GOAL Geoethics' Syllabus

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Geoethics' Syllabus for Higher Eduation

TITLE OF THE CURRICULAR UNIT	**Geoethics**
RATIONALE	To respect the Earth system is an ethical responsibility as much as a necessity, in order to assure a sustainable life. Geoethics can really contribute to build a more knowledgeable and responsible society. Geoethics is an emerging field of knowledge, considering that less than a decade has passed since its formal definition and publication of a significant number of books, chapters and articles (Wyss and Peppoloni, 2014; ; Gundersen, 2017; Peppoloni et al., 2017; Bohle et al., 2019). Nevertheless, the development of an ethical thinking towards the Earth system has been developed from a very long time, also as a philosophical reflection in different cultures and historical moments (Peppoloni et al., 2017; Bohle, 2019), particularly in "environmental ethics" and "sustainability ethics" (Du Pisani, 2006; Theodossiou, Manimanis & Dimitrijević, 2011; Chemhuru, 2017; Bohle et al., 2019). The urgent need to create a Geoethics syllabus for the formal higher education curriculum emerges when considering the lack of students' awareness about this new disciplinary field. The integration of Geoethics values, methods and applications as an integral part of the educational training will allow to get geoscientists more aware of their social role and capability to intervene on the Earth system in a more responsible way, to respect life on the planet in all its forms, and to better serve society, looking at its safety and health (Bobrowsky et al., 2017). Moreover, knowing and applying Geoethics values will imply practicing geoscience as an effort to accomplish the universal goals of the Education for Sustainable Development and to fully understand that not well pondered actions by humans, impacting the Earth system, can lead to irreversible consequences and to threaten the survival of human life on the planet. An in-depth preparation and training in Geoethics will help young and early career geoscientists to find acceptable and responsible solutions in their geoscience activity and to understand the importance of accurately informing society about negative and positive repercussions of any possible intervention on the environment (Bobrowsky et al.,2017). Communicating geoscience using appropriate language and methods is an important geoethical value, useful to make citizens capable of actively contribute to improve the quality and sustainability of human life on the Earth.
IMPLEMENTATION	Students need to have a standard knowledge in Earth Sciences so as to

	be able to highlight, analyse and discuss geoethical issues (including dilemmas). Nevertheless, the syllabus can be applied in all courses in the wide area of Earth System Sciences or whenever the knowledge about Geoethics values is required. The syllabus (and complementary educational resources added) was developed to be use in any country and mainly in a curricular unit of Geoethics within a higher education course. However, each module can be partially added and explored within other curricular units where the geoethical approach may be relevant. The time required for its implementation has to take into consideration the prior knowledge of the students, the familiarity with the educational methodology adopted and the in-depth approach of the subject contents required.
AIM	Narrowly contribute to improve the capacity of all geoscientists to think and act (geo)ethically so that future generations can be proactive citizens, by promoting a geoethical understanding and thinking of our planet, and playing an important role in creating conditions for a sustainable human life on Earth.
OBJECTIVES	• To understand the meaning of Geoethics. • To be capable of applying (geo)ethical values in Earth system sciences activities. • To critically analyse geoethical issues and dilemmas. • To know tools for facing and, if possible, solving geoethical issues and dilemmas. • To apply geoethical values in the evaluation and protection of the geoheritage. • To address geoethical values in the mitigation of geological risks. • To consider ethical aspects in the water management. • To geoethically evaluate environmental issues. • To responsible manage natural resources chain. • To support geoeducation in promoting Geoethics and its values. • To fully understand the importance of Geoethics for a sustainable development of planet Earth and act consequently.
SKILLS	- Critical thinking - Case and Problem Solving. - Cooperative attitude. - Social and Cultural awareness. - Scientific and Professional responsibility. - Earth System-thinking.
METHODOLOGY AND STRATEGY	CBL methodology appeared in 1870 in Law and Business Harvard Schools in the United States of America and was developed by Christopher

Langdell (1826-1906). He started to refer real cases in his classes, breaking away from decades of transmissive teaching. In this approach, cooperative learning is emphasized, but it can also be individual. The CBL methodology starts from cases (a dilemma is taken from real life and laid in the form of a case) and students are generally asked to work in groups, so they are exposed to several viewpoints and ideas (fig. 1). Students are also asked to evaluate each other's opinions. The exploration of a case usually finishes with a plenum discussion. This approach develops students' collaborative competences and their communication competencies (Vasconcelos & Faria, 2017).

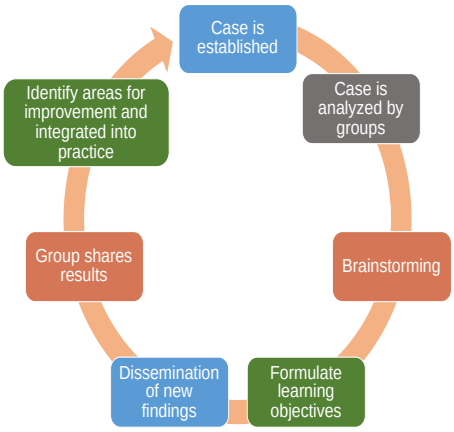

Figure 1 – The cyclic process of CBL
(Adapted from Williams, 2005, p. 578).

CBL requires to recall previous knowledge to solve the cases. In contrast, in PBL methodology the problem drives the learning process. Since CBL requires a prior knowledge, it provides to students the opportunity to effectively relate their previous knowledge with the new.

There are commonly strategies used in CBL like, for example, follow-up discussions, modelling activities, computer work, field trips, laboratory work, pencil and paper work, debates and role-plays, simulation games teamwork projects, video pills watching and articles critical analysis. On the other hand, specific teaching and learning strategies can be designed to lead students through a case, involving suitable questions, time allocation to group discussion and appropriate assessments of both group and individual outcomes so as to help students to find suitable solutions for the dilemmas.

CONTENT

- **Geoethics: foundations, definition, meaning and values**

  √ Three fundaments to start:
  - √ The origins of the geoethical thinking.
  - √ From ethics to geoethics.
  - √ The meaning of geoethics.

  √ The concept of responsibility: meaning and individual duties.

  √ The four geoethical domains: individual, inter-personal/professional, society, Earth system.

√ The ethical reference system of geoscientists.
√ Intellectual freedom: a pre-requisite for practicing Geoethics.
√ Geoethical values: ethical values, cultural values, social values.
√ Codes of ethics and training in geoethics.
√ Geoethics applied to geosciences: knowledge and skills of geoscientists, and themes of geoethics.
√ The four main features of geoethics: actor-centric, virtue ethics, geoscience knowledge based, context-dependent in space and time
√ Key geoethics concepts: sustainability, prevention, adaptation, education.
√ The Cape Town Statement on Geoethics.
√ The Geoethical Promise**.**

- **Geoethics and Georisks**
  √ Definition of risk.
  √ Risk perception.
  √ The acceptable limit of risk.
  √ Fundamental elements in risk studies.
  √ Risk management cycle (preparedness, response, recovery, mitigation) and the concept of resilience.
  √ Building a risk reduction strategy: key-points and values.
  √ Culture-based on facing the emergency and culture centred on prevention.
  √ Roles and responsibility of actors involved in risk decision chain.
  √ Citizen science in georisks' management.

- **Geoethics and Geoheritage**
  √ Definition of geoheritage and its different types of values.
  √ Natural and man-made threats to geoheritage.
  √ Fundamental elements in geoheritage management.
  √ Relation of geoheritage with public policies and with the society.
  √ Importance of transnational regulations to guarantee the conservation of geoheritage.
  √ Influence of cultural and social setting on the restrictions related with collecting natural specimens.
  √ Best-practices to avoid the over-artificialization of natural environments related with geoconservation actions.
  √ Compatibility between geoconservation and other types of land-use management.

- **Geoethics and Mining**
  √ Complexity in global (and local) markets of mineral resources.
  √ Environmental justice related to mining.
  √ Involvement of all stakeholders in mining projects.
  √ Public awareness of the importance of mineral resources for

	society. √ The relevance of well-informed citizens in the responsibility of the decision-making process. √ Responsible science communication to promote clarity and transparency in dissemination. √ Regulation and standards operation procedures internationally recognized in mining. √ White paper on responsible mining. • **Geoethics and water management** √ Human right to water and the United Nations Sustainable Development Goals (UN SDGs). √ Environmental justice related to water. √ Implications of climate change on water management. √ Competing interests of different stakeholders concerning water and land-use management. √ Coherent environmental policies as essential baseline to achieve societal goals related with water. √ Transnational implications of large water-infrastructure projects. √ Specificities related with ground water management. √ Personal daily behaviours and the influence on water consumption. • **Geoethics in Education** **√** Educating students to become geoethically responsible citizens. **√** Outdoor experiences as an important source to develop geoethical awareness. **√** Responsibility to include geoethics concepts, values and principles in higher educational courses. **√** Geoethics as an integral part of the professional training of Earth scientists.
EVALUATION	In a Social Constructivism approach evaluation must be regarded as a way to assess students learning achievements so as to scaffolding their learning process and allow them to overcome their most difficulties in engaging with the teaching methodologies and subject contents. It also gives professors a feedback of the strategies they are using to guide students in their problem-based or case-based learning. As such the presentation of a Geoethics case and its exploration in terms of values and principles that can be discussed and highlighted is the addressed proposal to evaluate students.
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