TEACHING FLUID MECHANICS AT UNIVERSITY: HOW HISTORY OF SCIENCE CAN HELP

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Fluid mechanics is part of the curriculum of many and diverse undergraduate courses – engineering, technician, and premedical courses for instance. These courses' goals are different and so are the student audiences. However, disciplinary elements such as the concepts of "Bernoulli equation" or "head loss" are common to all these curricula. So improving the way of teaching them may be useful for various undergraduate courses.

Opportunities may appear by increasing the students' knowledge on the Nature of Science (NOS; Duschl & Grandy, 2013). Indeed, as defined by the American National Science Teaching Association, "Nature of science (NOS) is a critical component of scientific literacy that enhances students' understandings of science concepts and enables them to make informed decisions about scientifically-based personal and societal issues." One element that is recommended by the international NOS research community is to increase the use of history of science in teaching in order to improve the students' learning (Duschl & Grandy, 2013; Maurines & Beaufils, 2013). Indeed, the literature indicates that referring to the history of science can help to learn scientific knowledge (Monk & Osborne, 1997), to better understand the nature of the scientific knowledge and the way this knowledge is elaborated (Maurines & Beaufils, 2013; Abd-el-khalick, 2013). However, such a way of teaching also presents difficulties, which are connected to the students' difficulties on reading historical texts, especially old historical ones, as well as the inadequacies of the in-service teachers' training.

Dealing with fluid mechanics, it is during the period that lasts from the 18th to the first mid 19th century that there is the building of the elements of theory which are currently taught in undergraduate courses (Eckert, 2007; Darrigol, 2005; Herrick, 1942). That's why studying this period can furnish useful tools for teaching.

I will present and discuss pedagogical propositions to teach fluid mechanics which are connected to the use of the history of science and which follow the NOS research community's recommendations. The four steps of my presentation are:

1. Elements of Physics of an undergraduate Fluid Mechanics course
2. Elements of History of Science of Fluid Mechanics
3. Pedagogical propositions
4. Discussion

REFERENCES

Abd-el-khalick, F. (2013). Teaching with and about Nature of Science, and Science teacher knowledge domains. *Science & Education, 22(9),* 2087–2107.

Darrigol, O. (2005). *Worlds of flow*. Oxford Univ Press.

Duschl, R. A., & Grandy, R. (2013). Two Views About Explicitly Teaching Nature of Science. *Science and Education*, *22*(9), 2109-2139.

Eckert, M. (2007). Hydraulics for royal gardens: water art as a challenge for 18th century science and 21st century physics teaching. *Science & Education, 16,* 539-548.

Herrick, J.F. (1942). Poiseuille's observations on blood flow lead to a law in hydrodynamics. *American Journal of Physics, 10,* 33–39.

Maurines, L., & Beaufils, D. (2013). Teaching the Nature of Science in Physics Courses: The Contribution of Classroom Historical Inquiries. *Science & Education, 22(6),* 1443-1465.

Monk, M., & Osborne, J. (1997). Placing the History and Philosophy of Science on the Curriculum: A Model for the Development of Pedagogy. *Science Education, 81,* 405-423.

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