BIP POLITOSPORT

Neuromuscular adaptations and assessment in sport

Laboratory for Engineering of the Neuromuscular System – LISiN

Dipartimento di Elettronica e Telecomunicazioni

Politecnico di Torino

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BIP OBJECTIVE AND PROPOSED PROGRAM

This BIP course will provide participants with basic and technical knowledge necessary for understanding and assessing the mechanisms at the basis of training adaptations. Key topics that will be dealt with during the course are:

- Muscle and mental fatigue
- Neural and muscular adaptations to motor training, in young and aged individuals
- Instruments for collecting biomechanical and physiological data, from motion capture to high-density surface electromyography
- Methods for data processing and information extraction

These goals will be achieved through challenges specifically devised to address problems in the field. Students will be requested to use the knowledge gained during the course to address these issues. Transfer and assessment of knowledge will be ensured by the use of some teaching strategies, among which the flipped classroom and the peer-assisted learning.

Even though the BIP program has yet to be established, below follows a proposed scheme of the course structure. Table 1 outlines the general structure of the course while the following page details my thoughts for the afternoon sessions.

ONLINE ACTIVITY: PRIOR TO STARTING THE COURSE

Research articles will be distributed to students at least two weeks prior to starting the course. These articles will be focused on applied research, dealing with issues of interest in sport science and rehabilitation. Proposed arguments are: peripheral fatigue, posture control, aerobic capacity, mobility. **Students will be divided into groups and each group will be tasked with reading the pre-selected articles about a specific theme and presenting their thoughts during the week preceding the course**: *specific instructions will be provided to ensure key points are touched during the presentation*.

COURSE ACTIVITIES: LEARNING, EXPERIENCING, SOCIALIZING

	Monday (day 1)	Tuesday (day 2)	Wednesday (day 3)	Thursday (day 4)	Friday (day 5)
8:00 – 12:00	**1.1–Turin** Techniques for the assessment of the neuromuscular system, including brain and muscle function as well as joint kinematics	**2.1–Sevilla** Mechanical, neuromuscular and metabolic responses to training **2.2–Tel Aviv** The potential of RPE as a tool for prescription and monitoring in resistance training	**3.1–Guarda** Neuromuscular adaptations to motor training, including its functional implication in young and aged populations **3.2–Team Building: Rowing** ARMIDA Rowing club	**4.1–Jyvaskyla** Central adaptations associated with training: How to quantify Cortical sensorimotor adaptations associated with training and injury? **4.2–Budapest** Muscle response to interventions: performance and injury prevention	**5.1–Mens sana in corpore sano** Trekking experience: exploring the mountains in preparation for the mentally demanding afternoon.
14:00 – 18:00	**1.2–Turin-Birmingham** ***Technology enhanced learning*** Tutorial: the use of smartphone to assess neuromuscular metrics of interest in rehabilitation and sport science.	**2.2–Turin-Birmingham** ***Peer-assisted learning*** Planning of experiments: from the definition of the experimental protocol to the test of hypothesis.	**3.3–Turin** ***Discovery education experience*** Data collection: necessary for testing the group hypothesis. Students will learn while exploring the data during the collection process.	**4.3–Turin** ***Interdisciplinary learning*** Students with different backgrounds will work together to extract information from the collected data.	**5.2-Everyone** ***Active learning*** Groups present and critically discuss their findings to classmates and lecturers.
After-hours	**1.3–La Mole Antonelliana** A bit of culture while watching the history of Cinema	**3.4 – Sharing thoughts** Brainstorming with a Spritz	**Classroom teaching**	**Alternative teaching**	**Social, cultural, and physical activities**

DETAILED DESCRIPTION OF AFTERNOON SESSIONS

1.2 – *Technology enhanced learning:* Tutorial: the use of smartphone to assess neuromuscular metrics of interest in rehabilitation and sport science.

Students will be taught how to use their smartphones and our EMG system to collect variables of applied interest. Working principle and technical issues will be dealt with during the tutorial, while ensuring there will be sufficient time for the students to leave the classroom with the skills necessary to collect data. Only variables related to the applications we select for the ONLINE ACTIVITY will be considered in the tutorial.

2.2 – *Peer-assisted learning:* Planning of experiments: from the definition of the experimental protocol to the test of hypothesis.

Each group will be asked to design an experimental protocol for assessing the neuromuscular adaptation associated with the application assigned to them during the ONLINE ACTIVY. Groups will be welcome to work on applications different from those pre-selected. With the guidance of peers-experienced students-course students will produce a report outlining their question, hypothesis, and how they will approach the question. This latter point requires identifying proper instruments, dependent variables, and controlling for confounders.

3.3 – *Discovery education experience:* Data collection: necessary for testing the group hypothesis. Students will learn while exploring the data during the collection process.

Using their own smartphone or the system for the acquisition of surface electromyograms, students will collect the data necessary for testing their hypothesis. In doing so, technical issues will likely emerge, highlighting the care necessary to ensure the data collected meets the highest standards. While real-time inspecting the raw data, the lecturer will deepen some of the concepts addressed during the classroom teaching.

4.3 – *Interdisciplinary learning:* Students with different backgrounds will work together to extract information from the collected data.

Testing for the group hypothesis requires analyzing the raw data properly. Knowledge on the physiological phenomenon under study and on techniques for signal processing is critically important here: this is when the background matured by the health science and the biomedical engineering students attending the course and integrating each group will attest the importance of interdisciplinarity.

5.3 – *Active learning:* Groups present and critically discuss their findings to classmates and lecturers.

Groups will be asked to prepare a brief presentation summarizing their findings, showing and critically discussing factual results. Lecturers as well as students from other groups will interrogate each presenting group about how appropriate the proposed protocol is for assessing the neuromuscular adaption subject of study.