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Article abstract

Bioethics has become a framework for debate throughout the world and, as such, it is an indispensable subject in scientific fields, especially in those related to life sciences. Nowadays, there is a need for its teaching to include not only the identification of ethical problems but also deliberation and critical reflection on those problems in order, among other things, to participate in decision-making processes. The methodological strategies for this are crucial. This article provides an analytical description of the use of learning logs as a tool of reflection and metacognition in bioethics courses, based on the experience of professors at the Faculty of Sciences of the Universidad de la República (Uruguay). An analysis of students' learning logs shows that this tool promotes complex reflective and self-reflective processes in which the development of skills such as abstraction, argumentation and problematization is manifested in an integrated way.

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ARTICLE (ÉVALUÉ PAR LES PAIRS / PEER-REVIEWED)

Learning Logs: Reflective Writing and Metacognition in Bioethics Courses

Marila Lázaro[a], Camila López-Echagüe[a], Fiorella Gago[a]

Résumé
La valeur que la bioéthique a ajoutée au discours entre la science et les sciences humaines est indispensable. Cependant, il est nécessaire que lorsque la bioéthique est enseignée, l'accent ne soit pas uniquement mis sur l'identification et l'analyse du problème, mais aussi sur la réflexion critique pour permettre à un étudiant d'intérioriser ce qu'il a vécu. Cet article fournit une description analytique de l'utilisation des journaux d'apprentissage comme outil de réflexion et de métacognition dans les cours de bioéthique, basée sur l'expérience des éducateurs de la Faculté des Sciences de l'Universidad de la República (Uruguay). Une analyse des journaux d'apprentissage des étudiants montre que cet outil favorise des processus complexes de réflexion et d'auto-réflexion dans lesquels le développement de compétences telles que l'abstraction, l'argumentation et la problématisation se manifeste de manière intégrée.

Mots-clés
éducation à l'éthique, cours de bioéthique, journaux d'apprentissage, problématisation, métacognition

Abstract
Bioethics has become a framework for debate throughout the world and, as such, it is an indispensable subject in scientific fields, especially in those related to life sciences. Nowadays, there is a need for its teaching to include not only the identification of ethical problems but also deliberation and critical reflection on those problems in order, among other things, to participate in decision-making processes. The methodological strategies for this are crucial. This article provides an analytical description of the use of learning logs as a tool of reflection and metacognition in bioethics courses, based on the experience of professors at the Faculty of Sciences of the Universidad de la República (Uruguay). An analysis of students' learning logs shows that this tool promotes complex reflective and self-reflective processes in which the development of skills such as abstraction, argumentation and problematization is manifested in an integrated way.

Keywords
ethics education, bioethics course, learning logs, problematization, metacognition

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> *Problematizing so many day-to-day things put me in an uncomfortable position. To be honest, I do not enjoy that feeling and would rather go back to my cave of imaginary certainties. In spite of that, it makes me feel more intellectually honest and gives me a fair starting point to improve myself. On the other hand, I did not expect that this course would lead me to question my relationships with others as well as group dynamics. I do not know whether it was intentional, but it is undeniable that this dimension of thinking is being fostered. If I had to highlight two aspects of this course, it would be these two: First that it is going to make me grow as a scientist, and if I keep up the effort it will probably also make me grow as a person.* (S1)

INTRODUCTION

According to VR Potter, who is seen as a founding father of modern bioethics, this discipline is a combination between science and philosophy, with "wisdom" being its main goal (1). Wisdom is seen as "the knowledge of how to use knowledge" for survival and for the improvement of quality of life (1, p.127). Bioethics, Potter argues, must be a bridge between science and humanities that enables survival in the face of threats from technological progress. He also proposed the term 'Global Bioethics' (2) as a synthesizing interdisciplinary approach. This included the extension of the concept of community to other living beings and nature as a whole (the "biological community") and the notion of interdependence between humans and nature that would also allow future generations to be considered as well. This global bioethics approach has received renewed interest in recent years, based on the need for interdisciplinary cooperation, dialogue between the sciences and humanities, and the recognition of the pertinence of multiple perspectives to explain complex phenomena. And it is based on the use of various methods and theories, on data and observations from empirical studies and philosophical analyzes, and on dialogue that occurs in both global and local contexts (3,4). From a global bioethics perspective, bioethics also contributes to conceptual and epistemological clarification that helps in the understanding of certain discussions or controversies, recognizing the non-neutrality of disciplinary discourses insofar as there are no "objective facts" (5).

This conception of bioethics points at a particular form of understanding the way it is taught, one which is in line with the pedagogical framework of experiential and reflective learning (6), problem-posing learning (7) and the commitment to integrative learning that involves not only the incorporation of a body of concepts, but also the development of intra and interpersonal skills (8,9). Teaching bioethics, in this regard, would require critical thinking and metacognition skills aimed at

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preparing students for deliberation, dialogue and reflection in the face of complex ethical problems (4,10,11). Using this pedagogical framework, innovative learning strategies, such as reflective writing, are required.

In the course on Bioethics taught by the authors of this article at the Faculty of Sciences of the Universidad de la República (Uruguay), having students write learning logs has been implemented for several years. The learning logs are a writing space where students are encouraged to record their experiences, concerns, and reflections throughout the course, to strengthen the way knowledge is acquired, promote reflective processes and enhance metacognitive processes.

In this article, we present the deployment of learning logs in our Bioethics course and analyze their utility as tools for stimulating reflection, problematization and metacognition. The intention is not to analyze the contents of the logs in detail, following pre-established categories, but rather to show elements that display different levels of reflection, problematization and metacognition in them. For this, different theoretical frameworks are used. These frameworks will be discussed along with a thematic analysis of the content. Twenty-five learning logs from the last three courses were selected based on a purposeful sampling approach (12,13). Excerpts of 15 of these logs were used to illustrate different levels of reflection found.

SOME CONSIDERATIONS ON BIOETHICS EDUCATION

To understand the nature of “learning”, Dewey’s (6) presentation of the relationships between experience, reflection, and learning process is helpful. According to Dewey, learning implies committing, reviewing, and re-signifying previous experiences in light of what is being learned. The learning process should have not only a cognitive dimension, but also an affective dimension. In recent decades, there has been growing interest in the consolidation of pedagogical approaches that incorporate a more comprehensive, humanistic and qualitative perspective to the learning processes. In this sense, far from being limited to the transmission of knowledge, learning should also incorporate the recognition of ourselves and others, focusing on living together, transforming the world, and being autonomous (8). This integrative approach to knowledge and reflexivity stimulates a discovery of personal skills (9).

With regard to teaching bioethics, there exists consensus that teaching should not be limited to the transmission of a body of content or a set of pre-established values. Instead, it should aim to develop critical reasoning and reflection skills, deliberation and decision-making in the face of complex problems and metacognition (10,14). Additionally, bioethics teaching should promote analysis and argumentation for understanding ethical problems and their implications to prepare students to face various complex challenges facing our communities (11). The concept of “metacognition” was coined in the late 1970s to refer to knowledge of one’s cognitive activities in learning processes (15). Since then, it has been used with different meanings and in different contexts (16). In this article, the term ‘metacognition’ refers to the ability to become aware of the thinking process itself. Students’ recognition of their own abilities, attitudes and knowledge provides students with a view of themselves that allows them to guide their learning process autonomously and consciously (17,18).These objectives require the implementation of activities that stimulate cognitive aspects such as critical thinking, but also emotional ones such as sensitivity and imagination in the face of the problems addressed (19). In this regard, Nussbaum (20) proposed a set of skills for higher education: the ability to critically examine oneself and one’s traditions; the ability to see oneself as a human being linked to others by bonds of recognition and mutual concern; the ability to think about what it would be like to be in someone else’s shoes and understand the emotions, desires and longings that another person might experience.

There are several possible strategies that encourage students to pause and reflect upon what is being done in their own practice, a concept that Schon refers to as “reflection in action” (21). One of the privileged spaces for such “reflection in action” is in writing. From a pedagogical perspective, and considering the role of language in teaching-learning processes, writing has been considered key to the development of complex cognitive skills, such as analysis and synthesis (22,23). Writing is an especially enriching and powerful learning strategy, as it involves a complex process that requires simultaneous use of different skills: abstraction, motor skills, vision (24). Reflective writing processes, in particular, exercise the writer’s cognitive skills and strengthen their commitment to the learning process itself. When writing, the student has the time to think, introspect, correct, go back, and rewrite: the pause forced by the writing exercise allows us to reach higher reflexive levels than those that could be reached by using only verbal arguments. The writing process allows, according to Vygotsky (22), to make an internal discourse explicit, which is not only essential for its socialization through a dialogue with an external reader but also offers the writer the possibility of objectifying and observing their own process with a certain distance. Enhancing the reflective process that writing requires, in turn, promotes applied metacognition (25). This has, as a result, led to an interest in incorporating reflective writing in university education, with the understanding that teaching content is no longer sufficient for students to be able to solve complex problems in their chosen disciplines (21,26). In ethics education, reflective writing helps students identify ethical issues of interest, connect theoretical concepts to practice, and respond to complex situations (27), and one strategy to accomplish this is via writing learning logs.

LEARNING LOGS AND BIOETHICS COURSES

Learning journals, learning logs and reflective diaries are terms commonly found in the literature and may be used as tools in many formal teaching settings. What distinguishes them from other writing processes is that they focus on the learning process itself, the starting point for record and reflecting on one’s thoughts. Moon (28) explores the characteristics, objectives and ways in which learning logs (called “learning journals” by the author) are usually employed across a variety of

subjects, and finds that they are used for different purposes, including fostering critical thinking and metacognition, promoting commitment to learning, improving professional practice, strengthening self-esteem, facilitating the expression of those students who are not comfortable with orality, encouraging creativity through unstructured writing and achieving greater interaction with the groups.

Boud (29) suggests that learning logs provide a space for students to make sense of their individual experiences in relation to what has been learned, thus generating significant new learning. The log works both as a record and as a means to re-signify and give meaning to what has been worked on in the course. According to Boud, reflection can take place before, during or after a certain learning event; the log offers students the possibility to reflect on any of these moments. At the beginning, the log allows for the articulation of explicit expectations, intentions, motivations, contexts and previous ideas. Later on, the log allows students to explain what is happening and how they are taking part in the learning process (including any internal reactions that they have towards working on a certain topic). Finally, after the event, reflection allows the student to revisit the experience and observe any feelings associated with their learning – these feelings may enhance or inhibit learning, so it is important that they be recognized and acknowledged. By examining their own experience, students can compare new information to previous ideas, identify different ways of reasoning and offer meaning to their learning process based on personal experience (29). The processes that contribute to developing the learning logs – such as evaluation and reflection, self-questioning, self-verbalisation, and the elaboration of questions – have proven to have a significant impact on the student's learning and contribute to establishing productive links between theory and practice (30), as well as enhancing critical thinking and metacognition (31). As Moon notes (31), learning logs are helpful in personalizing and deepening the quality of learning.

The Bioethics course, taught by professors from the Science and Development Unit[1], is offered as an elective course for students in any degree program within the Faculty of Sciences. The course also admits some students from other faculties, with the majority being from the Faculty of Medicine. In general, 70% of the students who take the course are from the Biology and Biochemistry Bachelor's Degree, 15% from the Geography, Geology, Human Biology, Physics or Mathematics Bachelor's Degree, and the remaining 15% from other Faculties of University such as the Faculty of Medicine. The number of students taking the course is usually between 80 and 120 annually. With such diversity, one of the methodological strategies of the course in its face-to-face modality is the formation of interdisciplinary groups (of no more than six students) who work together throughout the semester. The aim of the course is for students to be able to identify ethical dilemmas (particularly bioethical ones), to analyze and problematize them from a global and critical perspective, and to justify their position and possible courses of action. The content of the course is structured in theoretical-practical modules, the first being the most general: "Basic Concepts and Fundamental of Ethics" and "Science, Ethics and Society". The following topics are subsequently covered: "Bioethics, Health and Science", "Microbioethics: The Dilemmas of Genetics and Biotechnology", "Macrobioethics: Ethics and Environment", and "Science, Politics and Ethics". Each module is made up of one or two introductory classes, followed by workshops in which each interdisciplinary group delves into the subject of the module and explores its most dilemma-generating practical aspects. There is also free space for activities proposed by students, e.g., to investigate a topic of interest, discuss and debate a film, organize formal debates, or respond to general queries.

The writing of an individual learning log, and updating it throughout the course, is a fundamental part of the strategy to monitor and evaluate student process, as well as being a space for students themselves to evaluate the process and progress of their reflection and the significance of what has been learned. The learning log is presented to students as a travel journal to an unknown destination – it is "a philosophical reflection" that they may rarely experience in an organised way in their scientific careers. Students are thus explicitly asked to develop a reflective dialogue with themselves in the logs in relation to the topics explored during the course.

DIALOGUING WITH LEARNING LOGS

In the following sections, we present an analysis of selected learning logs from 15 students, all of whom gave written permission for the content of their logs to be used, anonymously, in the research presented in this paper. Each excerpt is identified by a code in order to protect the student's identity while permitting correlations between excerpts of the same student. The Ethics Committee of the Faculty of Psychology of UdelaR approved the research project "Evaluación de la enseñanza de la Bioética en el razonamiento moral y reflexivo en estudiantes de ciencias" that framed this study.

While exploring the learning logs, attention was paid to the different levels of reflection in relation to the main topics of the course, on group work, the log itself, and on the course as a whole and its dynamics. The excerpts presented below relate to the areas or modules of the course that allowed students to connect their reflective processes to the specific challenges of the topics. Also presented are some excerpts linked to their reflections on the course procedures.

[1] The Science and Development Unit, created in 1994 in the Faculty of Sciences of public University, teaches courses that emphasize the social dimension of scientific activity. These courses are aimed at generating discussion and reflection on the interface between science, the university and society, from historical, philosophical, political and ethical viewpoints. Its educational practice is directed at stimulating the production of reflections and personal texts on behalf of the student.

Fundamentals of Ethics

The Fundamentals of Ethics module aims to provide an introduction to the field of ethics and the identification of the type of problems that ethics addresses. It also proposes an overview of main ethical theories (deontology, utilitarianism, dialogical and virtue ethics) as an illustration of the general theoretical frameworks within which ethical problems can be analyzed. Some students showed in their learning logs the ability to make their own synthesis about the concepts at stake, denoting an understanding of the topics they were working on. This type of exposition transcends the mere reproduction of content but is still predominantly descriptive.

> *Regarding the first module, I want to stop at the questions: Why is it important to distinguish morals from ethics? How is that linked to a course on bioethics? I consider it is important to thoroughly understand the difference between morals and ethics because ethics allows us to identify and question the moral assumptions or beliefs (ideological, political, ecological, cultural, and religious) that are behind our decisions, so that we can problematize and question ourselves. Without ethics questioning our morals, we cannot identify where our opinions, judgements, evaluations or beliefs come from.* (S5)

This excerpt contains a frequent feature of the learning logs we analyzed: it is structured based on questions that serve as a starting point or central focus for the topics and problems addressed. In this case, these are questions that were explicitly posed in the course, and that the student selects as relevant to introduce conceptual aspects of the module on which they are commenting. Even though the answers to these questions are presented as personal opinion, "I consider that…", the purpose of this excerpt is to account for the handling of the definitions of two concepts at stake. Part of the objective is to offer a space to summarise and record the contents worked on during the class; therefore, this type of predominantly expository-style entries also help reinforce the understanding of the topics covered in the course by fostering the ability to summarize and synthesize. The learning logs' more ambitious goal is the promotion of metacognition and critical thinking skills; but it is also expected that students show understanding of the topics studied, be able to synthesize and explain them, even at a descriptive level. This also provides professors with information on the extent to which students have understood the topics studied, whether there is conceptual confusion or difficulties, and so an opportunity to intervene and clarify issues or concepts.

Another way of accounting for the acquisition of concepts from a creative approach is shown by some students who prepare a synthesis based on considerations of their own actions and feelings, giving meaning to theoretical aspects from their experience. This is the case in the following excerpt in which humour enhances self-dialogue. As Moon (28) mentions, one of the positive aspects of learning logs is that they stimulate an unstructured type of writing that allows creativity and expression to flow from a student's own style. In this sense, humour can be a way to acquire the concepts on which they have worked.

> *I am a 'relativist', I thought during class. "I believe that all moral systems are valid from the viewpoint of those who practise it, which makes us incapable of generating judgements." Immediately afterwards, I realized that I was not. I believe that women deserve equal rights and opportunities; that those most privileged must do everything they can to improve equity; that life is a right in itself, and that pineapple on pizza should be penalized; I think all of this should be true regardless of one's culture. Therefore, I judge those systems that do not conform to these principles. I am not a relativist, so long Einstein, but a universalist. This paradigm establishes the existence of universal moral minimums, regardless of the system. And despite having serious problems with the concept (how can they be universal if many systems do not accept them? How can they be objective if they are established by us, who are governed by an individual moral system?), I think I have begun to understand: The objectivity of the minimums arises from the ability to give valid arguments (not "because God said so", I suppose that would be dogmatism, it is right because it just is) about why something is right or not. If I understood it correctly, then, I like the idea. It does not imply the existence of some magic tablets created by Shiva about what the minimum that we can define as 'good' is, but rather it is based on dialectics (a positive aspect of the course is definitely the vocabulary I learned, which allows me to sound intellectually pompous).* (S6)

As in the previous case, this excerpt integrates concept definitions addressed in the course, but reworked with originality and even points out a possible problematization in the form of questions that, in this case, are no longer of a conceptual order, nor reflecting questions made directly in class; instead, they explore a certain underlying problem regarding the concepts at stake in the module.

Some students choose to position themselves and defend a personal viewpoint based on the theoretical framework worked on in the module, or to take these as a starting point for a literature review and the development of original reflections. This type of input not only shows content acquirement, but also enables students to develop and refine their argumentation and critical thinking skills.

> *If all inherently human activity is moral, does this mean that all moral activity is inherently human? This is a question that arose in class and that had as answers particular examples; according to these certain 'social' animals, they present certain moral behaviours or pseudo-morals. In researching the subject, I have come across various articles and information, mostly from the Dutch primatologist Frans de Waal. He shows us his findings, and how he believes that mammals also have moral values. He rests his theory on the fact that morality is sustained under two essential pillars: reciprocity, associated with the sense of justice and equity; and empathy, associated with compassion. The video shows us several experiments where we observe such traits: primates that do favours for each other selflessly, elephants that cooperate with each other. Additionally, primates that feel empathy, from basic expressions such as yawning (which we know is 'repeated' among beings with a sense of empathy) to more complex ones, such as animals that comfort others, in a similar way to human beings. After his presentation, he summarizes morality as something evolutionary, which is present and continuous in all primates. In conclusion, I consider this argument an interesting and very good answer to the question, and I share it.* (S4)

In this last excerpt, an interesting reflective process can be observed: as in previous excerpts, the student takes as a starting point a problematization of a statement made in the course. However, and unlike the previously excerpts, in this case the problematization is not limited to the mere elaboration of the question, but rather opens an inquiry process that leads the student to investigate and work on an answer. This type of exercise reflects the complex sets of skills that the logs enable students to put into practice: problematization, inquiry, connection between concepts worked on at a theoretical level and in practice (27), and personal argumentation from an original and critical view that transcends the mere reproduction of course content.

The conceptual bases in this module constitute the starting point for students to begin to practice a type of thinking that, in most cases, is quite far from their normal way of thinking. Without the student's learning log, we would not have the possibility to identify the reasoning process that, in this case, this student started from a class question.

Science and Ethics

This module provides a historical look into the conceptions of science and its greater or lesser connection to the world of morality. It tries to stimulate a reflection on the "received view" of science and its dissociation from social and moral dimensions, as well as to reflect on the role of the scientist and the purpose of science. Some learning logs show some of the initial concerns about this topic. For instance, in the following excerpt, one of the topics discussed in the module is translated into a question about the ethical responsibility of the scientist:

> *About the consequences of our actions, up to what level is one responsible as a researcher for the possible uses given to their findings? This question remains open to be addressed during the course, as I am presented with the necessary tools to answer it.* (S4)

Several of the learning logs show interest and reflection on the academic world in which students are trained, problematizing the field of science education, starting from the topics explored in the module. Some students even do so by reviewing their own process in the log.

> *Since childhood, perhaps because of the difficulty of establishing a fluid communication between the scientific community and the rest of society, the figure of the scientist is shown to us as something distant, totipotent, [and science] an activity only for geniuses, something to be contemplated almost like someone who watches a magic trick but without the intention of really understanding it. Then when we grow up, we have this idea rooted so deeply that, although we think differently, it is inevitable to act as if somehow the scientist is beyond the questioning of ordinary people because they are not an ordinary person (because ordinary people do not eventually become scientists, or at least that is what was thought). Partly because of that conception I think it was more difficult to classify the situation in which the scientist is positioned as the true hero, not only because of the different conceptions of hero but because perhaps from childish naivety we still unconsciously sustain the role of the scientist as something extraordinary and therefore inevitably related to good. But I believe that the main problem is that in this specific case the only one involved in the definition of 'good' is the scientist and, without any kind of regulation, nothing guarantees that this 'good' matches the definition of good created by the community.* (S10)

The value neutrality of science, once questioned, generates discomfort in most students and this is reflected in the learning logs. The following excerpt is an original reflection that shows conceptual integration and significant understanding for the analysis of the problematization posed.

> *"Science is not good or bad in itself. It is its later use that can be judged". This phrase that I heard in the first class was one of the first to make me restless, and it was even discussed and worked on in the first workshops of the course. "Science is the action of generating knowledge", we thought in class. We also said, "it is a human product." Considering that conception of science, I do not agree that it is neutral in itself, since all human action is linked to subjectivity. Why? Because there is no human being without*

> *ideas. To give a more 'biological' explanation of my arguments, I will remember that the simple fact of seeing is a mental construction. To perceive an object, our mind is based on two elements: the fibres that reach the visual cortex from the retina, and those that come from other brain areas. That is, seeing is an active phenomenon, in which the brain interprets based on previous experiences, in addition to the physical stimulus projected by the retina. Therefore, each person 'sees' differently. Although the physical stimulus that reaches the retina is the same, its construction, its perception of it, is different… But if each person perceives differently, science, like any human action, cannot be completely objective. We cannot think without previous ideas. We cannot look at the grass and think that it is "a green thing that grows from the earth in a thin and long form." Because just thinking about the word 'green', or 'earth', already implies having previous ideas. For these reasons I consider that the human being is subjective, and science, as a human action, is not exempt from subjectivity. I will continue with this idea later.* (S12)

Critical reflection on these discussions in science students is essential to start a bioethics course but also to stay attentive and critical of science and technology discourse and development. The logs represent an opportunity to practice this attention.

Microbioethics

This module provides some elements to discuss and problematize the ethical, social, political, and environmental dilemmas of biotechnology, and includes a historical overview in relation to the previous module.

> *What guarantees us that the fact that a private company has access to our genetic information does not mean that it can be used for economic purposes, which benefits none of us? Is my genetic information my heritage, and therefore am I entitled to decide what I want to do with it? Or do I have to accept that it does not belong to me entirely and can be used by others, for whatever the purpose may be? Would I marry a man who I know is likely to develop some pathology that could cause his premature death or that could be genetically transmitted to my children in the future? These and other questions are problems that the use of genetic engineering to diagnose diseases would probably bring about.* (S14)

The narrative elaboration of the excerpt does not show the question construction process, and the discussion does not take place; however, it introduces personal elements that bring the discussion closer to a concrete practical level. If one were to go deeper into the problems that are implied, these questions could be a good starting point for developing a meaningful process of reflection.

The ethical principle of responsibility and precautionary principle are transversal to the course and motivate students to elaborate on them in their learning logs. The following extract shows problematizing reflections on the application (or lack thereof) of the principles.

> *It is estimated that a period of 20 years is required to determine whether a certain element is the cause of a certain (I promise not to use that word anymore) effect. A problem arises here: do we wait for science to prove that something is not harmful before we start implementing it? In the previous entry I talked about the same thing, but now I come with another opinion (consistency of thought). Yes, or partly yes. We must be cautious. While we cannot predict everything, we can at least reverse the burden of proof, and ask science to prove that even if something is not completely safe, it is mostly not harmful, to prove that it is not carcinogenic, or allergenic, for example. This is 'simple' – it is not – in drugs, but what about environmental problems that are so hard to predict?* (S6)

This excerpt, aside from suggesting a problematization around the classic principles of bioethics, shows a dialogue of the student with themselves in reference to a previous entry in their log. The student sets out to examine a question relating to the Microbioethics module, and to do so they revisit their previous reflection and even reformulate their own position: they ask themselves a question, answer it, attempt a new answer that differs from a previous opinion, and find a new problem. This journey is enhanced by the written and progressive nature of the log in which the student periodically records their reflections and has the possibility of returning to them to revise or re-problematize them from new viewpoints. The learning logs record questions or problems that serve as introductions for more personal reflections, which, in some cases, do not end up being developed. One challenge of the logs is to achieve a problematization that transcends the enumeration of questions without reflection on their complexity or without an effort to respond. Even so, there is an accomplishment in questioning and reviewing one's own ideas and associated feelings: the relevance of the questions shows understanding of the problems at stake and directs possible further reflections.

Macrobioethics

This module works on the environmental dimension of ethical controversies and dilemmas, linking to environmental ethics approaches and to various methodological strategies that incorporate the visions and values of different stakeholders. This module also deals with the moral dilemmas of using animals, specifically in lab testing. This is the most extensive and ambitious module from both theoretical and practical viewpoints and includes problems that can be seen in any of the

university degree programs with which we work. A simulation of a Consensus Conference is carried out on a controversial topic that is present in the country (the topic has been mostly genetically modified organisms, GMOs)[2].

Different levels of reflection and problematization are recorded on different ethical approaches and their applicability to real situations, as well as on our roles as moral agents in the assignment of values. In some cases, this includes adopting a stance with different degrees of substantiation. For instance, the following excerpt contains several interesting aspects worth commenting:

> *Therefore, in defending a biocentric position, one might ask whether we can "live and let live". Taking this stance to the extreme, we could consider the case of Buddhist ethics, which advocates for not causing harm to any form of life. But would it be possible to carry out this lifestyle on a global scale? Human beings take resources from nature and transform them to lead more comfortable lives. Would people be willing to compromise such a lifestyle? Perhaps the extreme biocentric position is close to dogmatism, that is to say, it is only worth the proposition of mandatorily allowing all types of life as the only valid system of thought. This would very surely generate great conflicts and perhaps new problems to solve. But through the dialogical model, we could reach minimum principles that seek out the best interests and well-being of the rest of the creatures without causing drastic changes in our lives. We could reach, for example, agreements inspired by Immanuel Kant's imperatives (such as human rights), where, as stated at the beginning of the chapter, they are categorised as individuals with moral status and consequently have their own set of basic rights which respect their dignity. Thus, a universalist stance is perhaps most appropriate to adopt on this issue.* (S4)

This excerpt reflects several achievements: it shows an understanding of the topic and identification of underlying problems in a synthesis that manages to merge concepts addressed in different modules. With the purpose of discussing the complexity of biocentrism, the student states their position after pondering about the concepts of 'dogmatism' and 'universalism'; dialogical ethics, Kantian ethics and Buddhist ethics (all these are touched on in previous modules), are merged within a pertinent manner. This is an example of the complexity of the conceptual acquirement processes that the learning logs allow students to develop.

It is remarkable how, year after year, animal ethics becomes the most controversial, conflictive and motivating topic for students (in many cases, drawing from their previous experience or stance regarding animal testing). This situation is clearly shown in logs where students record, and notice, their own discomfort, opinions or feelings prior to their discussion in class.

> *One day, I was eating meat and for no apparent reason I felt strange. The fact that the thing on my plate was a dead body came to me, and I lost my appetite. That was the starting point for me to question whether this normalized practice was wrong. At the beginning of the log, I briefly commented on where I stood regarding ethics and morality. There, I made it clear that the mental processes that led me to such conclusions were always very anthropocentric because the place I found to base my moral vision was the ability to make agreements with others like me. It happens that with animals, it is impossible to make agreements; the ones we make are with those who are similar to us and for this reason I never had them [animals] on the moral radar. Could it be that I have to change?* (S8)

In some cases, the reflection also incorporates extra-module aspects to question the limits of scientific conceptualizations and definitions when determining courses of action.

> *Now, going back to animal testing, and assuming that we have all the knowledge necessary to tell sentient from non-sentient organisms, would everything be in place to solve the problem? Perhaps not, because what previously emerged were the limits that knowledge imposes on us. That is to say, as we know more, we know less about how to solve or where to draw the line between beings able to feel and beings not able to feel, but we never question what it means to feel and how only a definition can simplify or make the problem more difficult. If feeling is nothing more and nothing less than perceiving a stimulus from the external environment, oops, we can no longer talk only about animals with a highly developed nervous system, or a poorly developed one, or only about animals, but we must also position plants, trees, etc., within the debate. I find a lot of interest in seeing how many conflicts or problems can in some cases be summarized or taken from definitions, from language, a fundamental tool for our development, and also to see how this tool and knowledge are related.* (S16)

[2] Consensus Conferences, or "Juicio Ciudadano" as they have been called in Uruguay, are mechanisms for public deliberation based on the participation of the general public (not experts or stakeholders in the subject matter). Consensus Conferences are also considered a tool for applied ethics (like bioethics) since they allow for dialogues to be opened and minimum consensus between valid interlocutors, any citizen, and potential affected parties when faced with decisions, within the framework of debates associated with risks, values and responsibilities. Citizens are considered, from this viewpoint, as rational and autonomous beings who belong to different social groups and for whom exercising their autonomy means deciding on the circumstances that affect their own lives and those of the environment(s) that they consider valuable or important (32).

The subject of animal testing is one of the most 'expected', as well as the analysis of current regulations. The connection of the normative with the implicit ethical foundation is cause for reflection. And again, with humour, the very process of justification of ethics is questioned and some moral certainties or intuitions are problematized.

> *"Why is it wrong to do tests on prisoners?", commented a fellow student. "Think about how medicine would advance if we could test it on prisoners. Why on animals, and not on them?" That phrase activated a neuroreceptor in my brain and through simple inertia I released my humanist manifesto. I found it deplorable, frightening, something taken from Mengele's diary. Then I stopped (metaphorically speaking, since I never miss an opportunity to argue): Why not? To force them would be a horror (Kant would have a stroke on his categorical imperatives). But it could be with consent. And, yet, why with animals? They did not give any kind of consent. I think it is not the same with animals, and it is wrong to do tests on prisoners, but I have never thought why. For all practical purposes, I am just an ordinary Vincenzo Maculani.*[3] (S6)

The previous excerpt shows a thread of chained questions that account for a complex reflective process: the student begins by taking an initial question from a classmate who problematized a normalized moral assumption, the condemnation of testing on human beings. Then, they react to that question, problematize their own reaction, and through an analogy, elaborate a reflection on the problem of animal testing. Likewise, the previous reflection has the particularity of elaborating a questioning that could easily be rejected. The questioning and challenging of value systems, personal and collective, generates conditions for critical argumentation processes and for the reduction of confirmation biases (33).

In short, in this module, learning logs show overall concerns and questioning of students' own attitudes and beliefs that reveal a certain emotional commitment to the problem addressed in the course. As mentioned at the beginning, the log is one of the possible educational strategies that not only promotes critical thinking, but also contributes to the development of aspects such as sensitivity and empathy (19,20).

Science, Politics and Ethics

One of the objectives of this module is to promote reflection on the purpose of science: why and for what purpose do/should we practice science? Furthermore, it tries to analyze how the different ways of conceiving science (and the relationship between science, technology and society) condition different political approaches to scientific research, focusing, for example, on which activities are financed and by which organizations. To do so, some of the problems and complexities surrounding science policy are analyzed: how are science policy decisions guided? How is the funding of scientific activity structured according to the way the aims of science are politically conceived?

It is pointed out in several learning logs that the question "why and for what purpose should we practice science" generates processes of reflection and revision of one's expectations regarding one's career path. The example of the 90-10 gap (in development of and access to essential medicines) between rich and poor populations is also an aspect most of them use. The problematization works as a trigger for students to write a personal response associated not only with the purpose of science, but also with the purpose of their future practice as scientists.

> *The economic dimension is also important; in class it was mentioned that the study of diseases that takes most of the resources is the study of diseases that affect the lowest percentage of the population; but that sector of the population is the one with the most resources, the richest. Money and power have a close relationship, not today but for centuries. It is therefore logical that most of the resources go to scientific research that benefits that sector. Here we can demonstrate something that we have talked about repeatedly in class, the non-neutrality of scientific activity, given that research is oriented, directed, aimed at a social sector.* (S16)

The contents of the module encourage original and integrating reflections, with remarkable levels of problematization of reality.

> *We may consider that our actions make political sense if we think of politics not only as the act of voting to elect representatives, but also as something active that requires civic commitment by citizens and in which we should all partake (at least ideally). If we think of politics as a tool for building a better society, then how can we even suggest that science is unrelated? Some authors claim that the detachment of politics from different sectors of society is far from casual, and such detachment from citizens is the main enemy of healthy democratic processes because it is much easier to do what you want with the people when they are not interested in being heard.* (S10)

Overall, the reflections of the students in this module succeed in identifying the problems underlying the traditional model of scientific research as well as in building a critical viewpoint and developing argumentative skills. At the beginning of the course students are asked about their scientific motivations and aspirations. Words such as knowledge, truth, discovery, and

[3] A 17th-century Italian Catholic Cardinal and inquisitor.

curiosity are listed. In this last module, the social dimension of science is addressed in a critical manner. The logs in many cases show the students' evolution from their initial observations to their final more critical impressions.

Critical reflection on group dynamics

In this article, as in the course, it is assumed that the development of certain class dynamics which that promote teamwork, deliberation, problematization, and debate are an essential part of a bioethics course – that is, a teaching methodology that involves students' active participation. It is in this sense that a simulation of a Consensus Conference is carried out in a workshop. Different groups of students 'place' themselves in the role of a certain type of stakeholder to develop and present their arguments in a forum. The learning logs offer the students a space to distance themselves from these and other activities carried out in the course and, either before or after such activities, to observe them with a critical eye. It is not only about learning content, but also about developing skills linked to interaction, dialogue and teamwork. These skills are developed throughout the activity itself, as well as later, when the activity is revisited reflectively in the logs. The students also reflect on their own attitudes or character traits, especially when exposed to dialogue and deliberation in groups or in public. This helps with self-observation, and with making themselves intelligible to themselves and to others, a particular feature of ethics as according to Cortina (34).

In some cases, students' reflections are directed to the very process of development of the group activities, as in the following example.

> *It was clearly possible to see how we men spoke, often and confidently, even when what we had to say was not truly relevant or correct. Women, however, were much more aware of what they were saying, stating things in a more pondered way, without the impetus that is common in people who are always assumed to be right. Being part of the first group makes me a little embarrassed since I only realise these things as I am speaking. However, the inherent privilege of being a tall white man without a disability gives this feeling a certain pervasiveness.* (S1)

Some logs refer to activities carried out based on value judgements, not necessarily evaluating the course itself but rather how comfortable or uncomfortable they were with the course dynamics; several of them refer specifically to the Consensus Conference.

> *In the microbioethics workshop we conducted a simulation of a consensus conference on GMOs. Although there were two instances of this process, I still wanted to answer or discuss some comments or arguments. But this is what consensus conferences are like; it is not about trying to convince, but to give the best arguments and information from each viewpoint or stance, so that the citizen panel can build an informed opinion about the topic or issue. Moreover, it is the fair way for each group to have the same time to express themselves. This workshop, one of the nicest in my opinion, gave me several takeaways. First, I was able to get a better grasp on the transgenic issue, which is so controversial and important. Although I had to put myself in the place of the consumer defence panel, I identify with the citizen panel, in the way that listening to all the actors involved with their respective arguments enriched my information and reflection on the subject. On the other hand, the workshop taught me this system of citizen participation that I did not previously know. I would love to participate in a real one. Finally, it strengthened my reflection on the value of listening to different opinions and discussing interdisciplinarily.* (S12)

And in some exceptional cases, based on the same topic, a review of personal characteristics and original problematization are included.

> *Finally, after this activity [the Consensus Conference on GMOs], I have no clear position on the use of GMOs. If the activity was so pointless, why write about it in the learning log? Well, it was a trigger for a lot of interesting questions. Perhaps I did not take full advantage of the discussion in terms of the concrete information; but being part of an exchange with many actors involved (it is ironic, because it had a certain theatrical tinge in which each group interpreted a position), allowed me to question some things. First, I started to think about this prejudice of only listening to the "authorised" scientist voices, why limit myself to this? This thought is in line with my incipient process of de-idealization of the academic environment that I vaguely showed in an earlier section of the log, when I referred to the naivety of my believing that only what is scientific is good.* (S8)

Group work leads the students to experience dialogic processes both from their own perspectives and visions as well as from the perspectives of the roles played in some course activities. The logs allow us to observe these experiences from the reflections they share about what it is, and what is learned from, putting oneself in the other's shoes, an essential task of bioethics.

DISCUSSION

Students' perceptions on the course and its methodological strategies

The question of the ultimate purposes and applications of techno-scientific research is of paramount importance in assessing different types of responses. Cortina and Martínez (35) word it rather eloquently: "scientists are experts in terms of the means to achieve certain objectives, but in terms of determining the convenience of specifying one purpose or another, nobody is an expert" (35, p.170). This demonstrates the risk of leaving important decisions regarding the ultimate ends of techno-scientific activity in the hands of experts, political representatives, or transnational companies. This is why it is necessary to open a public and open dialogue on aims and on who has the right to decide, since, in many of these techno-scientific developments, citizens in general, as potentially affected parties, should be considered valid interlocutors and advised by a plurality of experts (32).

This is one of the aspects on which the Bioethics course tries to work and deepen, and some logs reflect this.

> *Summarizing what was expressed throughout the learning log, I was struck by the presence of a common denominator in different entries. In this sense, the reflections made during the entire semester lead to the conclusion that scientific activity has the clear ability of transformation at multiple levels. By this I mean that science not only creates knowledge and is related to the development of various technologies but is also capable of both favouring the perpetuation of oppressive systems, as well as promoting the formation of just and equitable societies. Thus, it is tremendously important that scientists are aware of the responsibility that research in science implies, and implement critical reflection continuously in their activity, for it has the potential of modifying the reality that surrounds us. Changing the academic hierarchy for one that is less structured and more accessible to all, promoting citizen participation in research processes, and research to solve the problems that affect humans and other beings in their daily lives, as well as ensuring access to quality information for all members of society and promoting the insertion of more citizens in tertiary education, are just some of the actions that researchers can promote, in an attempt to materialize a less fragmented society, with equal opportunities and rights, where oppressive schemes are no longer the norm.* (S9)

In the context of the activities in the stable interdisciplinary groups (in the scope of the workshops and students interaction throughout the course), work is carried out to fulfil the quality marker of a deliberation. Deliberation implies a particular mode of communication based on argumentation and mutual respect. Some key features are considered, such as learning from the exchange of perspectives of different actors in dialogue; orientation towards the solution of problems or conflicts; the opportunity to explore diverse emotional perspectives and personal experiences in a context free of competition; and the possibility of changing one's position based on new information, arguments and perspectives (36).

The learning logs also provide a space for individual reflection on the deliberative experience itself, as well as on the treatment of scientific-technological controversies and their ethical dilemmas.

> *During the course, many things led me to the same idea: how important it is to reflect! How important it is to think about the why of things! And self-reflection is not enough, since it is the opposing opinions that are most enriching. Yes, I do think so. That it is with those whose opinions are the opposite of ours that we should talk the most.* (S12)

It is interesting to highlight some considerations found in the logs about the course itself, its components and objectives, since they reflect in part the goals of the course.

> *It is true that I probably finished the course with more doubts than I started with, but I really believe that these are doubts that no scientist, and even no citizen should avoid.* (S18)

> *This course allowed me to reflect on the interconnection of my scientific discipline and my own training with society, politics and ethics. And it is here that I value what I have done with this log, since my thoughts shall forever stay in its pages regarding what I was able to process of each question raised throughout the semester, whether by myself, the authors of the readings, the professors, or my fellow students. The class discussion and the debates held throughout the workshops enrich us as future scientists, in a profession that feeds on debate, criticism and consensus.* (S19)

It is interesting to mention some examples of how students themselves evaluate the learning logs as a tool, not only because it is a form of assessment that is necessary for improvement, but also because some incorporate into it an introspection of their own achievements and changes associated with writing the log, regarding the reflective process and its relationship to writing.

> *But if there is one thing that I certainly believe was essential and valuable in my process, it was the learning log. I am not going to lie; at the beginning I was bored having to write reflections on things that I was seeing in the course. In fact, I felt that it did not make much sense and that it was not going to be useful to me. To my surprise, it was just the opposite. The learning log was one of the most important things in this whole process that I did during the course, since it somehow forced me to reflect and question myself about many things that I had never questioned before.* (S14)

> *During the reading of this learning log, you can notice connections between the different topics on which I expressed myself. Such connections do not become apparent after the topics have been raised separately; rather, they arrive while I try to form an opinion about some concept, new questions, ideas, contradictions and more, that create the connections between the different presentations.* (S16)

In this regard, it should be noted that the logs are one of the determining factors expressed by students for why they choose to take the Bioethics course. The learning logs have become an important element for the teaching team and for the students as well.

Problematization and metacognition promoted by learning logs

It is important to analyze the ways in which the exercise of problematization in writing the learning logs is concretely manifested. Quite possibly, the clearest way to identify the processes that lead to questioning or problematizing the assumed visions, and transforming them into problems to be investigated, is through students' questions. The functionality of the question cannot be analyzed in isolation from the discourse that produces or introduces it. The question plays a predominant role as an activator of different processes involved in learning. Questions can favour, generate or strengthen processes of high cognitive complexity (23,37-39), such as metacognition, critical reflection and problem-solving, and thus contribute to the development of abilities such as critical thinking (40), creativity (41,42) and citizenship (43,44).

Some questions found in the learning logs show an evolution of the reflexive process. In them, the question acts as a trigger for the use of increasingly abstract arguments or discursive developments. In this sense, original problematizing questions of contents or practices appear in the logs. Some of them identify problems underlying the subject matter, without developing them in depth. Others succeed in initiating a process of inquiry into the problems identified, as reflected in the fragment from S4: *"If all inherently human activity is moral, does this mean that all moral activity is inherently human?";* from this question, the student investigates morality surrounding animals, drawing on work by authors relevant to this area. Some questions allow us a glimpse into critical thinking processes: those which question concepts, authors, or theories. For example, the considerations of S7 are based on the questioning of the determination of welfare made by utilitarianism: *"Who decides what welfare should be, and under what arguments?".* Some students, on a more self-reflective level, even challenge their own attitudes, beliefs or preconceptions. As an example, see those presented above, by S8, where the student questions their own meat consumption and the reasons why they do so in spite of the strangeness or moral doubt. This last type of question is the one that best allows us a glimpse into metacognitive processes.

Perhaps it is in ethics courses that tools are most needed to enhance and aid with the processes of stimulating critical thinking and metacognition. The encouragement of metacognition is extremely valuable to enhance learning processes in general, but specifically to aid in the development of ethical reasoning skills, as it leads to clarifying ideas and concepts, distinguishing criteria about which behaviours are fair and which are not (45). In this regard, the following log excerpts illustrate the potential for achieving these skills.

> *When the time comes to confront oneself, all ideas, philosophy and ethical viewpoints are gone, leaving behind the refuge of familiarity. In hindsight this is understandable, it is a defense mechanism. It makes sense to want to preserve one's idea of oneself, not only as a moral agent, but as a being with the right morality. It is part of the identity that one forms. This is a problem that I really do not know how to solve. Perhaps, the answer is to progressively do ethical exercises, like debating a position that one does not hold, until one improves the mind's capacity. Thus, we could understand the idea that you are not bad or good because you have had a belief, and the value you can add comes from genuinely seeking an answer, not necessarily what the answer is. I do not know how valuable this can be, but I feel it is necessary to emphasize this to people so that they do not retreat into the cave of immutable thought tribes where changing your mind is taboo.* (S1)

> *The lesson I take away is no less than that I have realized that we are much more irrational beings than I would have been willing to accept at other times in my life. Why do I say this? I always believed that one could justify morality in a rational system that aimed to ensure the welfare of all participants, something like looking for an optimal strategy in the game of life to achieve Nash's equilibrium. When I was thinking about whether it is moral to kill an animal in order to eat it, even if there is no real need to do so, I observed that, if I am honest with myself, the only valid reasons I have for keeping my initial position are: because I do, because I like meat, or because I do not care. These are certainly not entirely rational approaches, and this led me to understand that we actually act most of the time out of habit or emotion.* (S8)

Moon (31) mentions that a learning journal must demonstrate quality in several elements, such as honesty and self-assessment, as well as the ability to review one's own ideas. The above excerpt is a clear example of a student's process of honest and detailed review of their own stance. The originality of the above excerpt, however, does not lie solely in its ability to convey a sincere narrative. The student does not limit themselves to the exposition of their ideas, nor do they seek to modify them in order to adapt them to a specific content. Instead, they transcend the concrete evaluation of the situation or problem and transfer the reflection from the individual to the collective dimension.

After narrating the dissection of a mouse that they carried out for a course, a student's log expresses the following:

> *I am going home; I cannot tell anyone about my experience. My partner does not want to hear about it because it turns their stomach on everything that has to do with viscera and organs (the fact that it is a mouse is not truly relevant to her). I cannot tell my mother-in-law either because she does not like the subject matter very much. I just sit there, not knowing what to think or what to feel. Nothing happens, no punishment, no reward. Whether I act morally or not in this situation, only matters to me. Then, I understand the reason as to why am I so active with some causes and not with others. I see acts of gender-based violence every day and I know other people are going to be affected and will see me differently based on my stance. That is the big motivator: the sense of justice only leads to guilt and anxiety. Having other people judge me brings me to action. I do not know if this speaks to the importance of collective action and of speaking out (even if no one listens to you), or of the power of inertia in human attitude. But I will definitely continue to process this experience for a long time.* (S1)

This excerpt exemplifies the skills that Nussbaum (20, p.8) points out as indispensable for "producing people who can function with sensitivity and alertness as citizens of the whole world": a critical examination of oneself and the ability to see oneself connected to others. This would encourage, according to the Nussbaum – and in line with Socratic pedagogy that "the unexamined life is not worth living" – the fact that people can reason and argue well for themselves, that they understand the difference between logically valid and invalid arguments, and that they can tell the logic of an argument from the truth of its premise (20).

Some of the challenges of learning logs

Among the difficulties that students face in scientific degrees when performing tasks related to the branches of philosophy, Gooday (46) especially highlights the problems related to essay-writing. Many students struggle with writing reflective essays. This difficulty can even lead to "failure to adequately develop critical thinking, analysis, and evaluation skills, and may be unable to lead a discussion" (47, p.201). What Gooday has proposed can be seen in the logs development process. In some cases, this notion is even expressed by students during the writing process.

> *I could say this apparent distance between the students of natural sciences and courses such as Bioethics is the result of the acquisition of certain prejudices regarding the field of philosophy, either because of bad experiences in high school, or because of the false belief that philosophy is meant for a few people. Perhaps it is due to the teaching methods in which we were used to learn, where questioning and interpellation are not always promoted or prioritised.* (S9)

It should be noted that most logs are descriptive in nature, given that, among other things, description is not discouraged as long as it can act as a summary for the student. They are, however, encouraged to move past mere description. Some do not move past the expository – those categorised as "off track". According to Hatton and Smith (48), such log entries could be defined as "descriptive writing"; that is, there is no discussion or exposition of critical personal views in these logs. On this basis, some entries showing increasing complexity record different ways of enriching logs and reflection.

A first level of complexity could be identified with "descriptive reflection": according to Hatton and Smith (48), the text is predominantly descriptive, but some elements appear that denote slightly deeper reflection. This level can in turn be associated with the first three stages of Moon's (49) map of learning. In a first stage, the student shows that a certain topic interests them and they relate it to some incident or concrete experience. In the second stage, they seek to know a little more about the subject matter. In the third stage, new information is assimilated by the student by asking questions and connecting ideas. A second level of complexity is established when the student distances themselves from their own experience or from the original content being described with the purpose of creating new meaning. It is a stage that approaches what Moon (49) calls "working with meaning" or Hatton and Smith (48) call "dialogical reflection".

Finally, some of the analyzed learning logs reach levels of reflection, metacognition and problematization nourished by group discussions, and show that they have acquired a learning process that gives them a personal orientation within the process itself. The presence of these elements would indicate, according to Hatton and Smith (48), a "critical reflection", or "transformative learning" in the words of Moon (49). Year after year, about a quarter of the logs reach this level of reflection. The challenge of the "remaining three quarters" should not, however, discourage the use of the tool. Since the writing process favours learning, the use of learning logs can stimulate each student to enhance their reflective abilities. As Moon states (28), the learning journals produce space in which the students can think, an opportunity to order thoughts and to

make sense of their own learning process with a language more like a conversation or the language of thought. The following excerpts showcase such effort.

> *Before taking the course I thought I would not be able to reflect or write about it in my learning log. But I did it, and I found I had more to reflect on than I had initially thought. I learned the importance of reflecting on everything, and that we must not only accept things "because that's just the way it is". We must question ourselves about everything.* (S20)

> *The learning log was one of the most important things of the process I went through during the course, for it somehow forced me to reflect and question myself about many things that I had never questioned before.* (S14)

In terms of the evaluation of critical thinking and metacognitive processes, there is a preference on the part of researchers for the use of less structured instruments (such as open-ended questions, essays, monographs, and group discussions, among others), while recognizing the possible biases and the challenges presented by reaching agreements among teachers (50). Systematic evaluation processes built on discussion and consensus among teachers increase the number of agreements and have the potential to generate high-quality tools for teachers to use (51).

> *Epilogue: I know that many phrases, ideas and comments remain in my inkwell, and this pen and keyboard would love to continue tattooing the paper, even if it is virtual, expressing my opinions on the matter… Anyway, I thank you for the opportunity you give us all to express ourselves through the logs and for forcing us to set sail on this adventure of writing one's thoughts. Thank you also for taking the time to read this and every one of the logs.* (S2)

The strategy described in this paper – which has been maintained in the different editions of the course – has allowed the consolidation of consensus among professors by creating a shared image that shows what it looks like to have a valuable critical-reflective process and self-reflection of one's own learning process and discursive elaboration.

CONCLUSION

Teaching bioethics with a pedagogical framework that proposes integral and reflective learning can promote skills associated with critical thinking and deliberative practice that are oriented at understanding, commitment, analysis and decision-making in the face of complex ethical problems. In this context, it requires the implementation of didactic strategies that promote metacognition, sensitivity to the problems addressed, and creativity. Student learning logs from the Bioethics course at the Faculty of Sciences (UdelaR) show that this tool promotes complex reflective and self-reflective processes in which the development of skills such as analysis, synthesis, abstraction, argumentation and problematization are manifested in an integrated way. Students of bioethics – each with their own style, interests, expectations, and preconceptions – find in the logs an unstructured environment to reorder their thoughts and integrate the concepts learned in various ways, expressing themselves with creativity and commitment. In this way, the readings and discussions worked on during the course are not isolated in a theoretical body of the curriculum but are used by students to question and challenge themselves. As some students who were not so comfortable with oral communication explained, the log is the tool that allows them to continue the dialogue and develop their personal viewpoint about what was discussed in class.

The Bioethics course aims to provide elements for the problematization of ethical and social reflections on the scope and impact of scientific-technological activity, with the understanding that such skills and capabilities are crucial to the training of students and future professionals and also to their critical and reflective performance. Just as ship captains use logs to review the decisions made in light of the events that happened, our bioethics students prove that they can use this tool to record their own sailing adventures through a course that challenges them. Learning logs are useful in stimulating the recognition of one's own learning process, which is essential to promoting critical thinking. The heading at the beginning of this article reflects this: despite the discomfort of abandoning certainties and "problematizing so many things", the student is encouraged to "come out of the cave" to feel "more intellectually honest" and to "improve themselves". The metaphor is also illustrative in another sense. In a Faculty of Science, the journey through a topic related to ethics is an exotic one. Learning logs can help spark the interest, as Nussbaum says, "with more than a casual tourist's interest" (20, p.88).

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