KIN 3650 Motor Learning & Performance Syllabus

Lectures: Tues/Thurs 8:00-9:15 am, ACT 206
Lab: Thurs 11am-12:30pm in KINES 231
FINAL EXAM: Tues, Dec 9th, 8:00-10:30 am, ACT 206

Instructor: Andrew G. Thompson, MS
Office: KINES 140 **|Office Hours**: Thursdays 9:45-10:30 am
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Course Description:

This is a lecture based course with a practicum component taught in the Motor Learning Laboratory. In this course, we explore theories and research in human motor learning and performance. Emphasis is placed on experiments in which healthy young adults learn complex motor behaviors. We will also delve into different populations (e.g., experts, individuals with motor disorders, older adults) and different levels of analysis to understand learning and performance at psychological and physiological levels.

Required Materials:

Textbook: Schmidt & Lee (2011), Motor Learning and Control: A Behavioural Emphasis (5th Ed.). Champaign, IL: Human Kinetics.

Laboratory Notebook: Any sort of notebook will do, but I would recommend a composition notebook with grid-lined pages. Grid-lines make the reproduction of graphs much easier. This notebook will be useful not only for recreating relevant figures from your readings and lecture but also keeping track of data that you record in the lab sessions. Your lab notebook in no way counts toward your final grade, but keeping an organized and detailed lab notebook is an excellent habit to cultivate.

Online lecture materials: You will probably find the online lecture slides relatively sparse and this is by design. These lecture materials are there to facilitate discussion in class and spark your memory while studying. You are welcome to print out these lecture materials and bring them to class, but I caution against studying these slides on their own.

Course Overview:

UNIT 1| PERCEPTION, MEMORY, ATTENTION AND ACTION

This section of the course focuses on factors that influence the performance of complex motor skills. We stress the integration of perception and action and factors that cause transitory, phasic changes in an individual's capability to perform an action.

Textbook Readings:

Schmidt and Lee Chapters 1, 2, 3, 4, and 5

Research Articles:

Wulf, G., Dufek, J. S., Lozano, L., & Pettirgrew, C. (2010). Increased jump height and reduced EMG activity with an external focus. *Human Movement Science, 29*, 440-448.

UNIT 2| FUNDAMENTALS OF NEUROMOTOR CONTROL

This section of the course focuses on motor control processes. While perception is fundamental to control, emphasis is placed on behavioural outcomes (e.g., what is being controlled) and the underlying physiology (e.g., how is control exerted).

Textbook Readings:

Schmidt and Lee Chapters 5, 6, and 8

Research Articles:

Kornatz, K.W., Christou, E. A., & Enoka, R.M. (2005). Practice reduces motor unit discharge variability in hand muscle and improves manual dexterity in old adults. *Journal of Applied Physiology, 98,* 2072-2080.

UNIT 3| LEARNING AND MEMORY FOR MOTOR SKILLS

This section of the course focuses on how we define and measure learning, variables in the training environment that enable or inhibit learning, and the neurophysiological changes that underlie learning.

Textbook Readings:

Schmidt and Lee Chapters 10, 11, 13, and 14

Research Articles:

Lohse, K. R., Wadden, K. W., Boyd, L. A., & Hodges, N. J. (2014). Motor skills acquisition across short and long time scales: A meta-analysis of neuroimaging data. *Neuropsychologia, 59*, 130-141.

Grading and Assessment:

Grades for this class are based on two tests, one final exam, lab assignments, and one brief presentation given in the lab.

Pedagogical Quizzes (10% of final grade): These quizzes will be offered online every week as tool to help you study. It is recommended that you take these quizzes every week to space out your studying and help identify strengths/weaknesses in your knowledge. Grades on these quizzes are based on ***participation***, not on the mark you earn.

Midterm Exams (40% of final grade; 20% each): These exams will be offered online and have a flexible time for completion. The reason for this is that I want you to spend time on your answers and really provide the best answer possible. Midterm exams will be a combination of short answer and multiple choice questions.

Final Exam (30% of final grade): The final exam is quasi-cumulative. Emphasis is placed on material from Unit 3, but will integrate concepts from Units 1 and 2. As with the mid-terms, the final exam will be a combination of short answer and multiple choice questions.

Lab assignments (20% of final grade): Your grade in the lab is based on completion of the lab assignments (worksheets that are completed in each lab) and a final presentation. The lab presentation is a brief presentation that is intended to get you to think critically and analytically about a motor learning/control question that is of interest to **you.** In the presentation, you will be asked to propose an experiment/s to test a research question. The proposal should be between 3-5 minutes in length and use at least 10 experimental papers as references. (These references can come from the textbook, but students are encouraged to find materials, especially recent publications, from outside the course as well.)

You presentation will be judged on the following criteria:

1. Significance of the research for the field (i.e., with respect to theory) or potential impact outside of the field (i.e., health or technological impacts).
2. Clarity and scope of objectives.
3. Clarity and appropriateness of methodology.
4. Originality and innovation (extent to which the proposal suggests and explores novel or potentially transformative concepts for the field).

Unit #1| Perception, Memory, Attention and Action.

Date:	Topic:	Read (before class)	Lecture/Lab Content:
R, Jan 15th		SL 1	Syllabus, overview, examples.
T, Jan 20th	Measurement	SL 2	History of motor learning; types of measurement; levels of analysis.
R, Jan 22nd			***Lab 1. Introduction to terms and experimental methods.***
R, Jan 22nd	Cognitive Processes	SL 3	Information processing models
T, Jan 27th	Memory	SL 3	Signal detection theory, sensation and memory
R, Jan 29th			***Lab 2. Understanding accuracy and precision.***
R, Jan 29th	Anticipation	SL3	Continue with SL chapter 3, focusing on anticipation.
T, Feb 3rd	Attention	SL 4	Types of attention and general theories of attention.
R, Feb 5th			***No lab this week***
R, Feb 5th	Attention	SL 4	Attention during movement and the focus of attention
T, Feb 10th	Attention	Wulf et al (2010)	The influence of instructional style on muscle recruitment and performance.
R, Feb 12th			***Lab 3. Eye-tracking in the motor learning lab.***
R, Feb 12th	Vision and Audition	SL 5	Visual and auditory systems.
T, Feb 17th	Vision and Audition	SL 5	Visual processes in motor control.
R, Feb 19th			***No lab this week***
R, Feb 19th	Vision and audition	SL 5	**Flex day…**
***	**Exam #1 assigned.**		

Unit #2| Fundamentals of Neuromotor Control.

Date:	Topic:	Read (before class)	Lecture/Lab Content:
T, Feb 24th	Proprioception	SL 5	The vestibular system and mechanoreceptors
R, Feb 26th			**No lab this week**
R, Feb 26th	Proprioception	SL 5	The vestibular system and mechanoreceptors
T, Mar 3rd	Proprioception	SL 5	The vestibular system and mechanoreceptors
R, Mar 5th			***Lab 4: Mobile EMG in the Motor Learning Lab.***
R, Mar 5th	Proprioception/Central contributions to motor control	SL 6	Open loop processes, the hierarchical control model.
T, Mar 10th	Central contributions to motor control	SL 6	Control of rapid movements, neuropsychology and motor disorders.
R, Mar 12th			***Lab 5: Feedback processing EEG lab***
R, Mar 12th	Central contributions to motor control	SL 6	Central pattern generators and the spinal cord
T, Mar 17th	Central contributions to motor control	Kornatz et al (2005)	Aging and motor control.
R, Mar 19th			***Lab 6. Explanation of the lab presentation assignment.***
R, Mar 19th	Coordination		***Flex day…***
***	**Exam #2 Assigned**		
M, Mar 23-27th	*Spring Break*		

Unit #3| Learning and Memory for Motor Skills.

Date:	Topic:	Read (before class)	Lecture/Lab Content:
T, Mar 31st	Motor Learning	SL 10	What is learning? How do we measure it?
R, Apr 2nd			***No lab this week***
R, Apr 2nd	Motor Learning	SL 14	Understanding testing conditions.
T, Apr 7th	Motor learning	SL 14	The distinction between learning and performance.
R, Apr 9th			***Lab 7. Fast learning and visuomotor adaptation.***
R, Apr 9th	Conditions of practice	SL 11	Performance curves, verbal information, observational learning.
T, Apr 14th	Conditions of practice	SL 11	Distribution of practice, variable practice, contextual interference.
R, Apr 16th			***Lab 8. Neuroimaging lab: Understanding neuroanatomy.***
R, Apr 16th	The learning process	SL 13	Theoretical perspectives on motor skill learning.
T, Apr 21st	The learning process	SL 13	Theoretical perspectives on motor skill learning
R, Apr 23rd			***Lab presentations***
R, Apr 23rd	A neuro-psychological model of learning	Lohse et al., 2014	Motor disorders: Processes and associated brain regions.
T, Apr 28th	A neuro-psychological model of learning		More on learning; Connecting psychology to physiology.
R, Apr 30th			**Lab presentations**
R, Apr 30th	A neuro-psychological model of learning		Structural and functional changes in the brain.
***	**Final exam assigned**		

Final Exam Due: Tues, Dec 9th, 8:00-10:30 am , ACT 206.