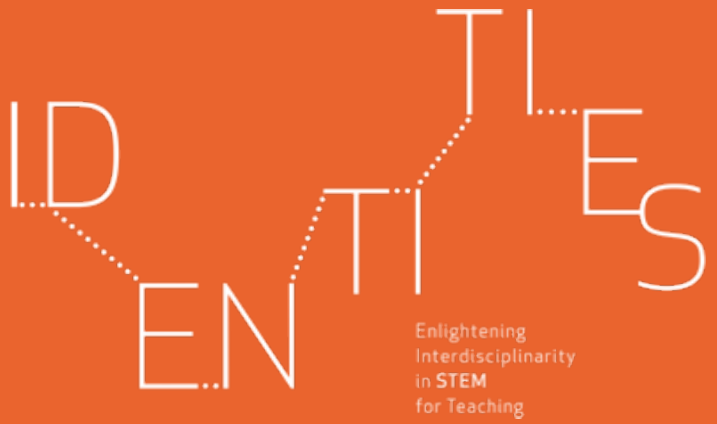

Introduction to the Family Resemblance Approach (FRA) to reflect on disciplinary identities and their comparison

Co-funded by the
Erasmus+ Programme
of the European Union
Grant Agreement n°2019-1-IT02-KA203-063184

At the basis of inter-disciplinarity there are disciplinary identities

"The term "discipline" contains the Latin root "discere", whose meaning is to learn. Disciplines are re-organizations of the knowledge with the scope of teaching it. In particular, disciplines ground their roots into the didactical necessity to re-organize knowledge in such a way that students, whilst building their knowledge, can also develop epistemic skills, like problem solving, modelling, representing, arguing, explaining, testing, sharing... Disciplines have been built to help student to make gradually sense of different categories of problems, approaches, tools and criteria to evaluate the correctness and efficiency of a procedure, a reasoning, an argument. From this perspective, disciplines can still play a relevant educational role, provided that they are explicitly pointed out as forms of knowledge organization historically developed and grounded on specific epistemologies" (Branchetti, Fantini, Levrini, 2019).

To reflect on the disciplinary identities and their comparison we used the Family Resemblance approach (FRA)

Irzik, G., & Nola, R. (2011). A family resemblance approach to the nature of science. *Science & Education*, 20, 591–607
Erduran, S. & Dagher, Z. (2014). Reconceptualizing the nature of science for science education: scientific knowledge, practices and other family categories. Dordrecht: Springer.

Family Resemblance Approach to Nature of Science

- framework theorised by Irzik and Nola (2011) and reconceptualised for science education by Erduran and Dagher (2014a);
- a specific stance with respect to the delicate methodological problem of defining science, accounting both for the diversity of the scientific disciplines and their reciprocal resemblances that create the "science family".
- The approach assumes that "there is no fixed set of necessary and sufficient conditions which determine the meaning of [science]" (Irzik & Nola, 2011, 59 p. 594). Yet, just like in a family, each member (out of the metaphor, each discipline) resembles some family members with respect to some aspects and other members with respect to other aspects.

Irzik, G., & Nola, R. (2011). A family resemblance approach to the nature of science. *Science & Education*, 20, 591–607

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Family Resemblance Approach to Nature of Science

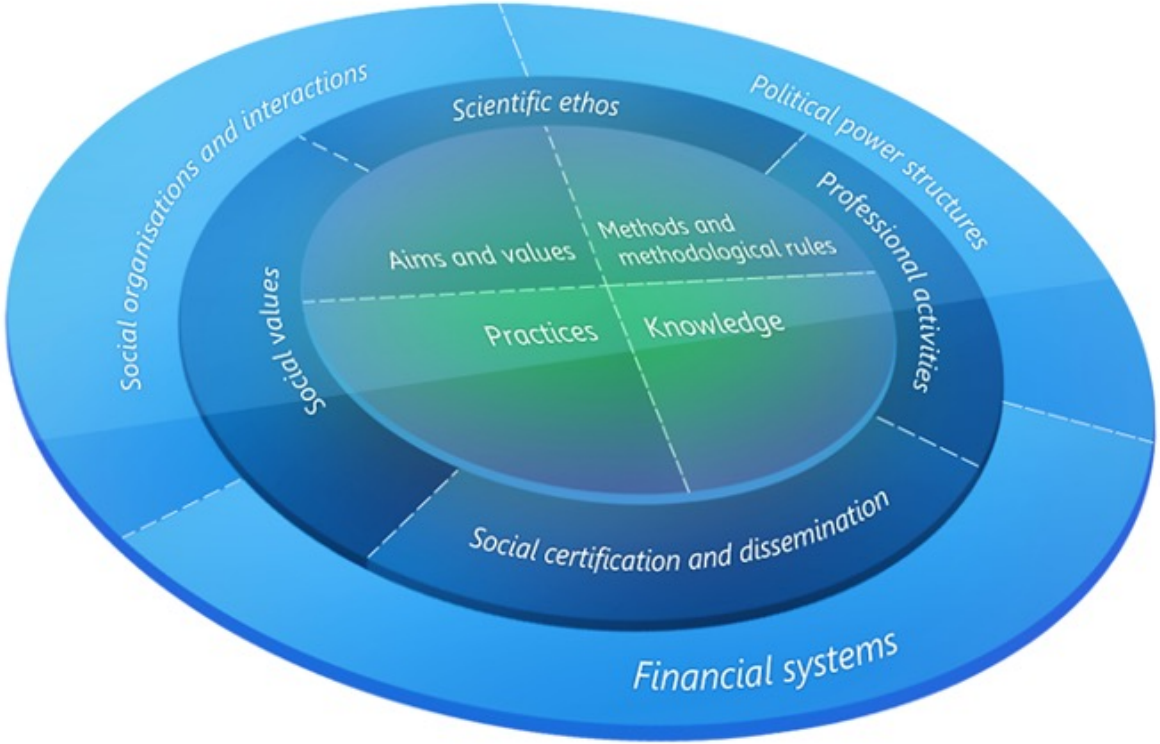

Figure 1. FRA wheel designed by Erduran and Dagher (2014, p. 28)

Cognitive-epistemic system aspects	Aims and values	The scientific enterprise is underpinned by adherence to a set of values that guide scientific practices. These aims and values are often implicit and they may include **accuracy, objectivity, consistency, scepticism, rationality, simplicity, empirical adequacy, prediction, testability, novelty, fruitfulness, commitment to logic, viability, and explanatory power**.
	Scientific Practices	The scientific enterprise encompasses a wide range of cognitive, epistemic, and discursive practices. Scientific [epistemic] practices such as **observation, classification**, and **experimentation** utilize a variety of methods to gather observational, historical, or experimental data. Cognitive practices, such as **explaining, modelling, and predicting**, are closely linked to discursive practices involving **argumentation** and **reasoning**.
	Methods and methodological rules	Scientists engage in disciplined inquiry by utilizing a variety of **observational**, **investigative**, and **analytical methods** to generate reliable evidence and construct theories, laws, and models in a given science discipline, which are guided by particular methodological rules. Scientific methods are revisionary in nature, with different methods producing different forms of evidence, leading to clearer understandings and more coherent explanations of scientific phenomena.
	Scientific knowledge	**Theories, laws, and models** (TLM) are interrelated products of the scientific enterprise that generate and/or validate scientific knowledge and provide logical and consistent explanations to develop scientific understanding. Scientific knowledge is holistic and relational, and TLM are conceptualized as a coherent network, not as discrete and disconnected fragments of knowledge.

Table 1: FRA categories (from Erduran and Dagher 2014a) – adapted from Yeh *et al,* (2019, p295)

Social-Institutional system aspects	Professional activities	Scientists engage in a number of professional activities to enable them to communicate their research, including conference attendance and presentation, writing manuscripts for peer-reviewed journals, reviewing papers, developing grant proposals, and securing funding.
	Scientific ethos	Scientists are expected to abide by a set of norms both within their own work and during their interactions with colleagues and scientists from other institutions. These norms may include organized skepticism, universalism, communalism and disinterestedness, freedom and openness, intellectual honesty, respect for research subjects, and respect for the environment.
	Social certification and dissemination	By presenting their work at conferences and writing manuscripts for peer-reviewed journals, scientists' work is reviewed and critically evaluated by their peers. This form of social quality control aids in the validation of new scientific knowledge by the broader scientific community.
	Social values of science	The scientific enterprise embodies various social values including social utility, respecting the environment, freedom, decentralizing power, honesty, addressing human needs, and equality of intellectual authority.
	Social organizations and interactions	Science is socially organized in various institutions including universities and research centres. The nature of social interactions among members of a research team working on different projects is governed by an organizational hierarchy. In a wider organizational context, the institute of science has been linked to industry and the defence force.
	Political power structures	The scientific enterprise operates within a political environment that imposes its own values and interests. Science is not universal, and the outcomes of science are not always beneficial for individuals, groups, communities, or cultures.
	Financial systems	The scientific enterprise is mediated by economic factors. Scientists require funding in order to carry out their work, and state- and national-level governing bodies provide significant levels of funding to universities and research centers. As such, these organizations have an influence on the types of scientific research funded, and ultimately conducted.

Table 1: FRA categories (from Erduran and Dagher 2014a) – adapted from Yeh *et al,* (2019, p295)

IDENTITIES

Enlightening
Interdisciplinarity
in **STEM**
for Teaching

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BARCELONA

ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ
UNIVERSITY OF CRETE

UNIVERSITÀ
DI PARMA

Co-funded by the
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