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Introduction to bioethics through mobilization of critical thinking skills

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Abstract

A course design to 'learn by doing' and to encourage critical thinking and reflective abilities, was initiated in the context of bioethics teaching. Critical thinking is a process that transcends disciplines, committing students to be actors of their learning. The course design combines formal teaching sequences, group work sequences and interactions (or exchanges between students). The students are confronted with authentic cases bringing values into conflict, which they will have to present. Using evaluation grids the students have designed, they can self-assess and assess their peers. They also benefit from teacher feedback between their oral presentations. The impact of the course design was assessed by analyzing student productions, using a questionnaire and performing group interviews. The data collected suggested that the students are particularly invested in their learning, while becoming aware of the objectives targeted by these teaching. Several strong points were raised and are discussed in this communication.

Keywords: *Critical thinking; bioethics; evaluation grid.*

1. Introduction

1.1. Context

The need for the development of a critical mind in students responds both to the demand for a society that upholds the values of democracy (Lecointre, 2018), and to a French ministerial injunction that defines critical mind as a set of attitudes and habits related to discernment, thinking and vigilance over one's judgments and those of others.

Students are exposed to a growing body of information and hoaxes, which requires the mobilization of a body of tools and knowledge to guide and to distinguish facts from interpretations, as well as truth from error. Managing this critical mass of information disrupts the relationship to knowledge: how to learn and how to teach in a context where there is immediate access to a multitude of content where knowledge, pseudo-knowledge, beliefs and opinions are mixed together?

Critical thinking training and the practice of critical thinking emerge as opportunities to explore tools and ways of working that can be appropriated by students and transferred to other areas. Critical thinking transcends disciplines: it engages students to be actors, to position themselves as citizens, through skills that implement both careers and personal lives.

The ethical issues linked to advances in medicine and biology are debated at regular intervals and are reflected in legislative texts, as for bioethics. This discipline has never been so fundamental for facing the challenges and issues that await us in the coming decades. We noticed a need among undergraduate students to understand ethical issues when working on raising awareness of the ethical dimensions of research protocols in animal experimentation (Bodart and Dupré, 2020). Critical thinking can be also seen as an important part of teaching ethics itself. It is, for example, included in the code of ethics of teachers who are members of the French-speaking pedagogical society (Prairat, 2006).

We recently aimed at clarifying with our students the ethical contexts of the knowledge taught, especially in the field of research in animal experimentation, genetic technologies, environmental threat, development of neurotechnologies, and aimed at stimulating their critical thinking. These concerns have led to the creation in 2020-2021 of two introductory bioethics modules, in the second (L2) and third (L3) years of the Bachelor mentioning in Cellular Biology and Physiology (LBCP). Such modules were also opened to L2 students mentioning in Biochemistry or in Biology of Organisms and Populations. These optional modules were included in the knowledge and skills block "Positioning yourself in a career / professional field". The objective of these lessons was to allow students to make well-argued and defended choices, as well as to become aware that the critical mind is part of an action, the learning of the mechanisms of which benefits both their professional orientation and to their personal life.

1.2. Nature of critical thinking and critical thinking training

Ennis (1987) defined specific capacities and attitudes characteristic of critical thinking while cognitive strategies were established by Paul, Binker, Martin & Adamson in 1989. Training in critical thinking had been noticeably studied by Boisvert, who offered conditions and illustrations of pedagogy in this area (Boivert, 2015). Critical thinking is characterized as a reflective process in which the propensity for self-correction is essential (Ennis, 1987; Lipman, 2003). According to McPeck (1981), critical thinking is best practiced when the student has in-depth knowledge in a particular field.

Three approaches have been reported for critical thinking training: (1) a general approach, which presents the elements of critical thinking separately from the subject of the teaching, (2) an infusion approach, where the students have the theoretical elements of the critical thinking provided as guides and where these elements are addressed in a context, (3) an approach by immersion, where the principles are not explicit but are developed implicitly during the lessons. The combination of an immersion approach and an infusion approach seemed to be the approach that exhibited the most positive effects to improve students' critical thinking skills (Abrami et al, 2015).

In the context of bioethics teachings, a combined approach has been therefore favored, (1) where the capacities relating to critical thinking have been clearly exposed to the students and (2) where the students are confronted with authentic cases, highlighting conflicts of values. The method chosen was based on group work, brainstorming activities, individual reflective activities, co-construction of evaluation grids, oral presentations and co-construction of knowledge.

1.3. Learning by doing

Our aim was therefore to develop and evaluate a teaching which encourages critical thinking and the capacities of the students to exert reflexivity on their thoughts, with the objective of increasing their capacities to argue from simple ethical lines. Therefore, the choice was made to drive the students in front of complex ethical situations, which they had to present and discuss the historical, scientific and ethical contexts. One has to note that these courses were for the majority of students their first contact with bioethics. The approach was to get them to manipulate concepts as well as to practice critical thinking and evaluate their practice. The method was presented as a process allowing to take a step back towards one's own beliefs, as well as to succeed in establishing the validity of certain facts or not. The methods used were also based on co-construction techniques and emphasized to the students the importance of group work.

These two modules were designed with strong inspiration from the Learning and Assessment Situations (LES), defined by Georges and Poumay (2020) to assess skills. Indeed, they are

based on four points : (1) students must be confronted with complex problems which require research, thinking and generate awareness (learning by doing); (2) the situations with which the students are confronted, must be close to the reality of professional life (situations with high authenticity) ; (3) learning and assessment should be combined so that the teacher can see students in action, and provide to the students the opportunity for self-assessment and constructive feedback; (4) an integrative dimension, which requires the use of knowledge from different fields. We also coherently articulate the three pillars of pedagogical alignment in the construction of these two teaching modules: objectives, method and evaluation (Biggs, 2003).

2. Courses design

The courses of this module have been developed in two ways, according to time constraints imposed by the Bachelor mention architecture and referred hereafter as L2 for second year courses and L3 for third year courses. Due to the Covid situation, the teaching were performed at distance during the year 2021The teaching in L2 consisted of 4 courses of 1.5 hours each, and three practical teaching sessions (volume = 10 hours). The scheme of the teaching sessions is depicted in figure 1 for L2 students .

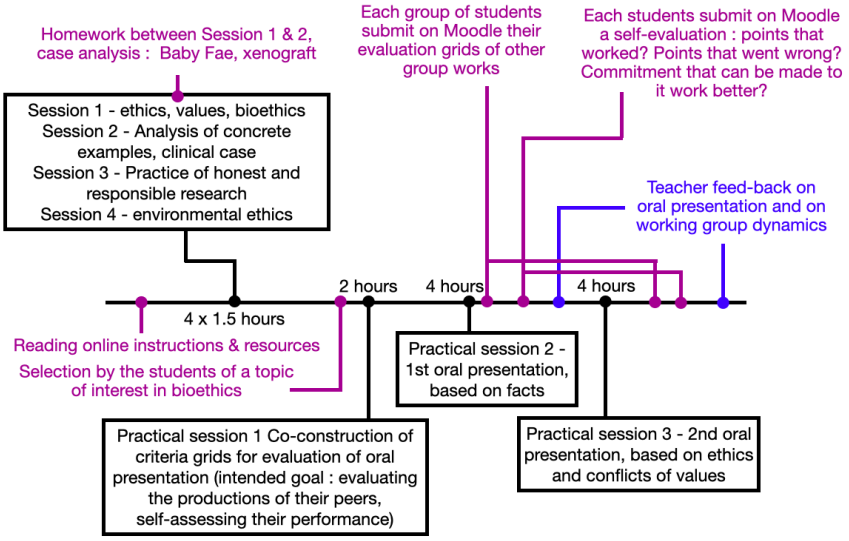

Figure 1. Overall scheme of teachings. Sessions performed with the teacher are indicated in black. Activities that shall be performed by the students are indicated in purple. Activities performed by the teacher are indicated in blue.

The first course aimed to present the module: definition of ethics, main currents of thought in ethics, notion of moral dilemma, notion of values and definition of the perimeter of bioethics. The second course was devoted to discuss a case analysis (xenograft of a baboon heart into a newborn, referred as Baby Fae case (Cifarelli, 1985)) and moral dilemmas related to scientific misconduct (i.e. fraudulent link between vaccine & autism; Flaherty, 2012). The third and fourth courses dealt respectively with the practice of honest and responsible research, and environmental ethics. In L3, topics related to environmental ethics were not directly addressed with the students due to time constraint and due to the consideration of their specialization and specific interest areas in cell biology and physiology.

Asynchronously, the students formed working groups and selected themes to work on: 4 themes had to be chosen from 6 themes proposed by groups of 16 students. The practical lessons were divided into three sessions of 2, 4 and 4 hours respectively.

The first practical session was scripted as follows: (1) presentation of instructions (15 min), examples of tables and expectations; group work, determination of criteria and descriptors (1 h), (3) pooling of the grids produced and discussion (45 min in L2, 30 min in L3).

The first practical session was devoted to creating an evaluation grid (criteria grid). The purpose of this evaluation grid is to be used by students to evaluate the presentations made during the second and third practical work sessions. It was explained that the creation of this grid aims to encourage their critical thinking, so that they can take a critical and reasoned look at any oral presentation, and be able to support discussions at the end of the presentations. Two examples of evaluation grids were provided; the constituent elements of a grid were discussed: criteria, performance levels and descriptors. Based on the work of Ennis (1987) and Paul, Binker, Martin & Adamson (1989), several tables have been provided so that students can identify criteria specific to critical thinking. During this practical session, students were told that they will be assessed on the evaluation grid created and how they will use this grid, as well as on the two oral presentations. Each grid created by the students was submitted on the Learning Management System Moodle (institutional and online pedagogic platform used by the University of Lille) within 24 hours after the session. This grid was not considered final until the end of the third practical session, when it was used for the evaluation of the oral presentations of the other groups.

The other two practical sessions were scripted as follows: (1) oral presentation + question-and-answer phase (15 min + 15 min; 4 groups maximum per session), (2) break (15 min, L2 only), (3) discussion phase where each group evaluated, according to their co-created grids, the presentations of the peers (30 min), (4) individual self-assessment phase on the group work (15 min for L2, carried out asynchronously for L3), and (5) a pooling phase (15 minutes per group). The assessment and self-assessment sheets were submitted on the Learning Management System Moodle after the session.

Between practical sessions 2 and 3, the teacher provided feedback on several lines, emphasizing areas for improvement in (1) group production and (2) group work.

3. Evaluation

We performed an evaluation of the courses. The objective of such evaluation was to improve the teaching: since 2021 was the first year of completion of this teaching, it was therefore necessary to optimize the teaching design. The evaluation system was made up of the following elements:

- An analysis of students' evaluation grid productions by the teachers. The evaluation grids constructed by the students were analyzed (Figure 2). Teacher's evaluation grid of this work includes 6 criteria, which evaluate the criteria chosen by the students, as well as the description of the expected performance levels : (1) clarity of criteria, (2) independence of criteria, (3) expression and clarification of strategies, aptitudes and capacities specific to critical thinking (4) clarity of descriptors, (5) differentiation of the levels of performance, (6) use of the grid by students (support for metacognition). One has to note also that four performance levels have been established and described: insufficient, acceptable, good and very good.

- A questionnaire. An anonymous questionnaire was carried out using the LimeSurvey software. The same questionnaire was submitted to both L2 and L3 students. It was made up of 23 closed questions and 3 open questions. The closed questions were organized according to 5 categories: (1) general appreciation, (2) lessons, (3) animation of the lesson and interactions, (4) activities and (5) evaluation. The open-ended questions focused on the relevance of teaching in their training, on the three strengths of teaching and the last question invited students to provide suggestions for improving teaching.

- Group interviews. In addition to the questionnaire, two collective interviews with L2 students were carried out. The objective of the interviews was (1) to question the students on the contributions of the teaching to the building of their career, and (2) to address the connections between the objectives of the teaching and the way in which the courses are dispensed. These interviews were designed to deepen and / or clarify the data collected by the questionnaire.

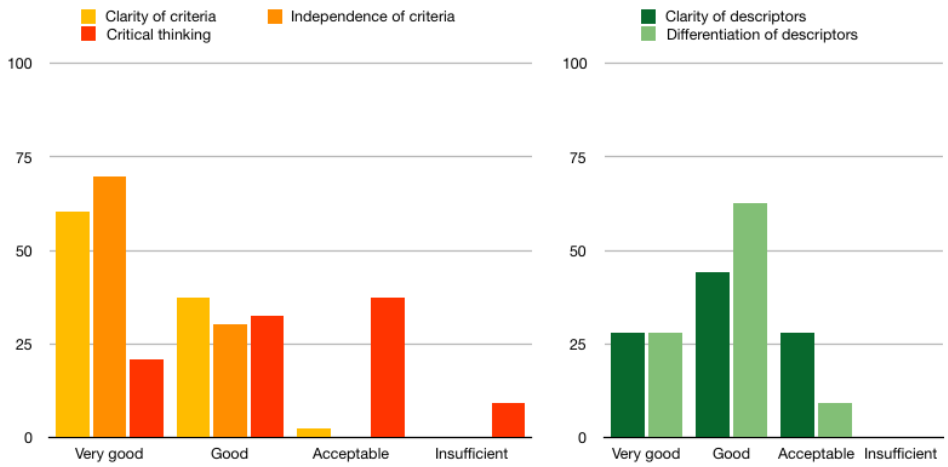

Figure 2. Analysis of co-created grids of evaluation. 43 grids were analyzed immediately after their co-construction by the students. Metacognition criteria and use of the evaluation grids by the students was assessed at the end of the teaching, and was not included in this figure.

4. Results and discussion

The lessons were built as mixed approaches. The students were confronted with authentic cases bringing into conflict ethical values which they will have to explicit. Using the evaluation grids they have designed, students were able to self-assess and assess oral presentations of their peers. They also benefited from teacher feedback between their oral presentations during practical sessions 2 and 3.

The student productions (oral presentations) drove us to conclude that students correctly understood the different currents of thought in bioethics and were able to produce materials that transcribe their ability to argue and develop simple ethical links. L2 students apprehended in a globally satisfactory way the exercise of co-building of the grids of criteria (Figure 2). L2 and L3 students exhibited performance levels that were distributed in a similar manner. Drafting clear and independent criteria did not raised major difficulties. One group out of four had difficulties to handle the use of critical thinking criteria in their evaluation grids.

By relying on the results and observations from questionnaires, interviews and analysis of student productions, several teaching strengths emerged: (1) students felt involved in their teaching, due to the development and maintenance of interactivity with them, and among themselves; 20 students (out of 40, L3) identified the interactions and discussion phase as strengths for this teaching, (2) the aims of the module had been understood by the students; the teaching clarified their vision of science, and their representation of bioethics, which no

longer appeared as abstract (L2: 6 students out 12 who answered the poll; L3: 19 students out of 40 expressed this idea), (3) the feedback provided, as well as the peer review, allowed the students to evolve and see themselves progressing through mobilization of critical thinking skills: respectively 16.6% and 20% of the L2 and L3 students who answered the questionnaire acknowledged the importance of this feedback. The 4 dimensions relating to Learning and Assessment Situations (Georges and Poumay, 2020) noticeably appeared in the students' feedbacks: a complex situation that mobilizes a critical mind, a situation close to professional reality, self-assessment and constructive feedback, and interdisciplinarity. We also surprisingly observed that 1 out of 4 students (either in L2 or L3 students' responses) stressed the importance of the teacher's involvement and attitude.

According to interviews and questionnaires, the importance of interactions was stressed by the students: "I wouldn't have gone this far on my own". Several strengths of this teaching were underlined by students: (1) interactions between students and teacher are considered (formative evaluations), (2) feedback from self-evaluations, which build a space to act together in a positive and constructive manner, (3) group work (diversity is perceived as an advantage and this joint action between teaching actors, teachers and students, could be analyzed with reference to the work of Sensevy (2011)), (4) creation of "a space for free and respectful speech", where "knowing how to listen to others" and "being listened to" (posture of the teacher) are essential. Therefore, we would like to stress that the tensioning of the teacher's posture is therefore important in a professional practice which aims to promote interactivity.

Several areas for improvement have emerged: (1) modification of the courses in order to increase interactivity and that students can have a better quality interaction space, (2) vigilance on the clarity of instructions and insistence on their understanding by all students, (3) the reformulation of certain thematic proposals, since the relevance or feasibility of a few topics were raised by several students, (4) an optimization of the time management between two presentations, allowing the teachers to improve the quality of the feedback and enabling the students to integrate the provided feedbacks, (5) the addition of a feedback on the evaluation grid that they produced, in order to reassure them or to guide them to improve on criteria or descriptors.

The conclusions of the course evaluations lead us to several observations, including that the students appreciated to develop their critical thinking: "it was not simply a question of sitting down and listening to a list of problems, but of thinking through ourselves, to deepen the reflection instead of learning something by heart." Students became aware of their ability to evaluate not only their own performance but also the one of their peers. Teaching support and self-assessment tools could be easily transferred to other teachings.

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