

SUBJECT TEACHING GUIDE

M2153 - What is Science? Research in Civil Engineering

Master's Degree in civil Engineering, Canal and Port Engineering

Academic year 2022-2023

1. IDENTIFYING DATA					
Degree	Master's Degree in civil Engineering, Canal and Port Engineering			Type and Year	Optional. Year 1
Faculty	School of civil Engineering				
Discipline	CROSS CURRICULAR EDUCATION				
Course unit title and code	M2153 - What is Science? Research in Civil Engineering				
Number of ECTS credits allocated	3	Term	Semester based (2)		
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. CIENCIA E INGENIERIA DEL TERRENO Y DE LOS MATERIALES				
Name of lecturer	DIEGO FERREÑO BLANCO				
E-mail	diego.ferreno@unican.es				
Office	E.T.S. de Ingenieros de Caminos, Canales y Puertos. Planta: + 0. DESPACHO (0004)				
Other lecturers					

3.1 LEARNING OUTCOMES
- Distinguish the different ingredients that make up scientific knowledge.
- Discern the role of logic-mathematics, experimentation, theorizing and numerical modeling in Science.
- Understand the approach given by the Logical Positivism.
- To understand Popper falsificationism.
- To know the approach proposed by Kuhn.
- Have the ability to criticize epistemological relativism.

4. OBJECTIVES

The general objective of this course is to provide the student with the tools to be able to discern the scientific nature of knowledge. It is also intended to provide a sufficient criterion to understand worrying social phenomena (epistemological and moral relativism, antisecularism, anumerism, etc.) that have developed in recent decades.

As specific objectives, the following can be listed:

- Understand the role of facts, observation and experimentation in the scientific process.
- Know the different approaches that have been developed historically to derive theories from facts . In particular, the approaches of classical empiricism, logical positivism and Popper's falsificationism.
- Understand scientific development as a social process. In this sense, the conceptions of Kuhn (with his successes and his errors) and the extreme position of Feyerabend will be explored.
- The phenomenon known as "science wars" will be analyzed, in particular the episode (hoax) of Sokal and Bricmont. This chapter will allow to establish a critique against relativism, in particular of an epistemological type, defended from postmodern positions.

6. COURSE ORGANIZATION

CONTENTS

1	INTRODUCTION: Description of the contents and objectives of the course.
2	EXPERIMENTATION: Observation is the foundation of scientific theories. Is scientific observation an immediate and objective process? As we will see, there is a deep interrelation between observations and theories, and those depend on these, that is, "observations are theory laden". Experimentation is a deliberate intervention that is framed in the context of a conceptual framework.
3	DERIVING THEORIES FROM FACTS: INDUCTION: Does inductive logic exist? No, it is a myth. However, despite its lack of rigor, induction is an extraordinarily attractive device. We will see why.
4	CLASSICAL EMPIRICISM: The British classical philosophers (Berkeley, Locke and Hume) laid the foundations of empiricism. We will critically review its assumptions and limitations.
5	LOGICAL POSITIVISM: Starting in the 1920s, some of the brightest minds in the field of philosophy of science (Carnap, Reichenbach, etc.), inspired by philosophers such as Bertrand Russell or Immanuel Kant, by characters such as Wittgenstein or by scientists like Einstein, undertook a colossal project that sought to build the definitive foundations of knowledge (in general) from experimental evidence supported by mathematical logic. What could go wrong? Everything. After decades of intense dedication, they had to abandon the project of a lifetime. However, we can learn a lot from their mistakes.
6	POPPER'S COUNTERFEITISM: Karl Popper was possibly the most important philosopher of the 20th century, both in the field of philosophy of science and in social philosophy. His influence on scientists has been enormous, and yet the conceptual structure of falsificationism has unacceptable consequences that most scientists ignore.
7	KUHN: PARADIGMS AND REVOLUTIONS: In 1962 Thomas Kuhn wrote an essential book, The Structure of Scientific Revolutions. It is a bipolar work that highlights the importance of the social structure of science. However, Kuhn goes too far and sometimes slips the idea that science is just a social construction, like religion. this is one of the bedside books of the defenders of epistemological relativism, a fact that Kuhn always regretted.
8	THE WARS OF SCIENCE: Epistemological relativism is an unintended consequence of Kuhn's book. Since the 70s of the 20th century, a confrontation has developed between the defenders of Science as a mere social construction and those who defend that Science contains elements of objectivity and that it is characterized by progress. In 1996, the physicist Alan Sokal published an article, deliberately loaded with egregious errors, in Social Texts, one of the most prestigious journals in the field of epistemological relativism. The paper was accepted and praised. Two days later Sokal revealed that it was a hoax, highlighting the lack of quality standards in this context.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
EXPERIMENTATION	Activity evaluation with Virtual Media	No	Yes	5,00
DERIVING THEORIES FROM FACTS: INDUCTION	Activity evaluation with Virtual Media	No	Yes	5,00
THE CLASSICAL EMPIRICISM	Activity evaluation with Virtual Media	No	Yes	5,00
LOGICAL POSITIVISM	Activity evaluation with Virtual Media	No	Yes	15,00
POPPER'S FALSATIONISM	Activity evaluation with Virtual Media	No	Yes	20,00
KUHN: PARADIGMS AND REVOLUTIONS	Activity evaluation with Virtual Media	No	Yes	20,00
THE SCIENCE WARS	Activity evaluation with Virtual Media	Yes	No	10,00
FINAL PROJECT	Work	No	No	20,00
TOTAL				100,00
Observations				
Observations for part-time students				
Part-time students will be offered to participate in continuous assessment activities . In case they could not, they will take a single final exam.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

- Chalmers, Alan. What Is This Thing Called Science? Third Edition (1999). 288 pages. Open University Press; ISBN-10: 0335201091, ISBN-13: 978-0335201099.
- Godfrey-Smith, Peter. Theory and Reality: An Introduction to the Philosophy of Science (2003). 272 pages. University of Chicago Press. ISBN-10: 0226300633, ISBN-13: 978-0226300634.
- Newton-Smith, William H. The Rationality of Science (1981). 308 pages. ISBN-10: 0415058775, ISBN-13: 978-0415058773.
- Sokal, Alan. Fashionable Nonsense: Postmodern Intellectuals' Abuse of Science (1999). 300 pages. St Martin's Press. ISBN-10: 0312204078, ISBN-13: 978-0312204075.