UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Research Methods in Cognitive Neuroscience

2526-1-F5109P007

Learning area

RESEARCH METHODS IN EXPERIMENTAL PSYCHOLOGICAL SCIENCES

Learning objectives

Knowledge and understanding
• Knowing the functional and technical properties of the most important non-invasive research methods in Cognitive Neuroscience
• Understanding the genesis and dynamics of brain signals and how they reflect mental functions

Applying knowledge and understanding
• Acquisition of the methodological knowledge required to (i) critically analyze studies applying state-of-the-art techniques in cognitive neuroscience, and (ii) design empirical studies in the field.

Making judgment
Students will gain the ability to independently integrate methodological and theoretical skills in the field of cognitive neuroscience and to apply them to critically judge previous studies and propose new research projects in the different sub-fields of cognitive neuroscience, taking into account the specific critical aspects of each research technique and various operational situations. Students will also gain the ability to reorganize the acquired knowledge to promote innovative and original solutions through judgment based on empirical data and a critical reading of the complexities inherent to cognitive neuroscience. This will be achieved through class discussions and group work.

Communication skills
Students will acquire communication skills that allow effective interaction with various professionals from different cultural and scientific backgrounds; through group presentations, students will learn how to propose innovative research projects in cognitive neuroscience and to communicate their results and conclusions to an audience of

specialists and non-specialists in a clear, detailed, and scientifically grounded manner, using the specific lexicon of the discipline. Students will also learn how to coordinate during teamwork and collaborate effectively and competently in English.

Learning skills
The course will promote the acquisition of the ability to adopt new developments and innovations emerging from international scientific results in cognitive neuroscience, updating one's skills to the rapid evolution of the field. The course will also promote the use of specialized bibliographic resources to perform in-depth scientific reviews to critically judge current knowledge in cognitive neuroscience and capitalize on it to propose further advancements in the field (e.g., through the development of new scientific projects). This will be achieved by discussing the available digital instruments to perform bibliographic research and through class discussions.

Contents

This laboratory course provides essential knowledge on the methodological bases required to apply state-of-the-art techniques in cognitive neuroscience, with a specific focus on functional magnetic resonance imaging (fMRI), to explore the domains of Cognitive Neuroscience.

Detailed program

- Brief review: how the brain can be studied with cognitive neuroscience techniques.
- Brief review: how to design a cognitive neuroscience experiment from a methodological point of view.
- In-depth discussion of functional magnetic resonance imaging (fMRI): basic principles of functioning, critical discussion of some examples on how it can be applied in cognitive neuroscience studies (the case of Motor Cognition will be taken as an example), and hand-on exercises on data analysis.
- Practical activity: critical discussion of a research study applying fMRI to address a specific theoretical issue.
- Practical activity: development of a research project to address a specific theoretical issue by applying fMRI.

Prerequisites

This course requires a basic knowledge of Cognitive Neuroscience of the nervous system and its cognitive functions, and the language skills required to understand scientific articles in English.

Teaching methods

The laboratory consists in lecture-based lessons (12 hours) and interactive classwork (20 hours) to be attended in physical presence. The interactive class-work will include: (i) group discussion on how published studies apply different cognitive neuroscience techniques, (ii) hand-on excercises on fMRI data analysis, and (iii) small-group work aimed at preparing two presentations, one critically reviewing a published study and one discussing a new research project that applies fMRI to address a specific theoretical issue in cognitive neuroscience.
Attendance is mandatory for at least 70% of the classes. Failure to meet this minimum attendance requirement

may result in not passing the course.

Assessment methods

The course will be assessed on a pass/fail basis only. There is no final exam; evaluation will be based on active participation and any assignment or activity carried out during the course.
Specifically, students learning will be assessed during data discussion, hands-on experience, and during the presentation of the research project, with questions pertaining issues addressed in class.

Textbooks and Reading Materials

Learning material will be provided during the course.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING