SERVIÇO PÚBLICO FEDERAL
UNIVERSIDADE FEDERAL DE SANTA CATARINA
CENTRO DE DESPORTOS
PROGRAMA DE PÓS-GRADUAÇÃO EM EDUCAÇÃO FÍSICA
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TEACHING PLAN

1. IDENTIFICATION

Course: **Advanced Research Methods in Biodynamics of Human Performance**
Code: **DEF410068**
Number of Credits: **02 Theoretical Credits**
Workload: **30 hours class**
Level: **Masters and PhD in Physical Education**

2. SYLLABUS

Historical aspects of strength training methodology; strength training program design; the neuromuscular system; neural control of muscle force; muscle force properties; training principles and loading parameters; designing a resistance training program; programming for muscle hypertrophy; programming for maximal strength; effects of aging on muscle strength/power; resistance training for injury prevention

3. OBJECTIVES

- **Physiology of the Neuromuscular System:** Understand the physiological processes underlying the neuromuscular system and its role in muscle strength and power.
- **Biomechanics of Muscle Strength and Power:** Explore the mechanical aspects of muscle function, focusing on how biomechanics influence strength and power output.
- **Neuromuscular Adaptations to Resistance Training:** Study the adaptations that occur in the neuromuscular system as a result of resistance training.
- **Scientific Basis for Prescribing Resistance Training Exercise:** Gain fundamental knowledge of the science behind resistance training to inform evidence-based exercise prescription for health, performance, and injury prevention.
- **Programming for Specific Training Goals:** Develop practical skills in designing resistance training programs tailored for specific goals, such as muscle hypertrophy and maximal strength, through in-class whiteboard program design sessions.

4. CONTENT

Please verify in item “7. SCHEDULE”

5. TEACHING STRATEGIES

This class incorporates a combination of lectures, in-class group work to demonstrate learning objectives, and a group assignment. Each lecture will be defined by 3-5 learning objectives with a 45-minute lecture component and followed group discussion. There will be two lectures per class.

6. ASSESSMENT

Class Participation 20%
In Class Program Design Sessions 15% each x 2 = 30%
Final Group Presentation = 50%

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7. SCHEDULE OF CLASSES

Date & Time	Topics	Reading	Exams/Assignments
Opening Class: 14/10 9-12 am	Review of the reading material	Check the list below under "Readings"	Presence and Participation
Class #1 19/10 9-12 am	•Strength/Power for sport •Effects of Aging on Muscle Strength/Power •Resistance Training for Injury Prevention	Bird 2005, Hunter, 2016; McKinnon, 2016; Bechshøft, 2017; Müller, 2021 Lauersen, 2018, Jordan, 2023	**Design a program**
Class #2 21/10 9-12 am	•The Neuromuscular System •Neural Control of Muscle Force	Aagaard, 2003; Strength/Power in Sport Chapter 4 &5	
Class #3 22/10 9-12 am	Muscle Force Factors: •Force-Velocity Relationship •Power-Velocity Relationship	Herzog, 2009	
Class #4 23/10 * **8-12 am XIV SNA**	•High Performance Sport Analysis: the Jim Hay Method (Dr. Walter Herzog) •Integrative Analysis of Exercise Using Wireless and Wearable Sensors (Delsys)		
Class #5 29/10 9-12 am	•Training Principles and Loading Parameters •Designing a Resistance Training Program	Schmidtbleicher, 1980; Strength&Power in Sport Chapter 25 Schoenfeld, 2021; Jukic, 2021	
Class #6 29/10 14-17 am	•Programming for Muscle Hypertrophy and for Muscle Strength •In-Class Whiteboard Program Design Session	Peterson, 2005; Suchomel, 2016; Wilk, 2021 Aagaard, 2002; Cormie, 2011 (2); Lopez, 2021	**Program Design Session**
Class #7 30/10 9-12 am	•Group Presentations **		

* Class at R. Alm. Alvim, 528 - Centro, Florianopolis - SC, 88015-380 – Workshops XIV Neuromechanics Applied Symposium.

**** Group Presentations**
Students will work as a group (n=3 to 5 students/group) and design a resistance training program to address a case study scenario provided in class. All students are expected to contribute to the background research, design and delivery of the resistance training program. However, a single grade will be given to the group. Students will prepare one resistance training program for their case study. Students will give a 10-minute presentation, supported by six slides. Please use Microsoft Power Point and bring a laptop or a USB drive. The five slides will address: (Slide 1) background information for the case study (references required); (Slide 2) needs analysis for the exerciser; (Slide 3) present a single resistance training session – this should fit on one power point slide; (Slide 4-5) demonstrate two exercises from the program explaining proper technique and target muscle groups. Students are required to provide videos of their key resistance training exercises as a part of their presentation along with an explanation of proper technique, cues to teach the movement and common mistakes. Students should consider how their program may be modified to increase inclusion and accessibility for vulnerable populations (e.g., aging, visually impaired, physical or neurological impairments). (Slide 6) Students must provide at least three peer reviewed scientific references to justify their approach that will be included at the very end of their presentation on a single Power Point slide.

8. REFERENCES

Link to all references here: Readings Dr. Jordan Class

Aagaard, P. (2003). Training-induced changes in neural function. Exercise and Sport Sciences Reviews, 31(2), 61–67.

Aagaard, P., Simonsen, E. B., Andersen, J. L., Magnusson, P., & Dyhre-Poulsen, P. (2002). Increased rate of force development and neural drive of human skeletal muscle following resistance training, 93, 1318–1326.

Bechshøft, R. L., Malmgaard-Clausen, N. M., Gliese, B., Beyer, N., Mackey, A. L., Andersen, J. L., … Holm, L. (2017). Improved skeletal muscle mass and strength after heavy strength training in very old individuals. Experimental Gerontology, 92, 96–105. http://doi.org/10.1016/j.exger.2017.03.014

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Herzog, W. (2009). The biomechanics of muscle contraction: optimizing sport performance. Sport-Orthopädie - Sport-Traumatologie - Sports Orthopaedics and Traumatology, 25(4), 286–293.

Hunter, S. K., Pereira, H. M., & Keenan, K. G. (2016). The Aging Neuromuscular System and Motor Performance. Journal of Applied Physiology, jap.00475.2016.

Jordan MJ, Aagaard P, Bishop C, McClean Z, Mossel NB van, Pasanen K, et al. Explosive strength and stretch-shotening-cycle capacity during ACL rehabilitation: mechanical biomarkers for return to sport and performance readiness. Aspetar Sports Medicine Journal. 2023;12:324–31.

Jukic I, Van Hooren B, Ramos AG, Helms ER, McGuigan MR, Tufano JJ. The Effects of Set Structure Manipulation on Chronic Adaptations to Resistance Training: A Systematic Review and Meta-Analysis. Sport Med [Internet]. 2021;(0123456789).

Komi, P. V. (2003). Strength and Power in Sport. In The Encylopaedia of Sports Medicine (2nd ed., pp. 3–523). Blackwell Science Ltd.

Lauersen, J. B., Andersen, T. E., & Andersen, L. B. (2018). Strength training as superior, dose-dependent and safe prevention of acute and overuse sports injuries: a systematic review, qualitative analysis and meta-analysis. British Journal of Sports Medicine, (October 2012), bjsports-2018-099078. http://doi.org/10.1136/bjsports-2018-099078

Lopez P, Radaelli R, Taaffe DR, Newton RU, Galvão DA, Trajano GS, et al. Resistance Training Load Effects on Muscle Hypertrophy and Strength Gain: Systematic Review and Network Meta-analysis. Med Sci Sports Exerc. 2021;53(6):1206–16.

McKinnon, N. B., Connelly, D. M., Rice, C. L., Hunter, S. W., & Doherty, T. J. (2016). Neuromuscular contributions to the age-related reduction in muscle power: Mechanisms and potential role of high velocity power training. Ageing Research Reviews. http://doi.org/10.1016/j.arr.2016.09.003

Müller DC, Izquierdo M, Boeno FP, Aagaard P, Teodoro JL, Grazioli R, et al. Adaptations in mechanical muscle function, muscle morphology, and aerobic power to high-intensity endurance training combined with either traditional or power strength training in older adults: a randomized clinical trial. Eur J Appl Physiol [Internet]. 2020;120(5):1165–77.

Peterson, M. D., Rhea, M. R., & Alvar, B. A. (2005). Applications of the Dose-Response for Muscular Strength Development: A Review of Meta-Analytic Efficacy and Reliability for Designing Training Prescription. The Journal of Strength and Conditioning Research, 19(4), 950. http://doi.org/10.1519/R-16874.1

Schmidtbleicher, D. (1980). Strength Training: Structure, Principles and Methodology. *New Studies in Athletics*.

Schoenfeld BJ, Grgic J, Van Every DW, Plotkin DL. Loading Recommendations for Muscle Strength, Hypertrophy, and Local Endurance: A Re-Examination of the Repetition Continuum. Sports. 2021;9(2):1–25.

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