for solutions. The fact is that complex issues that involve delicate domains of personal values, customs, and preferences cannot be discussed solely from a personal perspective, as science demands from scientists reflections that take them out of their comfort zones, in order to produce more critical and expanded observations and postulates. Certainly, the module "Bioethics and Innovation in Health" combined these and other virtues, although we must consider the still prevalent dissociation between the man of science and the human person, while persisting the question of whether it is possible to teach virtue. However, it is in the realm of opportunity and reflection that humanity advances in search of solutions to issues that it itself has the demerit of causing.

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Contributions of the authors
Adenard Cunha participated in the study conception and design, data collection, article writing and review. Gabriela Pimentel, Maria Luiza Raposo and Layla Abou El Hons Cordero participated in the literature review and article writing. José Antônio Cordero Silva participated in the study conception and design, critical content review, and final approval. Mauro Ricardo Souza da Luz participated in the literature review, study design, and article writing. Rosa Helena Chaves and Bárbara Fernandes participated in the literature review, study design, and article writing.

Data availability: All data used or generated in the research are fully described and presented in the body of the article.

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Research