TUM Department of Sport and Health Sciences
Technische Universität München

Module Catalog

M.Sc. Sport and Exercise Science

TUM Department of Sport and Health Sciences
Technische Universität München

www.tum.de/
www.sg.tum.de

Module Catalog: General Information and Notes to the Reader

What is the module catalog?
One of the central components of the Bologna Process consists in the modularization of university curricula, that is, the transition of universities away from earlier seminar/lecture systems to a modular system in which thematically-related courses are bundled together into blocks, or modules.
This module catalog contains descriptions of all modules offered in the course of study.
Serving the goal of transparency in higher education, it provides students, potential students and other internal and external parties with information on the content of individual modules, the goals of academic qualification targeted in each module, as well as their qualitative and quantitative requirements.

Notes to the reader:

Updated Information
An updated module catalog reflecting the current status of module contents and requirements is published every semester. The date on which the module catalog was generated in TUMonline is printed in the footer.

Non-binding Information
Module descriptions serve to increase transparency and improve student orientation with respect to course offerings. They are not legally-binding. Individual modifications of described contents may occur in praxis.
Legally-binding information on all questions concerning the study program and examinations can be found in the subject-specific academic and examination regulations (FPSO) of individual programs, as well as in the general academic and examination regulations of TUM (APSO).

Elective modules
Please note that generally not all elective modules offered within the study program are listed in the module catalog.

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Master's Thesis | Master's Thesis

Module Description

SG862000:

Thesis

Version of module description: Gültig ab winterterm 2017/18

Module Level: Master	**Language:** German/English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:*	**Total Hours:** 900	**Self-study Hours:** 900	**Contact Hours:** 0

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The Master's Thesis consists of a scientific exposition and a presentation. The scientific exposition should demonstrate the ability to independently deal with a problem from the respective subject area according to scientific methods within a given period of time. The scope of the work depends, among other things, on the subject matter and is to be agreed individually with the supervisor.
The presentation consists of a presentation part (about 20 minutes) and a subsequent discussion (about 30 minutes) of the Master's Thesis. The presentation part presents the most important theses and findings of the Master's Thesis. The discussion is intended to show that the student has sound knowledge of the respective subject area and has applied it meaningfully in his work. The presentation is graded.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
After successful assignment of all modules of the 1.-3. Semesters (except free electives)

Content:
The participants work under guidance in a question of the sport scientific diagnostics. They receive a related question that is still quite general and not specified yet. They must investigate and evaluate different solutions, and decide for themselves which one to perform. The accompanying exposition summarizes the essential aspects of the subdiscipline, discusses different approaches, justifies the choice made, and describes the chosen solution.
This module is offered by all chairs. The chairs select suitable topics from their area of expertise, usually a partial aspect of one of their research projects. They support the students in learning

the scientific skills to comprehensively explore an aspect of a subject area and, based on this, to answer a limited yet general question about this aspect with scientific methods.

Intended Learning Outcomes:
After completing the Master's Thesis, the participants will be able to familiarize themselves quickly with a question in sport science diagnostics. Based on a specific question, they will understand how to analyze and evaluate the essential aspects of the research steps required for the solution. They can define the scope of possible procedures, describe them and choose a solution. They are able to accurately describe, discuss and solve a sport science problem.

Teaching and Learning Methods:
The module requires independent work. The Master‘s Thesis can be supplemented by a colloquium to discuss the status of the final thesis and to clarify emerging theoretical and empirical questions around the Master’s Thesis.

Media:
n / A.

Reading List:
self recherche

Responsible for Module:
Franklin, David; Prof. Ph.D.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.

Mandatory Modules | Pflichtmodule

Module Description

SG810002: Study Design; Ethics - Research Methods | Study Design; Ethics - Research Methods

Version of module description: Gültig ab winterterm 2017/18

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
In a written examination (90 min; 60%) students demonstrate their theoretical, methodological and analytic competence by answering questions using given answers. This will show that they understand different study designs, study conduct and study analysis as well as methods to control bias and confounding. Additionally, the attainment of learning outcomes for the module will be assessed by a written research grant proposal (about 15-20 pages; 40%). By developing a research grant proposal, students will show their ability to work independently and in detail on a selected complex epidemiological study design, applying good epidemiological practice, principles of ethics and international quality standards.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge of study design and research methods, basics of epidemiology, basics of biostatistics

Content:
- Study design, planning, conduct and analysis
- Research questions and hypotheses
- Ethical approval
- Research grants
- Time / Cost / Resource Assessment
- Literature review and Meta-Analysis
- Standards / Principles of Ethics

- International human rights / guidelines
- Good Epidemiological Practice Good Clinical Practice
- Methods to avoid bias and control confounding

Intended Learning Outcomes:
After successfully completing the module, students will be able:
- To understand advanced epidemiology
- To understand details of different epidemiological study designs
- To understand study planning and conduct
- To understand the importance of ethical issues
- To understand the responsibilities of research ethics committees
- To apply Good Epidemiological Practice
- To apply principles of ethics and international quality standards
- To understand informed consent
- To write a research grant proposal
- To develop a study design (including literature review / analysis / ethics)
- To understand study conduct
- To apply study analysis
- To understand bias and confounding

Teaching and Learning Methods:
The module consists of one lecture with blended learning components and one practical seminar. The content of the lectures will be discussed in detail in the seminars using research papers and student presentations. Students will work in small groups on a research grant and will be encouraged to study the relevant literature.

Media:
PowerPoint slides, Scientific publications from elektr. Semester apparatus, exercise sheets

Reading List:
Gordis, L. (2014). Epidemiology. Oxford: Elsevier LDT (fifth edition).
Rothman, K.J.; Greenland, S.; Lash, T.L. (2013). Modern Epidemiology. Philadelphia: Lip-pincott Williams & Wilkins (third edition).
Further literature will be announced in the lecture

Responsible for Module:
Klug, Stefanie; Prof. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
Applied Study Design; Ethics (Seminar, 2 SWS)
Eberl M, Gimazova K, Liang L, Sudharsanan N

Advanced Study Design; Ethics (Vorlesung, 2 SWS)
Gimazova K, Klug S

For further information in this module, please click campus.tum.de or here.

Module Description

SG861001: Biomechanics, Human Movement and Neuromechanical Control | Biomechanics, Human Movement and Neuromechanical Control

Version of module description: Gültig ab summerterm 2019

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 60	**Contact Hours:** 90

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
A written exam (90 minutes) comprised of short open written questions and multiple choice, will contribute 100% of the mark and will assess the students' ability to understand basic scientific principles of biomechanics, neuromuscular physiology, neuromechanics and motor control presented partly in original research articles in English. Exam questions will probe the ability to apply the obtained knowledge to creatively solve problems relating to sport, exercise, human movement and rehabilitation.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
This class will introduce the scientific basis of biomechanics, human movement and neuromechanical control with discussions of applications to sport and exercise. Major topics include:
- Biomechanical diagnostics of muscle force and strength
- Inverse kinematics
- Transfer of muscle force to external forces and moments
- Muscle architecture and muscle force
- Muscle contraction and history dependence
- The development of muscular force
- Muscle mechanics
- Neural control of muscle force

- Stretch reflexes
- Peripheral fatigue
- Central pattern generators
- Motor learning and conditions of practice
- Neural correlates of motor control and motor learning
- Motor control of the hand and hand dominance
- Motor control of eye movements
- Motor control of gait and stance
- Information processing and resource limitations
- Motor cognition and the perception-action linkage
- Psychophysics

Intended Learning Outcomes:
After successfully completing the module, students will be able to:
- understand theories of motor control and neuromechanics, principles of motor learning and their practical implications, and how these relate to both the neuromuscular physiology and biomechanics
- understand advanced methods of biomechanical testing and to evaluate related up-to date research outcomes
- read scientific publications in English and prove the understanding in presentations and discussions
- explain and apply the principles of biomechanics, motor control and neuromechanics
- apply the obtained knowledge to creatively solve problems relating to sport, exercise, human movement and rehabilitation, for example if the rehabilitation or training are too slow or the methods of motor learning are not efficient enough
- debate theories and techniques used in the fields of biomechanics, human movement and neuromechanical control.

Teaching and Learning Methods:
This class will be jointly taught by Prof. Dr. Schwirtz, Prof. Dr. Hermsdörfer, and Prof. Dr. David Franklin. Each week there will be 3 hours of lecture, followed by 3 hours of seminar. The lectures will demonstrate the connections between all three disciplines. The seminars will be used to develop discussion and debating skills as well as the necessary skills in biomechanics, human movement and neuromechanical control. In the seminar, the students will be involved in targeted questions, discussion, presentations, and debates about the topics covered in the lectures.
Teaching methods used is the seminars include:
- Open discussion of the lecture material
- Mathematical problem solving tasks
- Student presentations
- In depth discussion of scientific papers
- In depth discussion of applications to sport and exercise

Media:
Slides (pdfs of PowerPoint lectures), example questions

Reading List:
- Purves, Neuroscience, Sinauer Associates
- Winter, Biomechanics and Motor Control of Human Movement, Wiley
- Enoka, Neuromechanics of Human Movement, Human Kinetics
- Zatsiorsky & Prilutsky. Biomechanics of skeletal muscles. Human Kinetics, 2012
- Robertson, D. Gordon E. Research methods in biomechanics. Human Kinetics, 2004
- Nigg & Herzog. Biomechanics of the Musculo-skeletal System. Wiley, 2007.
- Schmidt & Lee. Motor Control and Learning. A Behavioral Emphasis. Human Kinetics, 5th edition, 2011.
- Pinel, Biopsychology, Pearson, 9th edition, 2015
- Additional literature to be announced.

Responsible for Module:
Franklin, David; Prof. Ph.D.

Courses (Type of course, Weekly hours per semester), Instructor:
Neuromechanical Control (Vorlesung, 1 SWS)
Franklin D, Leib R

Classical and contemporary research in human movement science (Seminar, 1 SWS)
Gulde P, Kampe T, Kern J, Schmidle S, Stadler W

Human Movement Science (Vorlesung, 1 SWS)
Hermsdörfer J, Stadler W

Biomechanical tests and current research questions (Seminar, 1 SWS)
Holzer D, Schwirtz A

Research in Neuromechanical Control (Seminar, 1 SWS)
Leib R, Orschiedt J

Biomechanics (Vorlesung, 1 SWS)
Schwirtz A
For further information in this module, please click campus.tum.de or here.

Module Description

SG861002: Current Topics in Exercise Biology, Performance Testing and Health | Current Topics in Exercise Biology, Performance Testing and Health

Version of module description: Gültig ab summerterm 2020

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 60	**Contact Hours:** 90

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students have to write three 1500 word scientific essays.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
We will cover current topics in relation to exercise biology and performance analysis and -testing. These topics will mainly be recent, important research questions. Here we can give a flavor of topics that might be covered:
- Classical exercise physiology: What VO2max, cardiac output, lactate threshold, running efficiency would you need for a sub 2 h Marathon without doping (i.e. “normal” haematocrit)?
- Molecular adaptation to exercise: What signaling pathways mediate muscle hypertrophy adaptation to resistance (strength) training? What targets would you choose if the aim was to develop a drug to boost muscle mass in the elderly or patients with cachexia? Is a resistance exercise-mimicking pill likely?
- Sport and exercise genetics: Is the “talent” of elite athletes due to favorable variants for many polymorphisms or due to rare mutations? How could you find out?
- Sports nutrition: Sports nutritionists recommend high protein intake for the elderly to better preserve muscle mass but at the same time caloric restriction is a proven intervention to prolong lifespan. Resolve this apparent paradox.
- Exercise & health: Is the Warburg effect an explanation for the relationship between high muscle mass, leanness, good glycaemic control versus low muscle mass, adiposity and insulin resistance?

- Classical performance testing: There is actual research on testing of complex constructs like agility. How to deal with the speed-accuracy trade-off in testing?
- Action detection: How to create a categorial system that obey central demands on observational systems: objectivity, relevance and completeness?
- Position detection: Actually, we see a change from video-based position detection to sensor based technologies like radar and GPS. How to assess their compatiblity? What are current gold standards in position detection?
- Theoretical performance analysis: There is a continuous flow of theoretical approaches meant to model specific aspects of sports. What are the most current ones? What are the respective foci and modeling assumptions?
- Practical performance analysis: What is the actual "practical impact debate" about? What is generally the difference between applied and basic research in performance analysis? What are the most actual methods and concepts in this area?

Intended Learning Outcomes:
Candidates that have successfully completed this module will be able to understand, communicate and apply selected concepts in the areas of:
- Classical exercise physiology topics to analyse the effect of acute and chronic exercise on the human body
- Molecular adaptation to exercise to explain the molecular mechanisms that mediate adaptation
- Sport and exercise genetics to understand how DNA sequence variation affects sport and exercise-related traits
- Sports nutrition to aid physical performance with nutrition
- Exercise & health to explain the mechanism by which exercise prevents disease and acts as a treatment
- Classical performance testing topics to develop a deepened understanding of the roots of performance analysis
- Action detection to create observational systems with grassroots methods of game analysis
- Position detection to develop an understanding of the potential of positional data
- Theoretical performance analysis to understand the basic modeling assumptions
- Practical performance analysis to dispose of an action repertoire to solve problems in practical applications.
They will also be able to
- Interpret journal articles
- Develop methodologically sound recommendations for training in different settings
- Develop evidence-based recommendations for athletes, the wider population or special populations including individuals with disease
- Generally use knowledge to creatively solve problems in relation to sport and exercise science
- Reason logically, communicate science orally or in writing, debate it and be able to convince others
- Use their knowledge to develop business ideas and to act as an entrepreneur.

Teaching and Learning Methods:
Every week we will have 3 h lecture and 3 h of seminar. The lectures will introduce each “current topic” and in the seminar we will use a series of teaching methods to further explore each topic. Students need to bring an internet device so that they can easily search for additional knowledge. Teaching methods used in the seminar include:
- Open discussions of the lecture materials
- Mathematical and other problem solving tasks
- Conference-style student presentations
- Debates (the class will be split into two groups that have to argue as lobbyists either in favour or against a proposal (e.g. genetic testing in sport))
- Short scientific writing assignments
- Entrepreneurial tasks (e.g. develop a concept and business idea for a wearable computer allowing blind individuals to exercise independently e.g. by using ideas from self-driving cars).

Media:
Slides of the lecture on Moodle, current papers to the topics, PowerPoint, Flipchart

Reading List:
Baca, A. (Ed.).(2015). Computer Science in Sport. London, New York: Routledge. McGarry, T., O'Donoghue, P. & Sampaio, J. (Eds.). (2013). Routledge Handbook of Sports Performance Analysis. London, New York: Routledge.
Lames, M. (1994). Systematische Spielbeobachtung. Münster: Philippka.
McArdle WD, Katch FI & Katch VL. Exercise physiology. Nutrition, energy and human performance. 8th edition. Wolters Kluwer 2014
Wackerhage H Molecular Exercise Physiology. Routledge 2014

Responsible for Module:
Wackerhage, Henning; Prof. Dr. Sportwiss.

Courses (Type of course, Weekly hours per semester), Instructor:
Current topics in performance analysis & testing (Seminar, 1 SWS)
Blauberger P, Kolbinger O

Current topics in performance analysis & testing (Vorlesung, 2 SWS)
Lames M

Current topics in exercise biology (Vorlesung, 1 SWS)
Wackerhage H, Stöcker F, Spitzenpfeil P, Kastenmüller G

Current topics in exercise biology (Seminar, 2 SWS)
Wackerhage H, Stöcker F, Spitzenpfeil P, Römisch-Margl W
For further information in this module, please click campus.tum.de or here.

Module Description

SG861003: Current Social and Political Topics of Sport in Global Societies | Current Social and Political Topics of Sport in Global Societies

Version of module description: Gültig ab summerterm 2019

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The exam consists of a debate of a given topic. Students have to demonstrate their ability to debate rationally from either position. Therefore, they are assigned to both teams (3-4 members each) and their positions in the debate randomly. After a preparation of ten minutes, using their own knowledge and experience to create their case, they have to prove that they are able to listen to arguments and to formally present their arguments and respond to the opponent's argument in a disciplined, polite, respectful but at the same time convincing manner. Precisely, students have to demonstrate that they can find appropriate arguments (with scientific support) and examples. They can express themselves in an adequate voice and wording. They engage with the topic and structure what they say with the aim to win a debate. The duration of the debate is 20 minutes (without breaks for preparation).

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic understanding of social and political institutions and processes.

Content:
- Sport culture and identities in Germany
- Globalization of sport
- Politics and sport: benefit, profit and corruption
- Sport management and commercialization
- Ecological awareness and sustainability in sports
- Sport, media and entertainment
- Diversity, equality and discrimination

- Lifestyle, healthism and body images
- Sport in ‚technosocieties' (technological enhancement)
- Doping (pharmaceutical enhancement)

Intended Learning Outcomes:
The overall goal of the development of strong personalities that are creative problem solvers with hands on technical, research, oral and written communication and entrepreneurial skills, requires knowledge of the embedment of sport in society. Sport and societal factors, such as culturally specific patterns, politics and economics are not only interdependent but deeply intertwined. Candidates that have successfully completed this module, will:
- Understand, communicate and critically assess selected social and political issues of sports in global societies. Social and political issues relate to corruption in sports (e.g., doping, bribery for hosting events), age and disability in sports (e.g., minimum age requirements, equality in disability sports), as well as physical activity outdoors (e.g., environmental aspects of exercising, built environment in cities)
- Interpret empirical studies, journal articles as well public discourses and use the information contained therein to develop grounded arguments, opinions and standpoints
- Use scientific knowledge in communication with debating skills to creatively solve problems in relation to sport and exercise science, such as reducing corruption, implementing ethical governance, guaranteeing equality, and preventing harm on the environment
- Reason logically and communicate science to convince others in areas where sport and physical activity have an impact on the development of our society

Teaching and Learning Methods:
The module consists of one lecture with interactive and blended learning components and one seminar. The lecture will introduce each “current topic”. The contents will be delivered by presentations of different lecturers and experts and will induce open discussions.
The seminar will have the function of a debating club. It will contain conference-style student presentations to further explore the topics. The class will then be split into two groups that have to argue either in favour or against a proposal.

Media:
Slides, Term paper

Reading List:
https://www.researchgate.net/profile/Herbert_Loellgen/publication /324986920_Sportmedizin_Gegenwart_und_Zukunft_Sportmedizin_im_Wandel_-_Wandel_durch_Sportmedizin/links /5afabeb3458515c00b6c3006/Sportmedizin-Gegenwart-und-Zukunft-Sportmedizin-im-Wandel-Wandel-durch- Sportmedizin.pdf

Responsible for Module:
Franklin, David; Prof. Ph.D.

Courses (Type of course, Weekly hours per semester), Instructor:
Current social and political topics of sport in global societies (Seminar, 2 SWS)
Baffour Awuah G

Current social and political topics of sport in global societies (Vorlesung, 2 SWS)
Baffour Awuah G
For further information in this module, please click campus.tum.de or here.

Module Description

SG861021: Technical Analysis | Technical Analysis

Version of module description: Gültig ab summerterm 2019

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The exam comprises a written test (90 min), where students have to show the ability of solving fundamental technical analysis and data processing problems in sport and health science. The students will have to answer questions as well as create and explain structures and perform calculations.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
- Fundamental data structures (variables, data types, lists, arrays, classes, files) to store scientific data
- Fundamental control structures (loops, conditions, if-statements, functions) for processing scientific data
- Reading of data from sensors or databases
- Converting data between different file formats
- Validation of data
- Visualization of data
- Processing biological signals
- Filtering and smoothing data
- Data interpolation

Intended Learning Outcomes:
After successfully completing the module, students will be able:

- to understand and describe fundamental concepts of storing and processing data in computer systems
- to solve typical data processing problems in science using a programming environment.

Teaching and Learning Methods:
The module consists of a practical course, where general concepts of data processing are presented initially. Students will then need to solve tasks related to the presented topics and discuss the results.

Media:
Slide script, videos and exercises

Reading List:
Pdfs of slides
Attaway, St. (2011). Matlab: A Practical Introduction to Programming and Problem Solving. Amsterdam: Elsevier
Additional literature to be announced.

Responsible for Module:
Franklin, David; Prof. Ph.D.

Courses (Type of course, Weekly hours per semester), Instructor:
Technical Analysis (Seminar, 4 SWS)
Cesonis J, Franklin D, Link D
For further information in this module, please click campus.tum.de or here.

Module Description

SG861022: Advanced Statistics | Advanced Statistics

Version of module description: Gültig ab summerterm 2019

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 75	**Contact Hours:** 105

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
A written exam is deemed the most appropriate mode of examination (90 min). Using predetermined tools the students demonstrate their theoretical, methodological and analytic competence by answering questions, but may also be asked to do calculations as well as to analyze and interpret data.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Knowledge of study design, descriptive statistics and inferential statistics

Content:
- Probability theory
- Analysis of variance
- Exploratory data analysis
- Factor analysis
- Univariable and multivariable modeling
- Linear, logistic, Poisson and Cox regression models
- Meta-Analysis
- Handling of missing values
- Analysis of confounding
- Multivariate Methods

Intended Learning Outcomes:
After successfully completing the module, students will be able:
- To determine adequate quantitative approaches
- To understand analysis of variance and covariance analysis

- To understand fixed-effects and random-effects models
- To apply different modeling approaches
- To understand multivariate methods
- To deal with missing data
- To handle confounding
- To apply survival analysis

Teaching and Learning Methods:
The module consists of one lecture with blended learning components, one seminar and a tutorium. The content of the module is conveyed through lectures and presentations. In the seminar students learn to implement their theoretical knowledge by completing training tasks. The students acquire methodological knowledge and analytic competences. While the lecture is used to teach statistical models, the seminar is used to apply (use appropriate models, perform tests, interpret data) these models on research issue using the statistical software R. The tutorium is intended to provide a platform for individual support of the students in case of questions or possible gaps in presumed knowledge. The exercise is supposed to provide a practical introduction training to R.

Media:
Slides, exercise sheets, suggested solutions

Reading List:
Regression, Fahrmeir, Marx, Lang and Kneib, Springer Verlag, 2013 Further literature will be announced in the lecture

Responsible for Module:
Klug, Stefanie; Prof. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
Applied Statistics Practical Training (Übung, 1 SWS)
Eberl M

Applied Statistics (Seminar, 2 SWS)
Osmani V

Advanced Statistics (Vorlesung, 2 SWS)
Schauberger G
For further information in this module, please click campus.tum.de or here.

Module Description

WI001158: Entrepreneurial Opportunity Development | Entrepreneurial Opportunity Development [Entrepreneurial opportunity development]

Version of module description: Gültig ab winterterm 2017/18

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 120	**Contact Hours:** 30

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The examination is based on a project work. The project work consists of a group work with a group size of typically 5-10 students. The examination includes a presentation of 10-20 minutes (25%) in which the students describe the customer problem identified, how their product ideas can solve these problems, and how prototyping helped them to integrate customer feedback on developing the ideas. In an individually written report (40%) consists of 2 pages with an attachment of 10-15 pages. Students provide additional details on their solution to satisfy customer needs in a specific market, their data collection, the team, and integration of feedback. In addition, students will reflect on their learning experience. Finally, the 2-4 prototypes (35%) developed, illustrate students' understanding of the iterative process of idea development. The combination of different assessment methods ensures that the students understand the interplay between customer problem, idea generation, team work and engineering-based solutions (prototypes) as the basis of founding a new venture in an entrepreneurial team.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
The development of entrepreneurial business idea is a crucial part of the field of entrepreneurship, so "the field involves the study of sources of opportunities; the processes of discovery, evaluation, and exploitation of opportunities" (Shane & Venkataraman, 2000, p. 218)*.
Hence, the module covers the following topics:
- History of entrepreneurship at TUM
- Opportunity recognition and creativity

- Ideation
- Design thinking
- Business Model Canvas
- Learn startup approach
- Rapid prototyping
- Market research and customer interviews
- Entrepreneurial teams
- Methods of team work

*Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. Academy of management review, 25(1), 217-226.

Intended Learning Outcomes:
After the successful participation in the module, students are able to:
- identify customer problems,
- understand how the development of new products can overcome the identified customer problems,
- apply the principle of iterative prototyping based on customer feedback.
- understand the connection of engineering and a venture of an entrepreneurial team and can apply it

Teaching and Learning Methods:
The module consists of a lecture and uses the following teaching methods:
Through lectures, supported by a presentation, instructors show how to identify customer problems and iteratively develop prototypes to solve these problems. In group work students use the techniques introduced by the instructors to creatively identify real problems and develop possible solutions based on the iterative development of prototypes. Feedback sessions with experts and the instructors help in the prototype development process.

Media:
PowerPoint, videos, flipchart/whiteboard

Reading List:
Brown, T. (2008). Design thinking. Harvard business review, 86(6), 84.
Brown, T. (2009). Change by Design: HarperCollins.
Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. Academy of management review, 25(1), 217-226.
Osterwalder, A., Pigneur, Y., & Clark, T. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers: Wiley.

Responsible for Module:
Patzelt, Holger; Prof. Dr. rer. pol.

Courses (Type of course, Weekly hours per semester), Instructor:
Entwicklung unternehmerischer Geschäftsideen (WI001158, M.Sc. Sport and Exercise Science only) (Vorlesung, 2 SWS)
Patzelt H [L], Baur C, Patzelt H
For further information in this module, please click campus.tum.de or here.

Electives: A | Wahlmodule A

Module Description

SG861004: Biomechanical Methods and Application | Biomechanical Methods and Application

Version of module description: Gültig ab summerterm 2019

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
During a 20 min oral examination, students will be tested on methodological skills and theoretical background in the field of biomechanical testing. This oral examination can also include evaluation of presentations of mini-projects and discussion about literature provided during the semester.
To demonstrate their skills in applying theoretical understanding and practical knowledge, students will have to explain experimental methods, the principles of the data analysis and their possible limitations.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Participation of the Module Biomechanics, Human Movement and Neuromechanical Control

Content:
- Insights in state of the art scientific trends in the field of biomechanics
- Gait and posture analysis
- Dynamometric measurements of human movement
- Methods of anthropometric measurements
- 2/3d-motion capturing
- Isokinetic strength diagnostics
- Electromyographic assessments of muscle function
- Case studies of exemplar biomechanical diagnostics in competitive sports, health and rehabilitation

Intended Learning Outcomes:
After successfully completing the module, students will be able:
- To handle state of the art measurement devices for biomechanical testing
- To plan, prepare, measure and analyze biomechanical experiments
- To apply theoretical understanding and practical knowledge to specialized case studies
- To evaluate state of the art biomechanical diagnostics in competitive sports as well as in recreation, rehabilitation and health scenarios
- To create reasoned diagnostics/experimental studies for competitive sports, industrial (sports) products or medical therapies.

Teaching and Learning Methods:
The module consists of 2h lecture and 2h laboratory seminar. The content of the module is conveyed through lectures and presentations. Lectures will provide theoretical background of up-to-date biomechanical research methods.
Teaching methods used in laboratory seminars include:
- Theoretical and hands-on practical introduction in biomechanical methods
- Student presentations (midterms)
- Open discussion of recent topics in the field of biomechanics
- Application and training of statistical methods
- In depth discussion of scientific papers
- In depth discussion of biomechanical applications to sport and exercise
During the semester, students will have to work in small groups and perform several mini-projects with experimental testing and data analysis. Results of these mini-projects will be presented in 10-15 min oral presentations (midterms). For positive evaluation of midterms, students need to actively participate in all mini-projects, including data collection, processing and interpretation, and oral group-presentations. Passed midterms result in a 0.3 grade-bonification in final examination. Students will be encouraged to study the literature and the substantive discussion of the topics and presented methods in the light of latest research articles.

Media:
- PowerPoint presentations
- Moodle online content

Reading List:
- Zatsiorsky & Prilutsky. Biomechanics of skeletal muscles. Human Kinetics, 2012
- Robertson, D. Gordon E. Research methods in biomechanics. Human Kinetics, 2004
- Nigg & Herzog. Biomechanics of the Musculo-skeletal System. Wiley, 2007.

Responsible for Module:
Paternoster, Florian; Dr. phil.

Courses (Type of course, Weekly hours per semester), Instructor:
Application of biomechanical research methods (Übung, 2 SWS)
Paternoster F

Applied biomechanical research (Vorlesung, 2 SWS)
Schwirtz A
For further information in this module, please click campus.tum.de or here.

Module Description

SG861005: Methods in Human Movement Science | Methods in Human Movement Science

Version of module description: Gültig ab summerterm 2019

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Laboratory assignments: Students will do short research projects and discuss their progress in different phases of the project (elaboration of theoretic background, method development and results). This takes place in oral presentations at fixed dates during the semester (60% of the overall mark). In the end of the semester, one complete study is presented, either during a poster session or in a slide presentation in 20 minutes. The preparation of the presentations and parts of the research project are homework tasks.
In these poster or slide presentations, students demonstrate their skills in applying knowledge of concepts of motor control and motor learning and the underlying methods and in evaluating the results. Students will have to:
- Explain experimental design, the principles of the methods used and their limitations
- Explain the theoretic background and discuss their project results in the light of relevant theories of movement science.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Participation in the Module Biomechanics, Human Movement and Neuromechanical Control

Content:
The seminar covers (classical) research topics of human movement science relevant in highperformance sports, recreational sports, ergonomics, activities of daily living, prevention and rehabilitation. It introduces relevant methods. In the practical course students learn to use these methods. Methods that are covered either “hand on” and theoretically or only theoretically include:
- Movement recording and analysis using motion tracking and inertial measurement units
- Measuring and analyzing gross and fine motor behavior

- Measuring and analyzing gaze behavior using eye-tracking
- Psychophysical methods and behavioral testing (reaction time, executive functions, anticipation, working memory)
- Measuring physical activity
- Measuring mental representation of action (mental imagery, anticipation, observation)
- Studying effects of non-invasive brain stimulation
- Measuring and analyzing brain activation using brain imaging methods.

Intended Learning Outcomes:
After successfully completing the module, students will be able:
- To understand the rules governing human motor behavior during habitual activities and motor learning
- To understand the main principles of the nervous system controlling human movements
- To explain principles underlying methods in human movement science
- To apply knowledge of motor rules and motor systems in order to evaluate training and intervention programs in high-performance sports, recreational sports, ergonomics, prevention and rehabilitation
- To assess the scientific value of literature in movement science
- To know methods for assessment in human movement science, to being able to apply these methods and evaluate the results.

Teaching and Learning Methods:
The content of the module is conveyed through a seminar and a practical course. The seminar will be interactive including contributions by students (targeted questions, discussion, presentations, debates). Classical studies will be discussed with a particular emphasis on methodological principles. In the practical course, small groups of students will apply selected methods to design, conduct, analyze and produce a poster on an experiment involving a topic of human movement science.
Teaching methods used is the seminars include:
- Student presentations
- Open discussion of actual topics
- Student presentations
- Application and training of statistical methods
- In depth discussion of scientific papers
- In depth discussion of applications to sport and exercise.

Media:
PowerPoint, Demos in WWW, Life-Demos

Reading List:
- Schmidt & Lee. Motor Control and Learning. A Behavioral Emphasis. Human Kinetics, 5th edition, 2011.
- Pinel, Biopsychology, Pearson, 9th edition, 2015
- Original research reports

- Additional literature to be announced

Responsible for Module:
Hermsdörfer, Joachim; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Application of research methods in human movement science (Übung, 2 SWS)
Beer (Barda) R, Hermsdörfer J, Stadler W

Principles of research paradigms in human movement science (Seminar, 2 SWS)
Beer (Barda) R, Hermsdörfer J, Stadler W
For further information in this module, please click campus.tum.de or here.

Module Description

SG861006: Methods in Neuromechanics | Methods in Neuromechanics

Version of module description: Gültig ab winterterm 2020/21

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
An oral exam assesses the student's ability to understand the methods of neuromechanics, the scientific principles behind them, and ways in which they could be applied. In a given time (60 minutes) they have to demonstrate their knowledge by answering short open answer questions.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
This class focuses on the experimental techniques used in neuromechanics research to investigate the properties of the neuromuscular system. Where feasible the methods will be taught hand-on in a laboratory setting. In particular the class will focus on:
- Electromyography (Preparation, recording, controls, and basic and advanced analysis techniques)
- Robotic manipulandum (Design and control, perturbation types, mechanical properties of the musculoskeletal system, muscle stiffness, spinal reflexes, cortical reflexes, motor learning, kinematic and kinetic analysis)
- Experimental design for the study of motor learning and motor adaptation
- Using visualisation techniques to inspect and analyse the experimental data
- Using electromyography and other techniques to control brain-computer interfaces
- Analysing movement kinematics using image processing
- Understanding principles of subjective perception.

In addition, the appropriate physiology, background and limitations of the methods will be discussed during the lecture.

Intended Learning Outcomes:
After successfully completing the module, students will be able to:
- Understand basic robotic principles that can be applied to neuromechanics
- Understand the scientific principles behind electromyography
- Understand how to select the appropriate neuromechanical methods used for specific scientific questions
- Analyze and visualize the output of the experiments in neuromechanics
- Plan relevant experiments with a suitable research question, appropriate controls and awareness of the limitations.

Teaching and Learning Methods:
There will be 1 hour of lecture, followed by 3 hours of laboratory work in which the students will be involved in using experimental equipment and analyzing the data obtained from the experiments. In selected classes there will also be group discussion with the students to ensure they understand the basics of the laboratory methods used and are able to explain the principles by which they work.

Media:
Slides (pdfs of PowerPoint lectures)

Reading List:
- Winter, Biomechanics and Motor Control of Human Movement, Wiley,
- Enoka, Neuromechanics of Human Movement, Human Kinetics

Responsible for Module:
Franklin, David; Prof. Ph.D.

Courses (Type of course, Weekly hours per semester), Instructor:
Neuromechanics Methods (Übung, 3 SWS)
Cesonis J, Forano M, Franklin D, Leib R, Orschiedt J

Neuromechanics Methods (Vorlesung, 1 SWS)
Cesonis J, Forano M, Franklin D, Leib R, Orschiedt J
For further information in this module, please click campus.tum.de or here.

Module Description

SG861007: Exercise Biology Methods | Exercise Biology Methods

Version of module description: Gültig ab summerterm 2020

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
To show their ability to perform methods used in human exercise physiology, the students have to prepare an online talk on a method of a technique in the biology lab. Further, they have to work on specific questions in performance analysis and have to upload the results to E-learning platform. Both part has to be passed with success to get the midterm mark, improving the final mark for 0.3 credit points. The final exam is a oral online exam. Therfore, the students choose by lot three questions. The stundents have 5 min to prepare and 15 min to present the answers and respond to further questions.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
The entire focus of this course is on methods for scientific experimentation in exercise biology and their use in research or elsewhere. Methods that are covered either “hands on” and theoretically or only theoretically include:
- Human exercise physiology (Graded exercise tests, heart rate and rate of perceived exertion, VO2max testing, Lactate testing, Anthropometry)
- Molecular exercise physiology (Introduction to wet lab work, Metabolite & enzyme assays, Skeletal muscle histology & microscopy, Genetic testing, RNA methods, Protein methods (e.g. Western blotting))
- General topics (How to keep a labbook, Lab mathematics, Scientific report writing).

Intended Learning Outcomes:
Candidates that successfully complete this module will be able to carry out research projects using methods commonly used in exercise biology. Specifically candidates will be able to:
- Solve mathematical problems in relation to experimentation in exercise biology (e.g. respiratory calculations or the determination of volumes for dilution)
- Explain the principles of selected methods used in human exercise physiology (e.g. lactate testing), exercise biochemistry (e.g. muscle fibre histochemistry) and molecular exercise physiology (e.g. Western blot for an adaptation-mediating protein)
- Perform several of such methods “hands on” and record the experiments in a labbook
- Interpret their data and communicate the result as a short scientific report
- Plan relevant experiments with a suitable research question, appropriate controls and awareness of the limitations of each method
- Discuss best practice and limitations of methods based on journal articles
- Develop business ideas in relation to research methods.

Teaching and Learning Methods:
Every week there will be a 1 h seminar where the research methods are introduced and discussed plus a practical where the students learn to perform exercise biology methods. The duration of the practical depends on the method as a graded exercise tests may take 40 min whereas a Western blot can take 1.5 days). Teaching methods used include:
- Hands on experimentation
- Journal clubs where novel methods are introduced
- Mathematical and other problem solving tasks
- Conference-style student presentations
- Short scientific report writing assignments
- Entrepreneurship tasks in relation to research methods.

Media:
Script, slides, flipchart, exercises, PowerPoint

Reading List:
Wackerhage H Molecular Exercise Physiology. Routledge 2014
McArdle WD, Katch FI & Katch VL. Exercise physiology. Nutrition, energy and human performance. 8th edition. Wolters Kluwer 2014

Responsible for Module:
Wackerhage, Henning; Prof. Dr. Sportwiss.

Courses (Type of course, Weekly hours per semester), Instructor:
Exercise biology methods (Lab Course) (Übung, 3 SWS)
Wackerhage H, Spitzenpfeil P, Stöcker F, Schönfelder M, Krätschmer R

Exercise biology methods (Seminar) (Seminar, 1 SWS)
Wackerhage H, Spitzenpfeil P, Stöcker F, Schönfelder M, Krätschmer R

For further information in this module, please click campus.tum.de or here.

Module Description

SG861008: Methods of Performance Analysis and Testing | Methods of Performance Analysis and Testing

Version of module description: Gültig ab summerterm 2019

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students will be examined through a 30 min oral examination. Therefore, the students prepare their write up of two practicals in form of a short scientific communication.
During the examination students will have to:
- Explain experimental design, the principles of the methods used and their limitations
- Explain their short scientific communication.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Module “Current topics of Perfomance Analysis and Testing”, 1. Sem

Content:
The entire focus of this course is on methods for scientific measurements in performance analysis and testing. Methods are covered “hands on” and theoretically:
- Action detection:
- Design of an observational system
- Collecting data live
- Testing the quality of measurements
- Video based qualitative analyses
- Position detection:
- Video-based position detection (image processing steps, problems, indications)
- GPS-based position detection (indications and problems)
- Radar-based position detection (Setup, indications and problems)
- Gold standards for position detection (light barriers, laser ground contact measurement, laser distance measurement, Sub-centimeter VICON measurements)

- Accuracy assessment methods of position detection (protocols, design)
- Generic teaching
- Mathematical methods: signal processing, time series analysis, observer agreement
- Scientific report writing
- Entrepreneurial skills
- In-Depth Knowledge about fields that use sports data
- Business plan development. How to transform ideas into products in performance analysis.

Intended Learning Outcomes:
Candidates that have successfully passed this module will be able to:
- Solve mathematical problems in relation to position detection in sports (signal processing, time series analysis)
- Explain the principles of selected methods used in performance analysis and testing (e.g. image based and sensor based position detection, behavior assessment)
- Perform several of such methods “hands on” and record the measurements
- Write a short scientific communication based on data generated in a practical
- Plan relevant experiments with a suitable research question, appropriate controls and awareness of the limitations of each method
- Discuss best practice and limitations of methods based on journal articles
- Develop a business idea in relation to a research method.

Teaching and Learning Methods:
Every week there will be two 2 SWS seminars on methods of action detection and position detection respectively. Teaching methods used include:
- Hands on experimentation
- Journal clubs where novel methods are introduced
- Mathematical and other problem solving tasks
- Conference-style student presentations
- Short scientific report writing assignments
- Entrepreneurship tasks in relation to research methods.

Media:
PowerPoint

Reading List:
McGarry, T., O'Donoghue, P. & Sampaio, J. (Eds.). (2013). Routledge Handbook of Sports Performance Analysis. London, New York: Routledge.

Responsible for Module:
Kolbinger, Otto Klaus; Dr. phil.

Courses (Type of course, Weekly hours per semester), Instructor:
Methods of Position Detection (Seminar, 2 SWS)
Blauberger P, Kolbinger O

Methods of Action Detection (Seminar, 2 SWS)
Blauberger P, Kolbinger O
For further information in this module, please click campus.tum.de or here.

Module Description

SG861010: Methods in Performance Psychology | Methods in Performance Psychology

Version of module description: Gültig ab summerterm 2019

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 135	**Contact Hours:** 45

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students will be examined through writing a psychological evaluation report (4000-4500 words; 60%) on an athlete (laboratory assignment). The case has to be presented and discussed (20 minutes; 40%) in a plenary session. During the examination students will have to explain their decisions regarding the relevant psychological processes and regarding their evaluation criteria and assessments, defend the assessment methods and discuss the recommendations for interventions.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge of psychology and sports psychology

Content:
Differential Psychology:
- Interindividual Differences and Personality
- Methods in Personality research and assessment
- States and Traits, Skills and Abilities
- Interindividual Differences and Sport Performance Performance Psychology:
- Cognitive processes as building blocks of performance
- Mind-body-Interaction
- Action-Perception-Coupling
- Research Methods and assessment in cognitive psychology Psychological Assessment and Evaluation
- Evaluating psychological assessment methods
- Steps of a psychological evaluation report

Intended Learning Outcomes:
After participating in the module, students will be able to
- Present methodological approaches and constructs of differential and personality psychology that are important for athletic performance
- generate and test hypotheses on the moderating effect of differential characteristics on psychological processes of sport performance
- Critically evaluate test and questionnaire procedures of (sports) psychological diagnostics, assign suitable application questions in competitive sports and carry out exemplary procedures, evaluate them and assess their results
- Present constructs and methods of cognitive psychology as well as the processes important for athletic performance and discuss them against the background of embodied cognition
- Evaluate and design sport psychological interventions for performance enhancement against the background of embodied cognition. and derive these interventions from sport psychological diagnostics.

Teaching and Learning Methods:
In the two seminars, “Differential Psychology of Sport” and “Performance Psychology”, short impulse presentations will be combined with students-led discussions and short presentations. In the practical “writing a psychological evaluation report” students will administer tests and questionnaires among themselves, get short report writing assignments and entrepreneurship tasks in relation to acquisition of an athlete for assessment.

Media:
PowerPoint-Slides, Worksheets, Journal-Articles, Whiteboard, Flipchart

Reading List:
Beckmann, J., & Elbe, A. (2015). Sport Psychological Interventions in Competitive Sports. Newcastle: Cambridge Scholars.
Goldfinger, K., & Pomerantz, A. M. (2013). Psychological assessment and report writing. Sage.
Taylor, J. (2017). Assessment in applied sport psychology. Human Kinetics.
Raab, M., Lobinger, B., Hoffmann, S., Pizzera, A., & Laborde, S. (2015). Performance Psychology. Perception, Action, Cognition, And Emotion. London: Academic Press.

Responsible for Module:
Ehrlenspiel, Felix; PD Dr. phil. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Performance Psychology (Seminar, 1 SWS)
Ehrlenspiel F

Differential Psychology of Sport (Seminar, 1 SWS)
Ehrlenspiel F

Writing a psychological evaluation report (Übung, 1 SWS)

Ehrlenspiel F, Schwender J
For further information in this module, please click campus.tum.de or here.

Module Description

SG861023: Sports Informatics | Sports Informatics

Version of module description: Gültig ab summerterm 2020

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students have to perform a project which shows their ability to understand and describe fundamental concepts of programming and to analyze sport related data sets. To demonstrate their documentation skills, they have to write a project report (3000 words, specification-like style, 50% of overall mark).

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Students will have met the entry requirements for the MSc in Sport and Exercise Science and will have completed the module Technical Analysis.

Content:
The technological innovations of recent years – particular in the field of sensors – are leading to an increasing volume of data in sports (e.g. Positioning systems, gyms, fitness trackers, wearables). These enormous amounts of information (“big-data”) have relatively little value in themselves. What is required are appropriate methods for structuring, combining and analyzing these data. Against these background this module taught the following content:
-Fundamentals data analytics methods for sports: The first half focusses on fundamental computational methods for data analysis including data structures (variables, data types, lists, arrays, classes, files) to store scientific data and control structures (loops, conditions, if-statements, functions) for processing scientific data.
- Application of these methods on sport data: The second half is to apply technological skills in data sets by positions systems, human loggers, a fitness tracker or a training device. For example, students will learn how to model and calculate performance indicators and to find patterns in these data. This part is connected to the module “Methods of Action and Position detection.”

Intended Learning Outcomes:
After successfully completing the module, students will be able:
- to understand and describe fundamental concepts of programming (especially storing and processing data)
- to analysis data from positions systems, human loggers, fitness tracker or training devices.

Teaching and Learning Methods:
The module consists of a practical course/exercise, where first concepts of computational data analysis are presented. Students will be asked to bring a notebook, which will enable them to quickly obtain knowledge and to enhance their programming skills. Second, students will solve analyze sport related datasets, which are related to the topics presented. Results will be discussed.

Media:

Reading List:
Baca, A. (Ed.).(2015). Computer Science in Sport. London, New York: Routledge.

Responsible for Module:
Link, Daniel; PD Dr. phil. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Sport Informatics (Übung, 4 SWS)
Link D
For further information in this module, please click campus.tum.de or here.

Module Description

SG861024: Nutrition for Human Performance: Current Topics and Research Methods | Nutrition for Human Performance: Current Topics and Research Methods

Version of module description: Gültig ab winterterm 2021/22

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Oral examination (30 min, English). Students will participate in a graded discussion on relevant topics and specific questions related to nutrition and supplementation in the context of athletic performance. Students are expected to demonstrate that they understand fundamental principles of nutrition for human performance, are knowledgeable of key research methods and current scientific literature in sports and exercise nutrition, are able to evaluate the efficacy of nutritional interventions on performance-related outcomes and can translate this knowledge into practical recommendations. The oral examination will be held as an individual or group examination.

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Students should have a comprehensive understanding of exercise physiology. Students should further have a basic understanding of human nutrition.

Content:
This course is designed for students with a broad background in exercise science who wish to develop a better understanding of how nutrient requirements of athletes and how nutrition and supplementation can be utilized to improve human performance. The course is designed to provide:
- An understanding of the fundamental principles of sports and exercise nutrition and of the integrative and interdisciplinary nature of this field of study
- Exposure to current and cutting-edge scientific literature in the field of performance nutrition
- The tools and knowledge to evaluate scientific literature and to develop evidence-based nutritional strategies aimed at maximizing human performance.

Intended Learning Outcomes:
- Understand and know fundamental principles of nutrition for human performance
- Assess current scientific literature in sports and exercise nutrition
- Evaluate efficacy of nutritional interventions on performance-related outcomes
- Identify key research methods used in the field of exercise and nutrition
- Ability to translate knowledge and skills into evidence-based recommendations.

Teaching and Learning Methods:
The seminar (2 SWS) will facilitate an active learning environment which includes self-paced reading prior to weekly meetings, face-to-face lectures on background fundamental principles of sports and exercise nutrition, and group discussions of current scientific literature.
The exercise (2 SWS) will involve individual and group work to solve practical and theoretical problems set out by the instructors using an array of methods discussed during the seminar. Prior to their application, key knowledge and methods will be reviewed by the instructor.
The seminar and exercise will build upon each other such that each week's problems will build upon knowledge and methods discussed during the preceding seminar.

Media:
PowerPoint

Reading List:
- Reading material will be provided via TUMonline/moodle.
- Recommended: Louise Burke, Vicki Deakin, editors. Clinical Sports Nutrition 5th Edition, McGraw Hill, Australia, 2015. ISBN-13: 978-1743073681

Responsible for Module:
Köhler, Karsten; Prof. Dr. rer. nat.

Courses (Type of course, Weekly hours per semester), Instructor:
Research Methods in Sports Nutrition (Übung, 2 SWS)
Kirchner K, Nußer V

Current Topics in Sports Nutrition (Seminar, 2 SWS)
Köhler K, Wasserfurth-Grzybowska P
For further information in this module, please click campus.tum.de or here.

Electives: B | Wahlmodule B

Module Description

SG8000160: Sponsorship-linked Marketing (Online-course) | Sponsorship-linked Marketing (Online-Kurs)

vhb-course

Version of module description: Gültig ab winterterm 2021/22

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The module examination consists of a written test (60 min). The exam is to verify that the students are able to properly select and apply appropriate conceptual bases and methodological procedures (within a limited time and without aids) in the light of various challenges of sponsorship. Firstly, the questions include answers to each question from a set of predetermined multiple answers. Secondly, open-end questions are asked so that we can find out whether students are able to demonstrate the use of strategies and implementation steps as part of sponsorship.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic skills in Marketing

Content:
- Introduction and Overview of the Sponsorship-linked Marketing Management Process
- Introduction to Sponsorship and Sponsorship-linked Marketing
- The Sponsorship-linked Marketing Management Process
- How Sponsorship-linked Marketing Activities Influence Stakeholders
- The Effects of Sponsorship-linked Marketing Activities on Recipients
- Theories on the Processing of Sponsorship Messages (I)
- Theories on the Processing of Sponsorship Messages (II)
- Visual Attention to Sponsors at the Site of Events and in the Media
- Outcome Measurement and Controlling in Sponsorship-linked Marketing

- Measuring and Interpreting Sponsorship Outcome Variables
- Sponsorship-linked Marketing and the Financial Success of Brands
- Sponsorship-linked Marketing Implementation
- Leveraging Tools in Sponsorship-linked Marketing
- Non-sponsor Brand Behaviors: Official Sponsorship versus Ambush Marketing
- The Sponsor Perspective: How to Create Unique Sponsorship Portfolios
- The Sponsored Property Perspective: How to Recruit and Retain Sponsors

Intended Learning Outcomes:
At the end of the module students understand how sponsorship portfolios are created from the perspective of different stakeholders (sponsors and ambushers, event organizers, individuals, media). This includes sponsorship in sports, arts and culture, social causes, science and education, ecological causes, as well as the media. The students understand the basics in sponsorship and sponsorship-linked marketing, including recent developments and the chain of effects of the sponsorship-linked marketing management process. The students also understand the mechanisms of how recipients process sponsorship messages. They are able to use different methodological concepts in order to quantify the effects of sponsorship messages on recipients and relate these measures to the predefined goals of the stakeholders. The students are able to identify success factors of sponsorship-linked marketing and they can use methods that measure the success of sponsorship. The students are able to create both innovative sponsorship strategies as part of the sponsorship portfolio management and strategies that help sponsors protect the sponsorship rights against ambushers.

Teaching and Learning Methods:
Online lectures that cover the state of the art in the field of sponsorship and its implementation are provided using software technology. Students can access the materials using Internet technology. Learning progress monitoring questions are asked when students go through the content of the class. Students also take part in online training using case studies. They are provided with the relevant material to work on the cases, solve problems, and find solutions. They do so in the form of homework. Answers to the case studies are presented to the students after they have handed in their homework.

Media:
Online lectures

Reading List:
https://www.researchgate.net/profile/David_Woisetschlaeger/publication/317035913_Inferring_Corporate_Motives_How_Deal_Characteristics_Shape_Sponsorship_Percep
links/59916244458515b87b4d6b40/Inferring-Corporate-Motives-How-Deal-Characteristics-Shape-Sponsorship-Perceptions.pdf

Responsible for Module:
Königstorfer, Jörg; Prof. Dr. rer. oec.

Courses (Type of course, Weekly hours per semester), Instructor:
Sponsorship-linked marketing (Online-Kurs) (Seminar, 2 SWS)
Yang Y

Sponsorship-linked marketing (Online-Kurs) (Vorlesung, 2 SWS)
Yang Y
For further information in this module, please click campus.tum.de or here.

Module Description

SG810005: Qualitative Research Methods | Qualitative Research Methods

Version of module description: Gültig ab summerterm 2017

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Term paper (5-10 pages). The students understanding of theoretical concepts of qualitative research approaches and their ability to apply these concepts will be evaluated by submission of a term paper, which includes theoretical reflections and a summary of conclusions of the data interpretation process of the practical exercise.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge of social science theory and research practices

Content:
- History, theory and methodology of qualitative research
- Qualitative research in sport science
- Content analysis and objective hermeneutics
- Grounded theory and situational analysis
- Conducting interviews and focus groups
- Action research and participatory methods
- Processes of collecting, analyzing and interpreting qualitative data
- Coding and data mapping

Intended Learning Outcomes:
After successfully completing the module, students will be able:
- to understand and describe fundamental concepts of qualitative research methods and qualitative data analysis
- to apply strategies of qualitative analysis in practical exercises

- to create substantial interpretations of research data

Teaching and Learning Methods:
The module consists of one seminar with blended learning components and a supplementary exercise. In the interactive seminar, students are activated via tasks, presentations and structured discussions. The outcomes will be written down and saved in a MOODLE for further use within the exercise. In the exercise, students will be separated in small groups, to work on applicationoriented tasks, practicing the hands-on process of qualitative coding of data material using and - in recourse to the seminars materials - comparing strengths and weaknesses of different methods.

Media:
Multimedia presentations (PowerPoint), exercises on online platform (Moodle)

Reading List:
Flick, Uwe (2009): An introduction to qualitative research. London: Sage.

Responsible for Module:
Richter, Matthias; Prof. Dr. rer. soc.

Courses (Type of course, Weekly hours per semester), Instructor:
Methods of Qualitative Data Inquiry and Analysis (Übung, 2 SWS)
Schmid A

Methodology of Qualitative Research (Seminar, 2 SWS)
Schmid A
For further information in this module, please click campus.tum.de or here.

Module Description

SG860012: Neuromuscular Control and Learning | Neuromuscular Control and Learning

Version of module description: Gültig ab winterterm 2021/22

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students will be examined through a 20 minute presentation, which consists of an oral presentation with slides where they will need to make a presentation on their research project (including experimental design, principles and limitations of the methods, and theoretical framework to demonstrate their ability to design and conduct a research project), followed by a 10 minute discussion to test if they understand the physiology behind learning and adaptation as well as if they are able to analyze the physiological and
computational mechanisms that underlie neuromuscular control and motor learning. The weighting of the grades will be 50% for the project presentation and 50% for the discussion.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
This module covers current advanced topics in neuromuscular control and learning with a special relevance to sports, exercise and health. This class will cover the neural, physiological and computational basis of human learning and adaptation. The questions asked in the course is how do we learn new tasks or skills, and how can we use this information to improve learning.
For example, during rehabilitation, what sensory information would improve the motor ability of the patient? What type of tasks would faster develop a skill in an athlete? We will study these questions by examining the basic physiology involved, the neural processes, computational principles, and the experimental studies. The class will cover the computational theories of unsupervised learning, supervised learning and reinforcement learning. These learning systems will then be discussed in terms of their applications in human sensorimotor control, for example

the use of supervised learning in the learning of a forward model. We will then discuss the experimental work examining adaptation to novel dynamics, and explore computational models that can explain the generalization, representation of these dynamics as well as recent work investigating the sensory signals and contextual cues that can avoid interference. Finally, we will discuss how this information could be applied in rehabilitation, sports training, or in robotic systems.

Intended Learning Outcomes:
After successfully completing the module, students will be able to:
- Understand the physiology behind learning and adaptation
- Apply basic computational principles that can explain learning
- Read and discuss scientific articles
- Analyze the physiological and computational mechanisms that underlie neuromuscular control and motor learning
- Evaluate applications of the theories of learning to sports, exercise, health and rehabilitation
- Design and conduct a research project in neuromuscular control and learning
- Read and discuss scientific articles.
- Analyze the physiological and computational mechanisms that underlie neuromuscular control and motor learning.
- Evaluate applications of the theories of learning to sports, exercise, health and rehabilitation.
- Design and conduct a research project in neuromuscular control and learning.

Teaching and Learning Methods:
There will be 2 hours of seminar, followed by 2 hours of laboratory. The laboratory will be a mixture of experimental projects, computational simulations, open discussions, and presentations. In the experimental sessions projects will be performed with robotic systems, force transducers, electromyography and other associated equipment used to study behavioral learning and adaptation. In selected weeks, we will introduce simple modeling of the learning algorithms using Matlab. The seminar will predominantly have a lecture component, but will also involve group discussion and debates about the content. A major component of the class is the research project, which can either be computational or experimental depending on the individual student’s interest and background.

Media:
Slides (pdfs of PowerPoint lectures)

Reading List:
Principles of Sensorimotor Learning, Wolpert, Diedrichsen & Flanagan, Nature Neuroscience Reviews, 12, 2011.
Further literature (primarily scientific articles) will be announced during the course.

Responsible for Module:
Franklin, David; Prof. Ph.D.

Courses (Type of course, Weekly hours per semester), Instructor:
Neuromuscular Control and Learning (Vorlesung, 2 SWS)
Franklin D [L], Franklin D, Leib R

Neuromuscular Control and Learning Laboratory (Übung, 2 SWS)
Franklin D, Leib R, Orschiedt J
For further information in this module, please click campus.tum.de or here.

Module Description

SG860013: Human Robotics | Human Robotics

Version of module description: Gültig ab winterterm 2021/22

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
To show the ability to use robotic systems in the laboratory and their application in sports, exercise and rehabilitation, students will need to make a 20 minutes presentation on their research project, which consists of an oral presentation with slides followed by a discussion to test if they understand the social issues involved with the use of robotics and answer questions about both the project and the related physiology as well as how robotic principles can be applied in sport and exercise. Total time: 20 minutes. The weighting of the grades will be 50% for the project presentation and 50% for the discussion.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
This class will discuss human motor control from a robotics perspective, specifically focusing on:
- Problems in Motor Control
- Features of Performance, Task Goals and Movement Characteristics
- Stability and Muscle Contraction
- Stiffness and Impedance
- Motor Costs and Energetics
- Coordinate transforms
- Forward Models and Sensory Predictions
- Optimality and Cost Functions
- Optimal Feedback Control
- Feedback Modulation
- Motor Learning

- Applications in Robotics
- Applications in Rehabilitation
- Applications in Sports and Exercise.

Intended Learning Outcomes:
After successfully completing the module, students will be able to:
- Understand basic robotic principles that can be applied to human motor control
- Read and evaluate scientific articles
- Explain computational aspects of motor control
- Understand and use robotic systems in the laboratory that can be used to examine motor control
- Learn the human physiology associated with the principles of motor control
- Explain how robotic principles can be applied to sports and exercise and for rehabilitation
- Understand and discuss the social issues involved with the use of robotics
- Design and conduct a research project in human robotics.

Teaching and Learning Methods:
There will be 2 hours of seminar in which the students will both listen to lectures as well as be involved in discussions and targeted questions about the material, followed by 2 hours of lab in which the students will be involved in discussion, presentations, and simple modeling of the human system. During the lab time, we will also examine robotic systems to study human motor control. Students will be required to develop a research project in the field of human robotics during the seminar which can either focus on robotics, motor control, human-robot interaction, or applications of these topics to sport, exercise, health or rehabilitation.

Media:
Slides (pdfs of PowerPoint lectures)

Reading List:
- Human Robotics: neuromechanics and motor control” Etienne Burdet, David Franklin, and Theodore Milner, MIT Press, 2013
- Additional literature will be announced during the course.

Responsible for Module:
Franklin, David; Prof. Ph.D.

Courses (Type of course, Weekly hours per semester), Instructor:
Human Robotics (Seminar, 2 SWS)
Forano M, Franklin D

Human Robotics (Übung, 2 SWS)
Franklin D
For further information in this module, please click campus.tum.de or here.

Module Description

SG860014: Exercise Biology Specialisation | Exercise Biology Specialisation

Version of module description: Gültig ab summerterm 2020

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
To demonstrate their ability to design, carry out and validate a training intervention guided by precision medicine and aggregated marginal gains concepts, students have to write mini-reports (500 words, strict, journal-like style for abstarcts) about the study they carried at the end of this course. In addition, students have to work on an individual research question, which they have to present in an individual online presentation to get the mark. The the third part is that the students have to answer questions to the lecture.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
Specific information for this module
This module will be split into three parts where the following contents will be taught:
- Precision medicine & sport: People develop different diseases and their response to drugs and exercise varies greatly. Precision medicine bases prevention and treatment on people's individual differences in environment, genes and lifestyle. As the response to exercise programmes differs also greatly, the precision medicine approach can also be applied for prescribing exercise programmes for health or performance.
- Aggregated marginal gains: A significant component in the success of the British Olympic team during the Olympiads of London and Rio de Janeiro has been attributed to the "aggregated marginal gains" strategy that was initially applied by Sir Dave Brailsford to British cycling. The idea is that if athletes would improve by 1% each performance-limiting factor that determines cycling performance that there would be a significant aggregated increase in performance (Harvard

Business Review, 30.10.2015). This meant that cyclists and other athletes not only optimized the traditional, major performance-limiting factors such as VO2max and the lactate threshold but also minor factors such as sleep hygiene (ensuring sufficient sleep, allergy control), infection control (proper hand washing technique, clothing, interaction with others) and saddle soreness (saddle position, clothing design, treatment of sore spots were optimized involving a Cambridge University consultant).
- Mini research project: Training for health or performance intervention. The last third of the practical is to apply the precision medicine principle, the aggregated marginal gains strategy and quality-rated scientific evidence towards developing a time-limited training programme either for health or performance. In addition, students will select suitable performance or other tests to determine the success of their intervention.
Online reference https://hbr.org/2015/10/how-1-performance-improvements-led-to-olympic-gold

Intended Learning Outcomes:
At the end of this module you will:
- Be able to explain precision medicine and its application for the treatment of disease (esp. cancer) and for the development of training interventions aimed at improving performance or health
- Be able to explain the aggregated marginal gains concept and how it can be used in sport or elsewhere to improve performance or output
- Be able to apply the precision medicine and aggregated marginal gains concepts to design, carry out and validate a training intervention aimed at improving performance or health
- Be competent in (in relation to training interventions) solving mathematical and other problems, presenting scientific data, debating, and scientific writing.

Teaching and Learning Methods:
Precision medicine and the aggregated marginal gains strategy are newer and important concepts in medicine and sport and exercise science that are highly relevant for the development of exercise training programmes. We will teach these concepts and train their practical implementation through the following combination of teaching methods:
- One weekly 1 h lecture (1 SWS)
- One 2 h seminar/practical (2SWS). Students will be asked to bring a notebook, iPad or other internet device which will enable them to quickly obtain knowledge. The focus is then to use this knowledge. Generally seminars will include a mix of the following:
- Internet/Pubmed search to answer and discuss questions
- Mathematical and other problem solving tasks
- Short, conference-like student presentations
- Debates (modelled on the debating rules for Cambridge Union at Harvard: https://cus.org/members/debating/what-debating)
- Journal club-like paper reviews
- Scientific writing exercises
- Mini research project: training for health or performance intervention (1 SWS) students will design, plan and carry out their mini research project. Staff will supervise performance testing sessions and offer support so it is a combination of supervised and independent learning.

Media:
Written Standard Operating Procedures, Slides, Flipchart, PowerPoint

Reading List:
Wackerhage H. (2014) Molecular Exercise Physiology. An Introduction. Oxford, Routledge

Responsible for Module:
Wackerhage, Henning; Prof. Dr. Sportwiss.

Courses (Type of course, Weekly hours per semester), Instructor:
Exercise Biology Specialisation (Seminar, 3 SWS)
Schönfelder M, Stöcker F

Exercise Biology Specialisation (Vorlesung, 1 SWS)
Wackerhage H, Ludwig C
For further information in this module, please click campus.tum.de or here.

Module Description

SG860015: Performance Analysis Specialisation | Performance Analysis Specialisation

Version of module description: Gültig ab winterterm 2017/18

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The assessment will be one multi-component assessment:
To demonstrate their ability to apply technological innovations in game sports analysis to questions of theoretical as well as practical performance analysis, students have to write a report (3000 words, strict, journal-like style guidelines, 40% of the overall mark) about the study they carried out during the semester and present the project (30%). In the following discussion (30%) they demonstrate that they can explain performance analysis and theoretical innovations in game sports analysis including the mathematical background and its applications.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
This module will be split into three parts where the following contents will be taught:
- Theoretical innovations in game sports modeling: Game sports may be conceived as unique interaction process between two parties going for adversative goals at the same time. Observable behavior is emerging from this interaction process. In literature, there is a continuous stream of mathematical models, frequently from a dynamic systems background, designed to describe, validate and predict behavior in game sports. We will introduce a spectrum of these models with pros and cons for each
- Technological innovations in game sports analysis: Since FIFA has in principle allowed for sensors to be worn by players, new technologies from new competitors enter the market of game analysis. Standard positions sensor technologies will be enhanced in near future by Inertial Measurement Units (IMU) with 3D orientation, acceleration & rotation measurements and create

unique opportunities for game analysis. The technological background, the design of practical experiments, and the application to practical problems will be taught.
- Mini research project: Game Sport Analysis. The last third of the practical is to apply theoretical and practical innovations to a concrete question from performance analysis in game sports. Typically a field study is conducted acquiring data from top level athletes and analyze it with innovative methods. The study report should include experiences with communicating and introducing these concepts in sports practics.

Intended Learning Outcomes:
At the end of this module students will:
- Be able to explain performance analysis in game sports and its applications in game sports theory as well as game sports training
- Be able to explain theoretical innovations in game sports analysis including the mathematical background
- Be able to apply technological innovations in game sports analysis to questions of theoretical as well as practical performance analysis
- be able to solve mathematical and other problems, to present scientific data, to engage in debates, to review journal articles and to write short scientific texts in a modern science writing style.

Teaching and Learning Methods:
During the theoretical and technological innovation part the teaching methods will be:
- One weekly 2 h seminar
- One 2 h practical slot. Students will be asked to bring a notebook, iPad or other internet device which will enable them to quickly obtain knowledge. The focus is then to use this knowledge.
Generally the seminar and practical will include a mix of the following:
- Internet/PubMed search to answer and discuss questions
- Mathematical and other problem solving tasks
- Short, conference-like student presentations
- Debates
- Journal club-like paper reviews
- Scientific writing exercises
During the last third, the mini research project: game sport analysis students will design, plan and carry out their mini research project. Staff will supervise data acquisition in the field and offer support.

Media:
PowerPoint Slides

Reading List:
Baca, A. (Ed.).(2015). Computer Science in Sport. London, New York: Routledge.
McGarry, T., O'Donoghue, P. & Sampaio, J. (Eds.). (2013). Routledge Handbook of Sports Performance Analysis. London, New York: Routledge.

Responsible for Module:
Lames, Martin; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Performance Analysis Specialisation (Seminar, 2 SWS)
Lames M

Performance Analysis Specialisation (Übung, 2 SWS)
Lames M
For further information in this module, please click campus.tum.de or here.

Module Description

SG860017: Participation and Inclusion | Participation and Inclusion

Version of module description: Gültig ab winterterm 2017/18

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
To demonstrate their ability to organize and conduct inclusive sport events by implementing the current state of research in disability and health related diversity studies students have to prepare a presentation (30-45 minutes) that will be discussed during the seminar under consideration of social policy frameworks (20%). In a term paper (5-10 pages) students reflect their elaboration, considering the feedback of the seminar (80%).

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge of social theory and interest in working on issues of social (in-)equality

Content:
- Body, functioning and disability in historical perspective
- Diversity and Disability Studies
- The International Classification and Disability, Functioning and Health
- The Convention on the Rights of Persons with Disabilities
- Participation and Inclusion through sport
- Challenges of organizing and conducting inclusive sport events
- Special Olympics and Unified Sports
- Development of inclusive exercises

Intended Learning Outcomes:
Candidates that have successfully completed this module, will be able to:
- understand and critically asses the current state of research in disability and health related diversity studies as well as comprehend and apply social policy frameworks

- implement the theoretical context achieved in a) the lecture and b) other modules, into the praxis of inclusive sport events (e.g. Special Olympics, sport events for children and eldery etc.)
- organize and conduct inclusive sport events.

Teaching and Learning Methods:
The module consists of a seminar and an exercise. The Seminar, “(Dis-)ability, Diversity and Inclusion”, will convey state of the art research from within the study of disability, diversity and social politics. The Students will work with current literature und studies and will give oral presentations.
In the exercise, “Inclusive Sport Events”, students will learn how to implement theoretical aspects, policy frameworks and evidenced-based criteria of inclusion into practical fields of organizing and conducting sporting events.

Media:
Multimedia presentations (PowerPoint), exercises on online platform (Moodle)

Reading List:
Kiuppis, F., & Kurzke-Maasmeier, S. (2012). Sport im Spiegel der UN-Behindertenrechtskonvention. Interdisziplinäre Zugänge und politische Positionen. Stuttgart: Kohlhammer.

Responsible for Module:
Schwarz, Daniela Maria; Ph.D.

Courses (Type of course, Weekly hours per semester), Instructor:
(Dis-)ability, Diversity and Inclusion (Seminar, 2 SWS)
Langbein E, Schwarz D

Inclusive Sport Events (Seminar, 2 SWS)
Langbein E, Schwarz D
For further information in this module, please click campus.tum.de or here.

Module Description

SG860018: Psychophysiology of Stress in Sport | Psychophysiology of Stress in Sport

Version of module description: Gültig ab winterterm 2017/18

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 105	**Contact Hours:** 45

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
To assess students' ability to investigate the interaction between stress and sport and exercise examination consists of a group project. The group project consists of several steps: To evaluate background knowledge on mind-body-interactions students develop a research question, to evaluate methodological competencies students design and run a correspondent study. Results and conclusions are presented in a conference-style presentation (20 minutes; 40%) to assess communicative skills.
In a written journal-style report (4500-5000 words; 60%) students' ability to concisely describe a full research project will be evaluated.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in psychology and sport psychology

Content:
Models of Stress with a focus on physiological models
- Stress and Recovery
- Psychological questionnaires and tests of stress,
- Physiological markers of stress (neuroendocrine, neurophysiology, cardiovascular)
- Behavioral assessment of stress (Trier Social Stress Test), especially in sport
- Cognitive-behavioral interventions to reduce stress
- Biofeedback & Neurofeedback as interventions, Mindfulness-Interventions
- Mechanisms of "choking under pressure"
- Approaches to studying "choking"
- Bio-psycho mechanisms of sport and stress, sport and sleep

Intended Learning Outcomes:
After completion of the module, students will be able to
- explain the mind-body interaction of stress in sport
- apply psychological, physiological and behavioral tools to assess stress in sport
- apply psychological, physiological and behavioral interventions to alter stress perceptions, increase coping resources, and promote recovery
- investigate the effects of stress on sport performance and the effects of sport and exercise on chronic stress by applying psychophysiological methods
- describe and discuss psychophysiological methods and research in journal-style.

Teaching and Learning Methods:
In the seminar students present, analyze and discuss current “hot topic” empirical studies. The assessment and/or intervention methods applied in these studies will then be experienced in small-scale replications in the lab. Based on these replications students have to design, run, and analyze a mini-project on one of the topics.

Media:
PowerPoint-Slides, Worksheets, Journal-Articles, Whiteboard, Flipchart

Reading List:
Andreassi, J. L. (2013). Psychophysiology: Human behavior & physiological response. Psychology Press.
Ehrlenspiel, F., & Strahler, K. (Eds.). (2012). Psychoneuroendocrinology of sport and exercise: Foundations, markers, trends. Routledge.

Responsible for Module:
Ehrlenspiel, Felix; PD Dr. phil. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Psychophysiology Lab (Übung, 1 SWS)
Hähl W

Psychophysiology of Stress (Seminar, 2 SWS)
Mirifar A
For further information in this module, please click campus.tum.de or here.

Module Description

SG860019: Biomechanics for Strength and Conditioning in Elite Sports | Biomechanics for Strength and Conditioning in Elite Sports

Version of module description: Gültig ab winterterm 2017/18

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
During an organized poster session, students will present (20-30 min) a short research project in the field of performance analysis, strength and conditioning in elite/competitive sports that they have done at the end of the semester. Each student will work on an individual case study (< 5 subjects).
The preparation of the poster and parts of the research project are homework tasks. Examination includes the evaluation of the content of the poster, presentation and discussion (Q&A).
To demonstrate their skills in applying theoretical understanding and practical knowledge to specialized case studies students will have to:
- Explain sports specific needs of strength and conditioning, and performance analysis
- Explain the experimental design, the principles of the methods used and their limitations
- Explain the theoretical background and discuss their project results in the light of recent research findings

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Biomechanical methods and application

Content:
This module covers current assessments of strength and conditioning for physical performance analysis:
- Main tests and analysis for the determination of an athlete’s physical performance, mainly in the field of strength diagnostics
- Evaluation of the specific physiological needs of different types of sports
- Planning and performing of specifically adopted tests

- Presentation of results and how to communicate scientifically high end methods to athletes or coaches
- Specific sports scenarios and athlete's needs to enhance performance
- Latest developments and scientific research on performance analysis in competitive sports.

Intended Learning Outcomes:
After successfully completing the module, students will be able to:
- Understand the principals of analysis of physical performance in competitive/elite sports
- Apply practical tests for strength and conditioning and evaluate outcomes for specific sports
- Understand, present and discuss scientific articles on recent developments in performance analysis, strength and conditioning
- Discuss the need of scientific support and development for competitive/elite sports
- Evaluate applications of appropriate methods for kids, elderly, and health and rehabilitation scenarios
- Design and conduct a research project for strength and conditioning assessments in competitive/ elite sports
- Communicate/ present scientifically high-end methods and results to athletes or coaches.

Teaching and Learning Methods:
There will be 2 hour of lecture including a 'journal club' and 2 hours of laboratory work. The laboratory work will be a mixture of experimental projects, data analysis, preparation of reports, open discussions, and presentations. The lecture will predominantly provide specific theoretical information, but will also involve group discussion and debates about the content. A big component of the class is the experimental research project (case study) at the end of the semester.

Media:
PowerPoint

Reading List:
- Komi, P.V. Strength and power in sport. Blackwell Science, Oxford, 2003.
- primarily scientific articles (will be announced during the course).

Responsible for Module:
Schwirtz, Ansgar; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Methods in biomechanical performance analysis - strength and conditioning in elite sports (Seminar, 2 SWS)
Paternoster F

Biomechanics for strength and conditioning in elite sports (Vorlesung, 2 SWS)
Paternoster F, Rasp D
For further information in this module, please click campus.tum.de or here.

Module Description

SG860020: Muscle Function and Human Movement Studies (v2) | Muscle Function and Human Movement Studies (v2)

Version of module description: Gültig ab summerterm 2018

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Each student will work on an individual case study (< 5 subjects) at the end of the semester. During an organized poster session, students will present (20-30 min) their research project on recent biomechanical research questions concerning muscle function and human movement. The preparation of the poster and parts of the research project are homework tasks. Examination includes evaluation the content of the poster, presentation and discussion (Q&A). To demonstrate their skills in applying theoretical understanding and practical knowledge to specialized case studies students will have to:
- Explain the research idea, novelty and innovative approaches
- Explain the experimental design, the principles of the methods used and their limitations
- Explain the theoretical background and discuss their project results in the light of latest research findings

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Biomechanical methods and application

Content:
This class will cover:
- state of the art scientific research methods in biomechanics
- latest research findings on muscle function and human movement beyond textbook knowledge
- muscle mechanics and muscle function in history dependent scenarios such as force enhancement, force depression and stretch-shortening muscle action
- single to multi-joint muscle function
- cutting-edge research methods for the assessment of human movement

Practical skills in high-end biomechanical methods:
- High-density EMG
- Ultrasound
- Muscle and nerve stimulation.

Intended Learning Outcomes:
After successfully completing the module, students will be able to:
- Understand the principles of analysis of muscle function and human movement, and to combine basic knowledge with latest research findings
- Use high-end biomechanical methods, and to analyze and interpret outcomes
- Understand, present and discuss latest scientific articles on recent findings on muscle function and human movement studies
- Elaborate and derive ideas and hypothesis on muscle function and human movement
- Design and conduct a research project
- Present and discuss complex scientific results.

Teaching and Learning Methods:
There will be 2 hours of lecture including a ‘journal club’ and 2 hours of laboratory work. The laboratory work will be a mixture of experimental projects, data analysis, preparation of reports, open discussions, and presentations. The lecture will predominantly provide specific theoretical information, but will also involve group discussion and debates about the content. A big component of the class is the experimental research project (case study) at the end of the semester.

Media:
PowerPoint

Reading List:
- Enoka, R., Neuromechanics of human movement, Human Kinetics, Champaign, 2015.
- Nigg & Herzog, Biomechanics of the Musculo-skeletal System, Wiley, Chichester, 2007.
- primarily scientific articles (will be announced during the course).

Responsible for Module:
Schwirtz, Ansgar; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
High-end biomechanical methods in muscle function and human movement analysis (Seminar, 2 SWS)
Holzer D, Rasp D, Paternoster F

Muscle function and human movement studies (Vorlesung, 2 SWS)
Holzer D, Rasp D, Paternoster F
For further information in this module, please click campus.tum.de or here.

Module Description

SG860021: Evidence-based Training for Performance, Fitness & Health | Evidence-based Training for Performance, Fitness & Health

Version of module description: Gültig ab summerterm 2020

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 105	**Contact Hours:** 45

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students must recruit a test person and agree measurable performance, fitness and/or health goals. Students must then plan and conduct evidence-based training with the subject for at least 6 weeks and evaluate the success with tests. Based on this data, students then write a project paper in English (3000 words: Introduction, Methods, Results, Discussion, References).

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Bachelor in Sport and Exercise Science or a related subjects

Content:
Exercise training improves performance, fitness and health in most individuals. There are many opinions about what training works best for what purpose but the evidence varies greatly which will be discussed. In addition, we will analyse the training of children and the elderly as well as the prevention of diseases. In seminars and practical classes, the writing of evidence-based training plans as well as practical training will be demonstrated, practised and analysed.

Intended Learning Outcomes:
Students that have passed this module are able to:
- Critically assess the evidence for training and other interventions
- Be able to design training plans that are based on the best available evidence
- Carry out and assess the effectiveness of a training intervention that is aimed to improve performance, fitness or health
- Write a scientific project report.

Teaching and Learning Methods:
Lectures and practical exercises

Media:

Reading List:
McArdle, W.D., Katch, F.I., and Katch, V.L. (2009). Exercise Physiology. Nutrition, Energy, and Human Performance, 7 edn (Lippincott, Williams & Wilkins).

Responsible for Module:
Wackerhage, Henning; Prof. Dr. Sportwiss.

Courses (Type of course, Weekly hours per semester), Instructor:
Evidence-based training for performance, fitness & health (Vorlesung, 1 SWS)
Wackerhage H

Evidence-based training for performance, fitness & health (Übung, 2 SWS)
Wackerhage H, Meinhold M, Schönfelder M
For further information in this module, please click campus.tum.de or here.

Module Description

SG860022: Special Topics in Elite Level Sports | Special Topics in Elite Level Sports

Version of module description: Gültig ab summerterm 2020

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Project work:
Students perform a project work, in which they demonstrate an in-depth understanding of one of the topics discussed in the module. They do so not just by providing a theoretical summary, but also by analyzing qualitative data they gathered from an agent operating in this system. The students have to synthesize their findings in a mini-report (< 3000 words).
The subsequent oral exam is split into two parts: First, the project work (10 min) is presented, which is followed by a brief discussion about this work (5 min). For the second part of the oral exam, students can choose two topics on which they have to demonstrate that they are able to sketch their fundamentals and participate in in-depth discussions about those.
The final grade is an averaged grade from the project work (40 %) and the oral exam (60 %).

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Modules “Current topics of Performance Analysis and Testing” and “Current Social and Political Topics of Sport in Global Societies”

Content:
The module is divided into five thematic blocks, in which special topics of elite level sports will be discussed. Naturally, there are intersections between the topics and vice versa specific phenomena can be highlighted from different perspectives. The five topics are:
Selected integrity threats for elite level sports:
• Doping
• Sports betting
• Exploitation of third world players/ associations

• Excurse: Data-driven approaches to tackle integrity threads
Performance related problems of current elite level sport systems:
• Relative age effect – how sports rob themselves of stars
• Scheduling conflicts
Money rules the world – Media impact on elite level sports:
• Media as driving force behind rule changes
• Excessive sports data as media product (the transparent athlete)
Life of an elite level athlete:
• What's next? Education and career perspectives after sport
• Long-term health issues
• Lifestyle: Limitations and "benefits"
Disfunctions of Talent development systems:
• Human trafficking – how and from where top systems entice junior athletes
• The Relative Age Effect and its effect on individual athletes.

Intended Learning Outcomes:
An overarching goal of the MSc "Sport and Exercise Science" is to enable the students to engage with cutting-edge topics in sport research. To further push towards this goal in the area of elite level sports, this module provides the opportunity to gain particular background knowledge for these specific areas. In detail, upon completion of this module, students are able to:
• understand integrity threats of elite level sports and analyze how sport associations try to deal with those threats
• analyze the impact of media on elite level sports
• describe the conditions and consequences emerging from the decision to become an elite athlete
• evaluate performance related problems of elite level sports
• analyze the shortcomings of current talent development systems.

Teaching and Learning Methods:
The module consists of one weekly seminar and one weekly exercise, which is supplemented by blended learning components. The seminar includes lecture-style presentations as well as interactive parts to activate the students, like in-depth discussions of cutting-edge papers or group works in which the students prepare presentations about specific phenomena. In the exercise the students will perform hands on tasks in relation to the current topics of the seminar and work on their project work in peer-feedback settings. In addition, each project work is supervised by one of the lecturers.

Media:
Presentations, papers

Reading List:
Harvey, A. & McNamee, M. (2020). Sport Integrity: Ethics, Policy and Practice. London, New York: Routledge
Giulianotti, R. (2005). Sport. A Critical Sociology. Cambridge, UK: Politiy Press.

Pa#rssinen, M., Kujala, U., Vartiainen, E., Sarna, S. & Seppa#la#, T. (2000). Increased Premature Mortality of Competitive Powerlifters Suspected to Have Used Anabolic Agents. International Journal of Sports Medicine, 21(3), 225 – 227.
Thieme, L. (2020). Jung stirbt, wen die Go#tter lieben? Zur Mortalita#t deutscher Olympiateilnehmer 1956 bis 2016. German Journal of Exercise and Sports Research, Preprint. https://doi.org/10.1007/s12662-020-00654-x
Schröpf, B. & Lames, M. (2017). Career patterns in German football youth national teams - A longitudinal study. International Journal of Sports Science & Coaching, 13(3), 405-414.
Lames, M. & Kolbinger, O. (2011). German Bundesliga Club's rankings in season 2010/11 are significantly affected by the number of players released to World Cup 2010. International Journal of Performance Analysis in Sport, 11(2), 308-313.

Responsible for Module:
Kolbinger, Otto Klaus; Dr. phil.

Courses (Type of course, Weekly hours per semester), Instructor:
Special Topics in Elite Level Sports (Seminar, 2 SWS)
Kolbinger O, Lames M

Researching Special Topics in Elite Level Sports (Übung, 2 SWS)
Kolbinger O, Lames M
For further information in this module, please click campus.tum.de or here.

Module Description

SG861011: Current Topics in Human Movement Science | Current Topics in Human Movement Science

Version of module description: Gültig ab summerterm 2019

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Project. Students perform a scientific project, including literature research, method selection, data collection and analysis to show their ability to create novel scientific questions, to apply relevant methods and to process scientific data for result-report and -interpretation. In a 20 min presentation, students transform their knowledge to explain and discuss principles of human movement science and how these apply to the results of their research project. To document their progress in each phase of the project (theoretic background, methods, results, discussion), written reports (each betw. 500 and 800 words) will be delivered during the semester and can improve the final mark by 0.3 grades (mid-term).
In the examination students will have to:
- Explain hypotheses with scientific background and experimental design of their projects
- Explain the suitability of the employed methods and their limitations
- Explain and discuss the results of their study in the light of relevant literature.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
Movement science continuously keeps developing knowledge resulting in a variety of concepts and applications to describe and study movement and action of the human body. It employs new technologies to shed lights on many different parameters of motor processes in different settings in the laboratory, in the field and in virtual space. These approaches offer new ways to understand expertise, to monitor its development and to predict performance.

In this module, students will work on literature targeting motor learning and motor performance. They will study various factors of influence and get insight into current approaches to study and predict their effects. They will orient on cutting-edge research paradigms to develop and apply an experimental project involving a question on the following topics:
- Modulation of motor learning through physical activity, sleep, fatigue
- Object characteristics and their effect on planning, motor performance and learning
- Motor performance in virtual and augmented reality
- Anticipation of movement effects
- Motor planning under multitask conditions - limited resources and interference
- Movement disorders (e.g., dystonia in sport, such as yips in golfers)
- Diagnostics of behavioral deficits associated with mild head trauma in sport.

Intended Learning Outcomes:
At the end of this module students will:
- Understand the scientific questions and know the literature in the currently intensively investigated topics of motor cognition and neural mechanisms of motor control and various fields of applications in the context of sport and physical activity
- Be able to create novel scientific questions and apply relevant methods to foster research on the respective topic
- Be generally able to explain principles of human movement science and their application to assess motor performance and underlying cognitive and brain mechanisms in the healthy and in movement disorders
- Be able to discuss scientific paradigms and results and to defend their interpretations
- To transform knowledge and discussion to a written scientific text (according to contemporary style conventions).

Teaching and Learning Methods:
Students will search, study, present and discuss up-to-date literature in the field of the respective topic.
Students will design, plan and carry out one research project on their respective topic. Lecturers will supervise project design and data acquisition sessions and offer support.
Students will analyze their data under the supervision of lecturers.
Students will prepare written and oral presentations of their results and discuss their findings with all other students participating in the module.

Media:
Powerpoint, Demos and Reports from WWW

Reading List:
Schmidt, R. A., Lee, T. D., Winstein, C. J., Wulf, G. & Zelaznik, H. (2018). Motor control and learning: a behavioral emphasis (6th edition). Champaign, IL: Human Kinetics.
Karen Zentgraf & Jörn Munzert (Hrsg.), Kognitives Training im Sport, 2014: Hogrefe.

Responsible for Module:
Hermsdörfer, Joachim; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Current Topics in Human Movement (Übung, 2 SWS)
Hermsdörfer J

Current Topics in Human Movement (Seminar, 2 SWS)
Hermsdörfer J
For further information in this module, please click campus.tum.de or here.

Module Description

SG861016: Sports Analytics | Sports Analytics

Version of module description: Gültig ab summerterm 2019

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Exercises. Students have to develop a Software Prototype (50% of the overall mark) to assess developing skills for sports data software products. To demonstrate their documentation skills, they have to write a project report (3000 words, specification-like style, 50% of overall mark).

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
Students will have met the entry requirements for the MSc in Sport and Exercise Science and will have completed the module Technical Analysis and Sports Informatics.

Content:
The course explores the field of Sport Analytics. The term originates from the US and has become a synonym for the collection, analysis and application of sports data in many countries. There are different goals and interests, which vary according to the different stakeholders. Coaches use the data for match analysis, regulation of training load, and prevention of injuries. Managers apply databases to support their transfer decisions, according to the “moneyball” hypothesis. Media companies differentiate themselves from other market players by enhancing their sports program using innovative statistics. The world’s largest data companies use sports data as a showcase for their data analytics products. Against these background this module taught the following content:
- Advanced Data analytics methods for sports: The first half focusses on computational methods for data analysis. The spectrum of methods ranges from classification algorithms based on simple heuristics rules up to big data methods and artificial intelligence, e.g. by using artificial neuronal networks, generic algorithms and deep learning approaches.
- Mini project to develop a sports data product: The second half is to apply technological skills and theoretical methods to develop a concrete product for mass media, competition information

provider, professional clubs and federations. Typically, this product bases on data provided by an optical or radio based tracking system, a fitness tracker, wearable or a training device.

Intended Learning Outcomes:
After successfully completing the module, students will be able:
- to understand methods from data analytics for modelling and analyzing phenomena in sports
- to specify requirements and to design and to document software systems for analyzing sports data
- to develop sports data products for mass media, competition information provider, top level sports, leisure sports or sport federations

Teaching and Learning Methods:
During the soft computing and big data methods part, students will be asked to bring a notebook, which will enable them to quickly obtain knowledge and to enhance their programming skills. In the seminar the theoretical background is presented. During the practical students will solve tasks which are related to these topics. Results will be discussed.
During the mini project to develop a sports data product part, students will design, plan and carry out a project to develop a product. Staff will supervise the development process and offer support.

Media:

Reading List:
Alamar, B. C. (2013). Sports Analytics. A guide for coaches, managers, and other decision makers. NewYork:Columbia UniversityPress.
Davenport, T.H., & Harris, J.G. (2007). Competing on analytics: the new science of winning. Brighton: HarvardBusinessPress.

Responsible for Module:
Link, Daniel; PD Dr. phil. habil.

Courses (Type of course, Weekly hours per semester), Instructor:
Sports Analytics (Seminar, 4 SWS)
Link D
For further information in this module, please click campus.tum.de or here.

Module Description

SG861025: Neuronal and Cognitive Aspects in Motor Control | Neuronal and Cognitive Aspects in Motor Control

Version of module description: Gültig ab summerterm 2019

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 90	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Project. Students perform a scientific project, including literature research, method selection, data collection and analysis to show their ability to create novel scientific questions, to apply relevant methods and to process scientific data for result-report and -interpretation. In a 20 min presentation, students transform their knowledge to explain and discuss principles of human movement science and how these apply to the results of their research project. To document their progress in each phase of the project (theoretic background, methods, results, discussion), written reports (each betw. 500 and 800 words) will be delivered during the semester and can improve the final mark by 0.3 grades (mid-term).
In the examination students will have to:
- Explain hypotheses with scientific background and experimental design of their projects
- Explain the suitability of the employed methods and their limitations
- Explain and discuss the results of their study in the light of relevant literature.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
None

Content:
The contribution of cognitive processes to voluntary action is currently in the focus of research. Special competence in motor activities, such as in sports, are associated with special brain mechanisms. While this seems obvious, only recently new technologies have enabled the identification, localization and analysis of these brain processes. Vice versa, movement and physical activity were shown to affect brain function.

In this module, students will work on literature targeting the role of attention / working memory, decision making, executive (voluntary) control in motor performance and studies on underlying brain mechanisms. They will orient on cutting-edge research paradigms to develop and apply an experimental project involving a question on the following topics:
- Cognitive training to improve physical performance
- Motor performance and physical activity to improve brain function, cognition and mental health
- Movement / sport expertise and how it shapes cognition
- Motor decision making
- Limited cognitive resources and multitasking
- Interference between competing processes
- Action observation and anticipation
- Action – perception linkage
- Behavioral and cognitive deficits associated with mild head trauma in sport.

Intended Learning Outcomes:
At the end of this module students will:
- Understand the scientific questions and know the literature in the currently intensively investigated topics in motor cognition and neural mechanisms of motor control and various fields of applications in the context of sport and physical activity
- Be able to create novel scientific questions and apply contemporary methods of movement science to conduct research on the respective topic
- Be generally able to explain principles of human movement science and their application to assess motor performance and underlying cognitive and brain mechanisms in the healthy and in movement disorders
- Be able to discuss scientific paradigms and results and to defend their interpretations
- To transform knowledge and discussion to a written scientific text (according to contemporary style conventions).

Teaching and Learning Methods:
Students will search, study, present and discuss up-to-date literature in the field of the respective topic.
Students will design, plan and carry out one research project on their respective topic. Lecturers will supervise project design and data acquisition sessions and offer support.
Students will analyze their data under the supervision of lecturers.
Students will prepare written and oral presentations of their results and discuss their findings with all other students participating in the module.

Media:
PowerPoint, Demos and Reports from WWW

Reading List:
Schmidt, R. A., Lee, T. D., Winstein, C. J., Wulf, G. & Zelaznik, H. (2018). Motor control and learning : a behavioral emphasis (6th edition). Champaign, IL: Human Kinetics.
Karen Zentgraf & Jörn Munzert (Hrsg.), Kognitives Training im Sport, 2014: Hogrefe.

Responsible for Module:
Hermsdörfer, Joachim; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Neuronal and Cognitive Aspects (Seminar, 2 SWS)
Stadler W

Neuronal and Cognitive Aspects (Übung, 2 SWS)
Stadler W
For further information in this module, please click campus.tum.de or here.

Electives: C | Wahlmodule C

Module Description

BGU62062: TUM.city | TUM.stadt

Version of module description: Gültig ab summerterm 2021

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The module's examination consists of an exam (90 minutes) and a voluntary mid-term performance in the form of a scientific work. With the written exam, students demonstrate that they are able to reflect the theoretical knowledge on City & Water, understand the interdisciplinary interactions and are able to evaluate them in practice.

The scientific work consists of a written paper (approx. 12 pages) and a final presentation. The students work on a chosen topic in the area of City and Water in greater depth. Here, the students show that the interdisciplinary aspects of a healthy city have been understood and how these can be analysed, interpreted and applied. With the oral presentation of the scientific paper the contents and results are presented.

The grade of the scientific paper can be credited with 33% of the overall grade if the exam is passed to improve the grade.

Repeat Examination:

(Recommended) Prerequisites:
Participation in the lecture TUM.stadt.

Content:
The course is based on the contents of the lecture.
What ecological, economic and social challenges do cities face with regard to climate change and redensification?
How can interdisciplinary approaches to solutions be developed?

What are the interfaces/encounters from the different disciplines on the topic of "City & Water"?

These and other questions are aimed at the core areas of a liveable city and this requires the interdisciplinary collaboration of
planners, engineers, natural scientists, social scientists, economists and life scientists.

The following contents will be dealt with in the lecture and seminar:
- Identification of the networking of engineers, architects, natural scientists, social scientists, economists and life scientists.
- Exploration of new, interdisciplinary basic knowledge
- Exploration of interfaces/synergies and contradictions on the topic of the city through different disciplines.
- Identification, analysis and, if necessary, further development of relevant urban systems
- Impulses for the transformation of our living environments
- Development of new research questions
- Development of new interdisciplinary approaches to solutions
- Practice of working together across disciplines

The contents and topics are taught in the form of lectures, which are deepened in the seminar through interdisciplinary collabaration practice and guidance of the experts.
Graphics, pictures, short films or other suitable forms are used to illustrate the topics. In addition, interesting articles and literature recommendations
are made available for download via Moodle.

Intended Learning Outcomes:
After successful participation in the course, students are able to evaluate the subject-related and interdisciplinary interactions (synergies, potentials, contradictions) with regard to city and e.g. well-being, water or mobility.

Teaching and Learning Methods:
The seminar builds on the lecture TUM.stadt. Experts from interdisciplinary fields are involved in the lecture series.
The teaching content of the lecture is conveyed through tandem lectures. These lectures are intended to sensitise students
to the topic of "City & Water", encourage them to discuss the content and give them insights into the subject area from different
specialist perspectives. The subsequent seminar is supervised by the assistants from the previous lecture and the initiators of TUM.stadt.
The students will be sensitised to the topic of "encounter city" through group work, on-site visits, etc., in order to actively and
consciously experience connections such as trees for shading, density, heat, stress,... or water as a design tool, food, medium for
leisure and health or natural hazard. Based on the knowledge gained, the students have to develop solutions in theory.

Media:
PowerPoint presentation, live feedback, blackboard work, video

Reading List:
Wang, Xiaochang C.; Fu, Guangtao (2021): Water-Wise Cities and Sustainable Water Systems: Concepts, Technologies, and Applications: IWA Publishing.
Grant, Gary (2016): The Water Sensitive City. Chichester, UK: John Wiley & Sons, Ltd.
Haass, Heiner (2010): StadtWasser. Wasserkonzepte in der Stadtplanung. Stuttgart: Fraunhofer-IRB-Verl. (StadtGestaltung).
Russell, James S.: The Agile City. Building Well-being and Wealth in an Era of Climate Change. Washington DC, 2011.
Bott, H., Grassl, G.C., & Anders, S. (2014). Nachhaltige Stadtplanung: Konzepte für nachhaltige Quartiere. [München]: Detail.
Ekardt, F. (2016). Theorie der Nachhaltigkeit: Ethische, rechtliche, politische und transformative Zugänge - am Beispiel von Klimawandel, Ressourcenknappheit und Welthandel (2., vollständig überarbeitete und aktualisierte Auflage). Baden-Baden: Nomos.
Friedman, T. L. (2009). Hot, flat, and crowded: Why we need a green revolution--and how it can renew America (Release 2.0, updated and expanded ; 1st Picador ed.). New York: Picador/Farrar, Straus and Giroux.
Meadows, D. H., Meadows, D. L., & Randers, J. (1992). [Hauptband] (6. Aufl.). Die neuen Grenzen des Wachstums: die Lage der Menschheit: Bedrohung und Zukunftschancen / Donella H. Meadows: A. Stuttgart: Dt. Verl.-Anst.

Responsible for Module:
Markus Disse markus.disse@tum.de

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.

Module Description

BGU62063: TUM.city - Lecture Series | TUM.stadt - Vorlesungsreihe

Version of module description: Gültig ab summerterm 2021

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 60	**Contact Hours:** 30

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
By means of comprehension questions in a written exam (90 minutes), it is tested to what extent the students have acquired the theoretical
basic knowledge of "City & Water", understand the interdisciplinary interactions and evaluate these in action.
Answering the questions requires the students to formulate their own answers. The content taught in the lecture course is tested under
time pressure and without aids.

Repeat Examination:

(Recommended) Prerequisites:
none

Content:
What ecological, economic and social challenges do cities face with regard to climate change and redensification?
How can interdisciplinary approaches to solutions be developed?
What are the interfaces/encounters from the different disciplines on the topic of "City & Water"?

These and other questions are aimed at the core areas of a liveable city and this requires the interdisciplinary networking of planners, engineers, natural scientists, social scientists, economists and life scientists.

The following contents will be dealt with in the course:
- Identification of the networking of engineers, architects, natural scientists, social scientists, economists and life scientists.

- Exploration of new, interdisciplinary basic knowledge
- Exploration of interfaces/synergies and contradictions on the topic of the city through different disciplines. Disciplines
- Identification, analysis and, if necessary, further development of relevant urban systems
- Impulses for the transformation of our living environments
- Development of new research questions
- Development of new, theoretical approaches to solutions

In the course of the lecture, representatives from various disciplines will present and discuss the following topics on the main theme
of "City & Water":
- Urban River Restoration
- Urban Green Infrastructure
- Climate Change
- Flood Resilience
- Sponge-City
- Real Estate
- Urban Agriculture
- Urban Water Management
- Water Rights– Water Governance
- Water Quality in Megacities
- Blue-Green Cities in Germany

Within the specific topics, the following general topics are also addressed:
- City
- Landscape
- Sociology
- Regional Planning
- Health
- Water/Wastewater
- Pollutants
- Energy
- Economics
- Law
- Climate Change
- Natural Hazards
- Ecology

The contents and topics are taught in the form of lectures. Graphics, pictures and short films are used to illustrate the topics.
In addition, interesting articles and literature recommendations are made available for download via Moodle.

Intended Learning Outcomes:
After successful participation in the module, the students are able to evaluate the subject-related and interdisciplinary
interactions (synergies, potentials, contradictions) with regard to focal topic "City & Water".

Teaching and Learning Methods:
The module consists of a lecture series.
Experts from interdisciplinary subject areas are involved in the lecture series. The teaching content of the lecture is conveyed
through tandem lectures. These lectures are intended to sensitise students to the main topic "City & Water", to encourage them to discuss the content
and to give them insights into the subject area from different specialist perspectives.

Media:
PowerPoint presentation, live feedback, blackboard work, video or appropriate on-line media.

Reading List:
Wang, Xiaochang C.; Fu, Guangtao (2021): Water-Wise Cities and Sustainable Water Systems: Concepts, Technologies, and Applications: IWA Publishing.
Grant, Gary (2016): The Water Sensitive City. Chichester, UK: John Wiley & Sons, Ltd.
Haass, Heiner (2010): StadtWasser. Wasserkonzepte in der Stadtplanung. Stuttgart: Fraunhofer-IRB-Verl. (StadtGestaltung).
Russell, James S.: The Agile City. Building Well-being and Wealth in an Era of Climate Change. Washington DC, 2011.
Bott, H., Grassl, G.C., & Anders, S. (2014). Nachhaltige Stadtplanung: Konzepte für nachhaltige Quartiere. [München]: Detail.
Ekardt, F. (2016). Theorie der Nachhaltigkeit: Ethische, rechtliche, politische und transformative Zugänge - am Beispiel von Klimawandel, Ressourcenknappheit und Welthandel (2., vollständig überarbeitete und aktualisierte Auflage). Baden-Baden: Nomos.
Friedman, T. L. (2009). Hot, flat, and crowded: Why we need a green revolution--and how it can renew America (Release 2.0, updated and expanded ; 1st Picador ed.). New York: Picador/Farrar, Straus and Giroux.
Meadows, D. H., Meadows, D. L., & Randers, J. (1992). [Hauptband] (6. Aufl.). Die neuen Grenzen des Wachstums: die Lage der Menschheit: Bedrohung und Zukunftschancen / Donella H. Meadows: A. Stuttgart: Dt. Verl.-Anst.

Responsible for Module:
Markus Disse markus.disse@tum.de

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.

Module Description

MGT001309: Design your life & career 2: Worauf es in Beruf, Karriere und Leben wirklich ankommt! | Design your life & career 2: Worauf es in Beruf, Karriere und Leben wirklich ankommt!

Version of module description: Gültig ab summerterm 2021

Module Level: Master	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 135	**Contact Hours:** 45

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Die Prüfungsleistung setzt sich zusammen aus
• einer Zwischenpräsentation (10% der Endnote)
• einer Abschlusspräsentation (40% der Endnote)
• 3) einer ausführlichen Beschreibung der Umsetzung der eigenen Creation (50% der Endnote)

In der Prüfungsleistung zeigen die Studierenden, dass sie:
• ein ihnen zugewiesenes Thema in der Tiefe verstanden haben und die wichtigsten Aspekte für ihre Kommilitonen verständlich aufgezeigt haben.
• praktische Anwendungsfelder für dieses Thema identifiziert und aufbereitet haben
• über Präsentations- und Kommunikationsfähigkeiten verfügen, die es ihnen ermöglichen, ihre Ergebnisse zu diesem Thema klar und strukturiert darzustellen und die Anwendbarkeit ihrer Ergebnisse auf die Geschäftspraxis zu diskutieren.
• eine eigene Geschäftsidee planen und für die Umsetzung vorbereiten bzw. direkt umsetzen können

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
Dieser Kurs existiert, um alle die Inhalte, die sonst zu kurz kommen – sei es in Schule, Hochschule, Ausbildung und öffentlichem Austausch – aufzuarbeiten und zu vermitteln, damit schon Studierende dieses Wissens erlangen und von ihm profitieren können.

Worauf kommt es wirklich an in Leben, Beruf und Karriere?
Viele der ungeschriebenen Gesetze und Zusammenhänge für sämtliche Berufsrichtungen werden von vielen Menschen erst spät im Leben entdeckt und oft nur informell untereinander weitergegeben.
Ziel dieses Seminars ist diese „weißen Flecken“ und „Lücken“ durch Vermittlung von praktisch-nutzbaren Inhalten, deren Kenntnis und Verständnis einen echten Mehrwert für Beruf, Karriere und andere Lebensbereiche darstellen, zu schließen. Hierbei wollen wir uns in diesem Seminar vor allem auf die Arbeitsgestaltung und Einkommensgenerierung der Zukunft fokussieren. Konkret bearbeiten wir in diesem Seminar die folgenden Themenschwerpunkte:
• Entrepreneurship (Die eigene Gründung vorantreiben; z.B. „Welche Arten der Gründungen gibt es?“; „Wie führe ich meine ersten Mitarbeiter?“; „Wie kompensiere ich Mitarbeiter, Berater, Advisory Board, etc.?“; „Wie kann ich ein Online-Unternehmen aufbauen?“)
• Creation: (Mehrwert für andere schaffen, z.B. „Was kann ich persönlich schaffen?“; „Wie kann ich mein Intellectual Property schützen?“; „Wie kann ich meine Kreation vermarkten?“; „Wie werde ich für meine Kreation kompensiert?“)
• Investment (langfristig Wohlstand generieren über investiertes Kapital, z.B. „Was muss ich bei Investionen beachten?“; „Worin kann ich investieren?“; „Wie kann ich die Leistung von Unternehmen bewerten?“; „Welche alternativen Investitionsmöglichkeiten existieren (z.B. Kryptowährungen)?“)

Intended Learning Outcomes:
Studierende, die dieses Seminar besucht haben, verfügen über
• ein umfassendes Verständnis über wesentliche Einflussfaktoren und Gestaltungsmöglichkeiten in Beruf, Karriere und Leben
• Kenntnis der wichtigsten Möglichkeiten um langristig aus eigener Kraft Wohlstand zu generieren.
• Herausforderungen und Lösungen in Bezug auf persönliche Verwirklichung und Wohlstandsaufbau sowie über vielversprechende Ansätze und Methoden, um diesen Herausforderungen entgegenzuwirken

Teaching and Learning Methods:
Im Rahmen des Seminars erhalten die Teilnehmer in verschiedenen Themenblöcken jeweils Input zu den behandelten Themen sowie Arbeitsmaterialien zum Eigenstudium und zur Aufarbeitung. Anschließend werden die Inhalte im Seminar im Rahmen von Übungen, Rollenspielen, Reflexionen, Präsentationen und Diskussionen vertieft.
Als Prüfungsleistung werden die Teilnehmer selbst ein Thema aus einem der drei Bereiche vertieft und detailliert erarbeiten und dies didaktisch so aufbereiten, dass alle anderen KursteilnehmerInnen davon ebenfalls profitieren können: Im Rahmen des Seminars erhalten sie die Möglichkeit, dieses Thema zu präsentieren und zu diskutieren sowie Feedback zu den erarbeiteten Inhalten im Anschluss an die Präsentation sowie im Rahmen eines peer-review

Verfahrens zu erhalten. Darauf aufbauend werden die Teilnehmer ihr Thema im Verlauf des Semesters weiter ausarbeiten, konkretisieren und anschaulich aufbereiten.

Media:
Handlungsorientiertes Lernen, interaktive Lehre, Flipped Classroom, Gruppendiskussionen, Präsentationen, Praktische Übungen, Reflexion, Literatur, Skript.

Reading List:
• Dalio, R. (2017). Principles: Life and work. Simon and Schuster.
• Housel, M. (2020). The Psychology of Money: Timeless lessons on wealth, greed, and happiness. Harriman House Limited.
• Carnegie, D. (2014). Wie man Freunde gewinnt: Die Kunst, beliebt und einflussreich zu werden. S. Fischer Verlag.

Responsible for Module:
Welpe, Isabell M.; Prof. Dr. rer. pol.

Courses (Type of course, Weekly hours per semester), Instructor:
Design your life & career 2: Worauf es in Beruf, Karriere und Leben wirklich ankommt! (MGT001309S) (Seminar, 4 SWS)
Born N, Mehrwald P, Ritter A, Treffers T, Uhlemann K, Welpe I
For further information in this module, please click campus.tum.de or here.

Module Description

POL67001: Digital Sustainability Transformation of, by and for the TUM | Digital Sustainability Transformation of, by and for the TUM

Version of module description: Gültig ab summerterm 2021

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 60	**Contact Hours:** 30

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students have to actively contribute to the lecture by participating in the discussions and writing two policy briefs of ~5 pages each. Each policy brief has to focus on a different thematic area of the lecture (see below). Each policy brief counts 50% to the final grade.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
This course is aimed at all students enrolled in a Master program at the TUM; it is thus designed as an interdisciplinary venue which brings together a range of scientific perspectives. No specific prior knowledge is required. We are highly encouraging students from other schools and departements at TUM to participate in the lecture series in order to ensure a diverse, interdisciplinary approach.

Content:
Sustainability and digitization are two of the key challenges of our time. Both transformations must be actively shaped, whereby it is crucial to think "sustainability" and "digitization" not only as two separate megatrends but examine their intersections and interplays. Universities like the TUM have a central role to play in shaping the digital and sustainable transformation: they are learning venues for sustainable/digital development with the goal to educate people; they serve as fora for public discussions and as hubs to connect important stakeholders; they are important incubators for innovations; and they (should) also function as role models for the society.

This course consists of a virtual lecture series that examines the question of digitainable transformations across four issue areas: 1) common good AI in smart cities, 2) intelligent sustainable mobility, 3) circular economy & smart waste management, and 4) green finance.
We will devote three session to each thematic area, and explore it from various angles including

participatory workshops, roundtables with experts from academia, stakeholders and/or political actors. Each session will be organized in cooperation with stakeholders from Munich and beyond in order to discuss the mutual opportunities and challenges of sustainability and digitization at various levels. While the focus will be on projects in Munich and Bavaria, topics will also be addressed at a national, supranational and global level.

Intended Learning Outcomes:
After successful participation in this course, students are able:
- to understand and to critically discuss key aspects linked to sustainable and digital transformations;
- to analyze how they can actively shape big transformations in their immidiate vicinity.

Teaching and Learning Methods:
The lecture combines (pre-recorded) videos and online presentations, with podcasts and interviews. To facilitate active participation with the content of the lectures, Q&A sessions, online discussions will be combined with offline workshops. Depending on the development of the Corona-pandemic, it is planned to hold 1/3 of the classes in person as participatory workshops, and 2/3 of the classes as online discussions.

Media:
The course is planned as a hybrid event combining online tools and in-person sessions (depending on the development of the Covid-19 pandemic). Depending on the development of the Corona-pandemic, it is planned to hold 1/3 of the classes in person as participatory workshops, and 2/3 of the classes as online discussions.

Reading List:
Sterling, St. et al. 2013. The Sustainable University. London: Routledge.
Filho, W. L. & P. Pace 2016. Teaching Education for Sustainable Development at University Level. Cham: Springer International.
Filho, W. L. et al. (eds.). 2019. Universities as Living Labs for Sustainable Development. Cham: Springer International.
Heinrichs, H. et al. (eds.). 2016. Sustainability Science. An Introduction. Cham: Springer International.

Responsible for Module:
Wurster, Stefan; Prof. Dr. rer. pol.

Courses (Type of course, Weekly hours per semester), Instructor:
(POL67000, POL67001) Digital Sustainability Transformation of, by and for the TUM (Ringvorlesung) (Seminar, 2 SWS)
Wurster S (Mohammed N), Siewert M
For further information in this module, please click campus.tum.de or here.

Module Description

SG120052: Orthopedic Knee- and Hipschool | Orthopädische Knie- und Hüftschule

Version of module description: Gültig ab winterterm 2017/18

Module Level: Bachelor	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 2	**Total Hours:** 60	**Self-study Hours:** 35	**Contact Hours:** 25

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Competence in organizing and conducting rehabilitation sports groups for knee and hip patients should be demonstrated in the form of a written paper as course work. Registration for the exam must be done via TUMonline, otherwise participation is not possible.

Repeat Examination:

(Recommended) Prerequisites:
Modules "Körperstrukturen und -funktionen", "Sportmedizin", "Training und Bewegung I", "Training und Bewegung II" - or after consultation

Content:
- Anatomy and function of knee and hip joint
- Osteoarthritis - clinical and functional changes
- Physiotherapy / physical therapy for osteoarthritis and endoprosthesis of the lower extremity
- conservative and surgical osteoarthritis therapy
- Foundations for the organization and implementation of rehabilitation sports
- Methodology and components of a rehabilitation sports program for groups
- Concept for implementation of rehabilitation programs in different settings
- Implementation and demonstration of specific training content and forms of exercise
- Use of various patient-friendly devices and materials

Intended Learning Outcomes:
After successful completion of the module the students are able to
- To classify basics of aetiology, symptoms and treatment methods of lower limb arthrosis and to apply specific rehabilitation measures for osteoarthritis and endoprostheses

- To identify content on the organization and reimbursement of rehabilitation groups and understand the prerequisites
- To structure and practically apply theoretical and practical methods as well as specific training contents for patients with osteoarthritis and / or endoprosthesis in the knee and / or hip joint
- To develop ideas and concepts for the planning and organization of a rehabilitation sports lesson and to perform lessons for knee and hip patients.

Teaching and Learning Methods:
The module consists of a block seminar with exercises as well as a lesson. The contents will be presented in the lecture as well as worked out interactively with the students. The topics are taught through German text reading as well as on the basis of specific topics and practical tasks, case studies. Under practical guidance practical content will be developed and implemented in own or group work. During the internship the students should acquire practical experience and apply already developed contents under guidance.

Media:
presentations

Reading List:
Haupt und Horstmann: Hüftschule: Das Erfolgsprogramm für Jung und Alt. Die besten Übungen für ihr Hüftgelenk, Hofmann, Schorndorf; 3. Auflage, 2009;

Merk und Horstmann: Knie Aktiv, S. Hirzel Verlag; 4. Auflage, 2008;

Haupt, Janßen, Krauß, Steinhilber: Das Tübinger Hüftkonzept – Von der Wissenschaft in die Praxis, Verlag hellblau, 2014

Responsible for Module:
Horstmann, Thomas; Prof. Dr.med.

Courses (Type of course, Weekly hours per semester), Instructor:
Orthopädische Knie- und Hüftschule (Seminar, 2 SWS)
Horstmann T, Pohl T, Putz E
For further information in this module, please click campus.tum.de or here.

Module Description

SG810024v2: Mountain Sports: Practice, Physiology & Technology | Mountain Sports: Practice, Physiology & Technology

Version of module description: Gültig ab summerterm 2020

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Students are examined through a 5000 word written assessment that has two parts. Part 1 is a 2000 word scientific essay on an essay question related to the lectures. Part 2 is a 3000 word scientific report (introduction, methods, results, discussion, references) that reports data generated during a field experiment carried out during the mountain expedition.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
No contraindication for strenuous exercise. Students should have at least a basic understanding of human biology.

Content:
The module covers the practice, physiology molecular biology and health aspects of different mountain sports including mountain walking/running, bouldering, rock climbing, winter/ice climbing, ski mountaineering, Alpine mountaineering and expeditions.
This module has different components.
Mountain sport practice: Students will have practical experience in the following mountain sports:
- Bouldering, climbing
- Mountain walking, mountaineering at a moderate altitude

Classical, molecular physiology and health aspects of mountain sports and life at altitude. In relation to this area students will have knowledge and will be able to apply knowledge in relation to the following topics:
- Performance-limiting factors for the different mountain sport disciplines
- Mountain sport training methods
- Environmental physiology: cold & altitude

- Health issues such as delayed onset of muscle soreness and altitude sickness
- Genetics of strength, endurance, and altitude performance
- Signal transduction mechanisms that mediate adaptation to endurance, strength & altitude (HIF1-EPO-haematopoeitic system signalling)
- Health issues at altitude: acute and chronic altitude sickness, pulmonary and cerebral oedema, weight loss.

Intended Learning Outcomes:
Students that successfully pass this module will be able to:
1) demonstrate basic climbing and mountaineering skills
2) explain the performance-limiting factors for several mountain sports
3) use appropriate performance testing methods and apply training methods and nutrition to improve performance in different mountain sports
4) calculate the energy requirements during expeditions, explain adaptation to altitude and problems such as altitude sickness
5) explain the effect of genetics and signal transduction on performance-limiting factors and discuss molecular mechanisms of high altitude adaptation
6) Plan, design, carry out and report a relevant scientific experiment during the mountaineering expedition.

Teaching and Learning Methods:
The teaching methods will be:
- Lecture (1 SWS): One weekly 1 h lecture will introduce the theoretical topics covered in this module
- Seminar (1 SWS): This is a 2 h seminar/practical slot every other week with an active learning approach where students learn to gather, interpret and use scientific information.
Learning methods will involve internet searches/tools, mathematical problem solving, conference presentations, debates and the interpretation of scientific publications
- Practical sports (2 SWS): Practical mountain sports sessions. During these sessions, students will be practically introduced to climbing and learn bouldering and climbing and abseiling.
Additionally, students will take part in a high altitude expedition typically during the Wildpitze. During this expediction, students will plan, design, carry out and report an altitude physiology scientific experiment.

Media:
PowerPoint

Reading List:
Wackerhage H. Molecular Exercise Physiology. Routledge 2014.
McArdle WD, Katch FI & Katch VL. Exercise physiology. Nutrition, energy and human performance. 8th edition. Wolters Kluwer 2014.

Responsible for Module:
Wackerhage, Henning; Prof. Dr. Sportwiss.

Courses (Type of course, Weekly hours per semester), Instructor:
Mountain Sports (Seminar) (Seminar, 1 SWS)
Schönfelder M, Wackerhage H

Mountain Sports: Praxis, Physiologie & Technik Übung (Übung, 2 SWS)
Thomann A, Wackerhage H, Weikert-Schmidt G

Mountain Sports (Vorlesung, 1 SWS)
Wackerhage H
For further information in this module, please click campus.tum.de or here.

Module Description

SG810040: Inclusive Physical Education – Summer School | Inclusive Physical Education – Summer School

Version of module description: Gültig ab winterterm 2019/20

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 30	**Contact Hours:** 120

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Project work. The examination performance comprises of three parts. First, a group project with several phases: identification of the problem, development of solutions, decision-making and elaboration of an idea with the aim of a group pitching session in front of an expert committee. The second part will then be a systematic, structured oral presentation, visually supported by suitable media (such as beamers, slides, posters, videos). The results and insights gained will be presented in a way that is limited to their summarized, complex subject matter. The lecturers, following the presentation, will evaluate several acquired or trained competences in an oral interview. These competences include the openness to new target groups, didactic and methodological inventory such as easy language and virtually simplified forms of presentation, and the use of barrier-free online resources. Presentation and discussion are equally weighted. Finally, an individual written assignment (5-6 pages) is the third examination component.
The weighting of the oral examination is as follows (1 pitch): (2 presentation and debate) : (3 written paper) - 40% : 30% : 30%.
Preparation time = 5 x 45 minutes, Pitch = 15 minutes

Repeat Examination:
End of Semester

(Recommended) Prerequisites:
The Summer School is held with international participation. Therefore, the participants must have very good English skills. Interest in designing innovative teaching/learning content and ideas in the fields of physical education, health, exercise and inclusion should be present.

Content:
InPhysEd – making physical education inclusive and open to all is a two-week international summer school. TUM students come together with students from other countries and develop

ideas. The topic/challenge: Making physical education lessons inclusive - in school and leisure time as well as developing conceptual training and support ideas that prepare and support for inclusive teaching. Inclusive teaching and learning is an essential component: Experts on their own behalf - people with special needs, especially people with an intellectual disability are also participants of the Summer School. Together, the challenges are questioned, problem solutions are developed, concrete ideas are worked out, tried out in practice and presented.
Lecturers from cooperating national and international universities as well as experts from health care, sports and education share their expertise and support the participants in the development process.

Intended Learning Outcomes:
Targeted student learning outcomes includes:
- detailed understanding of the challenges to inclusion - historical, social, cultural, how these impact on health and education experience of people with special needs, especially people with an intellectual disability
- participation in idea generation and applied skills to critically appraise and select best idea for development to inform the design of targeted approach to inclusive physical education
- foundational understanding in entrepreneurial thinking and approaches to idea generation and problem solving
- an understanding of core concepts of universal design for learning, practiced co-learning and co-teaching
- critical reflect on the work undertaken of other groups and projects
- improved communication skills through discussion and presentations
- ability to present / pitch ideas in front of a jury.

Teaching and Learning Methods:
Combination of input lectures, workshops, case studies, role play, group work, pair peer review and independent study and reflective practice will be utilized. The co-learning environment, incorporates inclusive teaching strategies addressing needs of all participants from diverse backgrounds, learning styles, languages and abilities. People with special needs, intellectual disability will co-teach and also participate in the problem solving exercises as co-learners.

Media:
Presentations, script, work sheets, case studies, articles

Reading List:
Kiuppis, F. (2018) (Ed.) Sport and Disability: From Integration Continuum to Inclusion Spectrum. London: Routledge
Kiuppis, F. (2018) Inclusion in sport: disability and participation. Sport in Society – Cultures, Commerce, Media, Politics 21(1), 4-21
McConkey, R. Pochstein, F. Carlin, L & Menke, S. (2019): Promoting the social inclusion of players with intellectual disabilities: an assessment tool for sport coaches, Sport in Society https://doi.org/10.1080/17430437.2019.1673369

Responsible for Module:
Schwarz, Daniela Maria; Ph.D.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.

Module Description

SG810042: Seminar in Health Care Management | Seminar Health Care Management

Version of module description: Gültig ab summerterm 2020

Module Level: Master	**Language:** German	**Duration:** one semester	**Frequency:** winter semester
Credits:* 5	**Total Hours:** 150	**Self-study Hours:** 105	**Contact Hours:** 45

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Oral presentation (20 minutes) and written assignment (22.200 signs):
Students give a presentation and write a research essay on a topic in the area of health care management. They demonstrate that they are able to synthesise, reflect and critically assess research findings in the area of health care management. The oral presentation gives the students the opportunity to present their results and to critically discuss their research essay in a group.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
- Basic knowledge in statistics
- Participation in the lecture to health economics or health care management
- Basic knowledge in scientific literature search methods
- Basic knowledge of health care systems

Content:
The seminar addresses students who have already attended courses in health care management and want to deepen their knowledge in this subject. The seminar topics focus on current topics in the research field such as the implications of innovations in the health care market or the management in specific health care sectors, e.g. the hospital market. Students will work on questions, as for example, how new drugs enter the market or how new technologies can be integrated into health care. Other possible topics address how hospitals or medical practices can act in competition with each other within the legal regulations. Beside a comprehensive introduction to important theories, principles, and methods of health care management, the participants will get to know individual topics in depth and will be able to apply and implement their knowledge in scientific seminar papers.

Intended Learning Outcomes:
By the end of the module, students will:
- have developed transferrable skills of independent research for a research paper;
- have developed written and verbal communication and small group work and visual/verbal presentation;
- be able to critically assess and synthezise research findings in health care management.

Teaching and Learning Methods:
- lecture with interactive elements
- workshop reflecting provision results
- presentation of the written essay in a short talk
- present a written essay to professional standards, including appropriate graphical and text presentation skills

Media:
- PowerPoint
- supplementary literature
- electronic textbook collection of the library

Reading List:
- Breyer, Zweifel, Kifmann (2013): Gesundheitsökonomik. Springer: 6. Auflage
- Schulenburg, Greiner (2013): Gesundheitsökonomik. Siebeck: 3. Auflage.
- Busse, Schreyögg, Gericke (2010): Management im Gesundheitswesen. Springer: 2. Auflage
- Busse, Blümel & Ognyanova (2013): Das deutsche Gesundheitssystem – Akteure, Daten und Analysen. MWV

Responsible for Module:
Sundmacher, Leonie; Prof. Dr. rer. oec.

Courses (Type of course, Weekly hours per semester), Instructor:
Seminar Health Care Management (Seminar, 3 SWS)
Flothow A, Franke S, Iashchenko I, Sundmacher L
For further information in this module, please click campus.tum.de or here.

Module Description

SG810043: Public Health and Socio-economic Aspects in the Prevention of Non-communicable Diseases (NCDs) | Public Health and Socio-economic Aspects in the Prevention of Non-communicable Diseases (NCDs)

Version of module description: Gültig ab winterterm 2020/21

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 4	**Total Hours:** 120	**Self-study Hours:** 90	**Contact Hours:** 30

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Research Paper consisting of a
a) Scientific essay/seminar paper of around 2000-3000 words
b) Presentation, 30 minutes:
The module examination consists of a scientific essay/seminar paper (60% of the grade) and a scientific presentation (40% of the grade). Students will prove that they can describe, analyze and evaluate socioeconomic concepts in the prevention of non-communicable diseases.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Basic knowledge in the field of prevention and health promotion

Content:
• Socioeconomic determinants of NCDs
• Consequences of NCDs and related life style factors
• Concepts of individual-level prevention
• Concepts of population-level prevention
• Effectiveness of prevention measures
• Cost-Effectiveness of prevention measures
• Population-impact of prevention measures
• Equity aspects of prevention measures

Intended Learning Outcomes:
After participation in the seminar students will be able to:
• Describe socioeconomic determinants and consequences of non-communicable diseases
• Analyze individual-level and population-level prevention concepts for NCDs
• Evaluate prevention measures concerning their effectiveness, cost-effectiveness, population impact and equity impact.

Teaching and Learning Methods:
• 30% introduction to the thematic field by the lecturer
• 30% one to one meetings between the lecturer
• 40% presentations and discussions in the plenum

Media:
PowerPoint-Präsentation, Flipchart

Reading List:
Oxford Textbook of Public Health, edited by Roger Detels et al. 2011
Promoting Health, Preventing Disease: The economic case. edited by David McDaid et al. 2015
The Heavy Burden of Obesity. The economics of prevention. OECD Health Policy Studies 2019
Further literature will be announced in the course.

Responsible for Module:
Laxy, Michael; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Public Health und Sozioökonomische Aspekte in der Prävention von Nichtübertragbaren Krankheiten (Seminar, 3 SWS)
Laxy M
For further information in this module, please click campus.tum.de or here.

Module Description

SG810049: Interdisciplinary research seminar: Current topics in chronobiology and circadian health | Interdisciplinary research seminar: Current topics in chronobiology and circadian health

Version of module description: Gültig ab winterterm 2021/22

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 60	**Contact Hours:** 30

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Presentation, research paper (essay):
- Final synthesis (research paper) of the interdisciplinary research topics presented in the seminars (85%) in an 8,000-word essay
- Literature search and 20-minute presentation (15%) of a topic presented by one of the external guest lecturers

Repeat Examination:
Next semester / End of Semester

(Recommended) Prerequisites:
Basic knowledge of psychology, sensory processing, sleep and/or circadian rhythms

Content:
This course will follow the online weekly research lecture series “Integrative Seminar in Chronobiology & Visual Neuroscience” organised by the Professorship "Chronobiology & Health" at TUM and the Max Planck Research Group "Translation Sensory & Circadian Neuroscience" at the Max Planck Institute for Biological Cybernetics. The lecture series’ focus on understanding the interplay between light exposure, the eye and the retina, the circadian system, and how it all comes to together, through the lens of a group of internationally renowned researchers presenting their current research. The lectures will be accompanied by a seminar to offer and develop a deeper view into the topics discussed by the researchers.

Intended Learning Outcomes:
At the end of the module students are able to:
- understand diverse state-of-the-art methods from psychology, vision science, and chronobiology

- apply diverse state-of-the-art knowledge from psychology, vision science, and chronobiology
- evaluate scientific presentations and presentation styles
- create syntheses of interdisciplinary research areas.

Teaching and Learning Methods:
Lectures, student-led presentations

Media:
Zoom
Webcam and microphone
PowerPoint presentation via Zoom

Reading List:
Blume, C., Garbazza, C., & Spitschan, M. (2019). Effects of light on human circadian rhythms, sleep and mood. Somnologie (Berl), 23(3), 147-156. doi:10.1007/s11818-019-00215-x

Responsible for Module:
Spitschan, Manuel; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:
Interdisciplinary research seminar: Current topics in chronobiology and circadian health (Vorlesung, 2 SWS)
Spitschan M
For further information in this module, please click campus.tum.de or here.

Module Description

SOT86700: EuroTeQ Collider - Leave no Waste Behind (Master) | EuroTeQ Collider - Leave no Waste Behind (Master)

Version of module description: Gültig ab winterterm 2021/22

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
During this module, students must complete following tasks: producing a presentation that provides information on the project concept development and implementation, as well as a final report, charting the progress of their work/research over time. These assessments will evaluate a) the success of the project and b) the learning success of the students in oral and written form.

Students will be graded based on the active participation in a group project (20%), a final presentation of project results (60%) and a final project report (20%). These examination requirements will assess the success of the project, but also examine the learning success of the students in oral and written form.

Repeat Examination:
Next semester

(Recommended) Prerequisites:
This module is aimed at all students enrolled in a Bachelor or Master program at the TUM; it is thus designed as an interdisciplinary venue which brings together a range of scientific perspectives. No specific prior knowledge is required; however, its project-based character requires high levels of intrinsic motivation and the willingness to actively participate in a project.

Content:
The way we live today produces a lot of waste. Aware of this fact, many initiatives try to stop this trend and reduce the amount of waste left by mankind. But there is still a lot to do! Waste is everywhere, not only in the use of packaging, in the over-use of natural resources, in the unuse of surplus or in the non-management of certain types of waste (chemical, nuclear). It also results from non-optimization of certain processes (energy loss during electricity production, extraction efficiency of certain materials), in our inability to find sustainable alternatives (fossil fuels) or to

consume differently (buy rather than repair). The process of waste reduction just began, and in order to succeed in leaving no waste behind, what will your contribution be?
The Technical University of Munich (TUM) joint forces with six leading universities of science and technology to foster the European spirit in a EuroTeQ format to promote innovative engineering education across Europe. Together we are creating the first EuroTeQ Collider in 2022. The Collider is an innovative learning format with the aim of bringing students together with vocational trainees and professionals to tackle challenges around the theme “Leave no waste behind”. The goal is to connect participants with different profiles and personalities to boost creativity, innovation, shared understanding, enabling participants to imagine new approaches and design disruptive solutions.
The module is a seminar which gives students the opportunity to apply their knowledge on topics related to the theme “Leave no waste behind”. Within this overarching theme, we are offering challenges on three different topic-domains, namely:
• Cities (eg. construction/ building, public lighting, streets (trash bins))
• Energy (eg. renewable resources, transport, data (storing))
• Consumption (eg. food, plastics, fashion).
Within every topic domain, interdisciplinary (and international) teams of students, vocational trainees and professional learners are formed to develop solutions towards a desirable future, test and validate tools and create prototypes of their solutions.
A selection of the best projects will be presented in a major high-level event, the EuroTeQaThon. The winner teams of the EuroTeQaThon will be invited to present their projects at the European Commission.

Intended Learning Outcomes:
After completion, all EuroTeQ Collider participants will be able to:
- Select and apply appropriate design, engineering and business approaches and tools to create an innovative and science-based solution to a real-life challenge.
- Develop a profound interpretation of a complex, real-life problem and its context using a system-thinking approach, considering multiple perspectives.
- Develop a problem-driven, creative, and integrative design, demonstrated by a concrete prototype that balances desirability, feasibility, and viability.
- Use disciplinary knowledge and expertise in an inter-disciplinary team to develop an innovative and scientifically sound solution in a European context.
- Communicate your ideas, at different levels of elaboration, via several mediums in an international context to a diverse set of stakeholders.
- Define and regularly reflect on personal and team development

Teaching and Learning Methods:
A range of teaching & learning techniques will be applied:
- (pre-recorded) videos and online presentations, with podcasts and interviews, Q&A Sessions with experts
- This module is focusing on service-learning and project-based learning
- After a set of introductory sessions which provide input on the core topics but also project management, students will work on their projects in groups. Progress will be determined through

project presentations during the semester, continuous feedback from the instructors, as well as peer-to-peer feedback. –
- Presentational skills will be further facilitated through the requirement to present the final results
- As students and professionals will work together in a joint effort, all participants will not only improve their technical skills but also enhance their soft skills such as team spirit, flexibility to work in multicultural environments, and design thinking, which are also very important in professional life.

Media:

Reading List:

Responsible for Module:
Wurster, Stefan; Prof. Dr. rer. pol.

Courses (Type of course, Weekly hours per semester), Instructor:
(SOT82700, SOT86700) EuroTeQ Collider - Leave no Waste Behind (Seminar, 4 SWS)
Becker V, Siewert M, Wurster S
For further information in this module, please click campus.tum.de or here.

Module Description

SZ0306: German as a Foreign Language B1.2 | Deutsch als Fremdsprache B1.2

Version of module description: Gültig ab winterterm 2019/20

Module Level: Bachelor/Master	**Language:** German	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
1 End Term Test 90 Min. (100%) - keine Hilfsmittel erlaubt
In der schriftlichen Prüfung werden die in der Modulbeschreibung angegebenen Lernergebnisse geprüft. Sie beinhaltet Fragen zur Anwendung von Wortschatz und Grammatik, zu Text- bzw. Leseverstehen, sowie Aufgaben zur freien Textproduktion. Das Hörverstehen wird anhand von Hörbeispielen mit Hörverstehens-Fragen überprüft, die schriftlich beantwortet werden müssen. Mündliche Reaktionsfähigkeiten werden anhand der Anwendung entsprechender Redemittel in schriftlichen Dialogbeispielen überprüft.

Repeat Examination:

(Recommended) Prerequisites:
Gesicherte Kenntnisse der Stufe B1.1; Einstufungstest mit Ergebnis B1.2.

Content:
In this module, knowledge of German as a foreign language will be further developed, enabling students to express themselves in German independently and confidently in familiar situations, e.g. in the classroom, at work, in free time and with family, on topics of general interest, e.g. films, music, sports, etc, when standard German is spoken. Students develop an expanded spectrum of vocabulary, figures of speech and idioms, discussion patterns, understand and use a basic repertoire of logical main and subordinate clauses (temporal clauses, causal clauses, infinitive clauses, final clauses, consecutive clauses and relative clause), verbs and nouns and expand their use of prepositions. They review and develop elementary aspects of grammar, such as the use of tenses, prepositions, adjective declensions and comparatives. They examine specific features of culture with regard to festivals and traditions, the educational system, the business world, lifestyles and leisure activities, and obtain insight into contemporary culture in Germany.

Intended Learning Outcomes:
The module refers to level B1 Independent Language Use of the CEFR. Students acquire knowledge of German as a foreign language at the standard language level with a focus on intercultural, cultural and academic aspects. Students obtain team competence through collaborative work in mixed, multinational groups. After completion of this module, students can make themselves understood in most situations likely to occur in the context of work, school and leisure, or while traveling in German-speaking regions. They can report on academic and business careers; describe plans and express hopes and wishes; make, accept or reject invitations; give advice and directions; express and discuss opinions. They can understand and summarize the general content of simple, authentic factual texts, literary texts, and radio and television programs and take part in spontaneous discussions on topics of general interest. Students can compose simple formal letters and longer personal letters and describe personal experiences. They can speak on everyday topics of personal interest in a structured fashion and produce a written text, taking a logically-defensible position on a current issue, when given assistance.

Teaching and Learning Methods:
The module consists of a seminar in which course objectives will be achieved in an activity-oriented, communicative atmosphere through listening, reading, writing and speaking exercises in individual, partner and group work. The fundamental language skills conveyed in the classroom are reinforced through the use of guided self-learning in the form of prepared (and online) materials. The basics of presenting and discussing everyday topics will be conveyed by means of the prescribed criteria and communicative patterns.

Media:
Textbook; multimedia teaching and learning materials (chalk/white board, overheads, worksheets, images, films, etc.) and online resources.

Reading List:

Responsible for Module:

Courses (Type of course, Weekly hours per semester), Instructor:
Deutsch als Fremdsprache B1.2 (Seminar, 4 SWS)
Aristakesyan V, Bauer-Hutz B, Gärtner A, Hartkopf D, Kouhi S, Kraut-Schindlbeck S, Lechle K, Niehaus B, Oelmayer J, Schmidt-Bender S, Steidten R
For further information in this module, please click campus.tum.de or here.

Module Description

SZ0425: English - Introduction to Academic Writing C1 | Englisch - Introduction to Academic Writing C1

Version of module description: Gültig ab winterterm 2015/16

Module Level: Bachelor/Master	**Language:** English	**Duration:** one semester	**Frequency:**
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 60	**Contact Hours:** 30

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Assessment is based on writing assignments covering various essay genres such as description, argument, persuasion and analysis. Students will be graded on their ability to present content clearly and succinctly taking readers' needs and writing conventions into consideration. The scores of multiple drafts are averaged to encourage learning based on the revision process.

Repeat Examination:

(Recommended) Prerequisites:
Ability to begin work at the C1 level of the GER as evidenced by the placement test at www.moodle.tum.de.

Content:
This course will help students learn to express themselves more correctly and persuasively in written English. There will be a focus on forming correct sentences and paragraphs, working towards the production of longer texts of the type students will be expected to write during their academic studies. They will also learn to evaluate and interpret the written texts of others.

Intended Learning Outcomes:
After completion of this module students will be able to write academic texts with greater fluency and accuracy and with fewer grammatical errors. They will be able to engage the rules of composition to construct logical and mature descriptions, explanations, and claims of the sort they will need throughout their academic years and beyond.

Teaching and Learning Methods:
This course makes use of peer group revision, working through multiple drafts, and evaluation of model texts to help students develop their academic writing skills.

Media:
Peer groups, handouts, textbook, online resources.

Reading List:
Textbook: Oshima, Alice, and Hogue, Ann. (2006) Writing Academic English, Fourth Edition. Pearson Longman Academic Writing Series, Level 4. ISBN-13: 978-01315235593

Responsible for Module:
Heidi Minning

Courses (Type of course, Weekly hours per semester), Instructor:
Englisch - Introduction to Academic Writing C1 (Seminar, 2 SWS)
Field B, Lemanowicz L, Msibi S, Ritter J, Schenk T, Schrier T, Starck S
For further information in this module, please click campus.tum.de or here.

Module Description

WI001278: What's cooking? Founding start-ups and unicorns in real time | What's cooking? Founding start-ups and unicorns in real time [What's cooking?]

What's cooking? Founding start-ups and unicorns in real time

Version of module description: Gültig ab winterterm 2020/21

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** summer semester
Credits:* 12	**Total Hours:** 360	**Self-study Hours:** 270	**Contact Hours:** 90

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The exams consist of several presentations based on a) summaries of current content of entrepreneurship and startup development as well as b) the creation of an own business venture (including the presentation of a prototype and a business plan). The project work should show that the students
- have researched and processed current academic and practice literature and other content (e.g., blogs, videos, podcasts, etc.) on startup creation and can visualize it properly
- have worked intensively on the topic of customer-centric business model development
- are able to develop business models using lean start-up methods of a project paper divided into a pitch presentation including the presentation of a prototype and a business plan. The project work should show that the students
- have presentation and communication skills that enable them to present their findings on challenging topics they are working on in a team in a clear and structured manner and to discuss the applicability of their findings in business practice.

The final grade is an average grade of an individual course work (50%; written aggregation of theories) and a team task (50%, pitch presentation, prototype and business plan)

Repeat Examination:
Next semester

(Recommended) Prerequisites:
Fluency in English

Interest in actually starting a venture this semester, current entreprenership, startup and venture capital content both from an academic and practice perspective

IMPORTANT: Available places will be allocated according to academic eligibility, relevant experience and skills. To register, please fill out the registration sheet (https://form.typeform.com/to/hLIs9pOQ) until September 30, 2021

Content:
The What's Cooking seminar is a highly interdisciplinary project-based learning experience that brings students from diverse backgrounds and TUM and LMU departments (e.g. management, computer science, engineering, architecture, etc.) together with respected startup and tech experts to develop startup ideas and found a startup in one semester.

Students from TUM and LMU will work in interdisciplinary teams and will analyze prevailing pain points of existing products and services and brainstorm ideas for high growth firms. Based on the identified pain points, students will start to build a startup that, in the best case scenario, will result in the creation of a company. Students will be supported by lectures from professors and invited entrepreneurs, serial founders, industry experts and investors as well as interactions with academics, in both methodological and entrepreneurial topics.
Student teams will consist of a balanced combination of students from all disciplines, e.g. computer science, physics, medicine, management, computer science, engineering as well as life science, etc.

All participants will go through workshops on identifying use cases, developing business ideas, prototyping, pitching, coaching by experts from academia and entrepreneurship practice and financial planning as well as peer-coaching. A large part of the seminar is based on actually working on startup building (in team work). Students are responsible for creating a prototype as well as a business model, developing a go-to-market strategy, and creating a VC-ready pitch deck.

At the end of the course, students will pitch their business idea to a selected group of high potential investors.

Intended Learning Outcomes:
Theory:
Students will research, read and summarize the most important academic concepts of startup building along the startup value chain. In addition students will also research, read and process thoughts and content from the most renowned and experienced actual entrepreneurs, VCs, movers and shakers in the entrepreneurial ecosystem.
They will learn to apply and aggregate fundamental concepts in all fields of digital technologies, emerging technologies across all industries, e.g. life sciences, Fintech, cybersecurity, FoodTech, Hr Tech, AI, Gaming, Blockchain, Robotics, EdTech, Deep Tech, E-Commerce, Energy, Construction, Agriculture, MedTech, IoT, Real Estate, Ventures for Good, and others.

Practice:

Students will gain dep knowledge of the most important players and actors that shape startup ecosystems worldwide as well as their ways of thinking and conceptualising. They will be able to summarize the key points of startup business ideas and disruption of established players. Students will apply customer centric prototyping by developing a disruptive idea based on pain points. Students will be able to perform technology assessment and prototype development

Method:
Students will learn from both academics and practitioners that shape, move and influence theory and practice of venturing and startup creation. We will work with academic journals, guest speakers as well as extracting knowledge from current videos, podcasts, conference presentations of the movers and thinkers of start-up business.

Teaching and Learning Methods:
The course consists of keynotes and a student-led project. The keynotes are given by university lecturers and guest lecturers who are leading experts in the fields of entrepreneurship and digitalization.

Media:
Power-Point, Videos, Zoom, Miro-Board, Moodle, Guest Speakers, Team Work, Coaching Sessions, Live Pitches, Peer Coaching

Reading List:
Books
Feld, B., & Mendelson, J. (2011). Venture deals. Wiley.
Sedniev, A. (2013) The Business Idea Factory: A World-Class System for Creating Successful Business Ideas. CreateSpace Independent Publishing Platform.
Bahcall, S. (2019). Loonshots: How to nurture the crazy ideas that win wars, cure diseases, and transform industries. St. Martin's Press.
Innovation, D. H. (2018). Digital innovation playbook: das unverzichtbare Arbeitsbuch für Gründer, Macher und Manager. Murmann Publishers.

Podcasts
Randoloph, M. (2021). Building Netflix, Battling Blockbuster, Negotiating with Amazon/Bezos, and Scraping the Barnacles Off the Hull. Retrieved from: https://podcastnotes.org/tim-ferris-show/marc-randolph-on-the-tim-ferriss-show/.
O'Shaughnessy P. (2021). Chamath Palihapitiya - The Major Problems Facing The World. Retrieved from: https://www.joincolossus.com/episodes/33654465/palihapitiya-the-major-problems-facing-the-world

Blogs
Altman, S. (2020). Idea Generation. Retrieved from: https://blog.samaltman.com/idea-generation

Videos

Thiel, P. & Perrel, D. (2021). Peter Thiel's Tips for Changing the World. Retrieved from: https://www.youtube.com/watch?v=f0DaNghFjdA&feature=youtu.be
Palihapitiya C. (2018). Chamath Palihapitiya and CEO Social Capital, on Money as an Instrument of Change . Retrieved from: https://www.youtube.com/watch?v=PMotykw0SIk

Responsible for Module:
Welpe, Isabell M.; Prof. Dr. rer. pol.

Courses (Type of course, Weekly hours per semester), Instructor:
What's cooking? Founding start-ups and unicorns in real time (WI001278) (Seminar, 8 SWS)
Born N, Mehrwald P, Ritter A, Treffers T, Uhlemann K, Welpe I
For further information in this module, please click campus.tum.de or here.

Module Description

WI001284: Behavioral Economics meet real world challenges | Behavioral Economics meet real world challenges [Behavioral Economics_Projectrally]

Version of module description: Gültig ab winterterm 2020/21

Module Level: Master	**Language:** English	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 6	**Total Hours:** 180	**Self-study Hours:** 120	**Contact Hours:** 60

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
The examination consists of the presentation (written project report of 10 pages) of the project work comprising a description of the relevant project planning steps required as well as a meaningful use of behaviroal economic instruments to bridge people´s attitude behavior gap. An oral group presentation of the results will also be required. The project work shall validate the student´s ability to transform their ideas into a project proposal including a corresponding work breakdown structure and a communication strategy, while the presentation shall allow to assess the ability to present a project idea to an audience, and to conduct a discussion about the presented issues.

Repeat Examination:
Next semester

(Recommended) Prerequisites:

Content:
The module offers participants an overview of current issues in behavioral economics and their application on current societal or environmental challenges and gives them the opportunity to examine one topic in more detail. The module may serve as starting point for further research, but also prepares participants for issues they are likely to face in their professional lives. Emphasis is put on aspects of choice architecture, social preferences, nudging/green nudges, herding, and further phenomena of behavioral economics and their application on a real world case. The topics are typically related to human behavior in an economic context and potential behavioral interventions.

Intended Learning Outcomes:
At the end of the module, students are able to develop a detailed project plan and to understand related communication processes as well as apply principles and tools of behavioral economics. They can present their results to specific target audiences in an organized manner. Additionally, they can organize ideas effectively and communicate them in a well-developed written report. Furthermore, students are able to understand the needs of different stakeholder groups touched by societal or environmental challenges and to apply techniques to avoid miscommunication in project management rooted in misunderstandings between different actors being involved in the project. After attending the module students are also able to analyze and evaluate basic principles of management. They can deduct recommendations and develop company-specific decisions in management. Furthermore students know how to assess pros and cons regarding the applicability and impacts on corporate management.

Teaching and Learning Methods:
In an introductory session, the topic of the current project is introduced and elaborated in detail. The introduction will also introduce the relevant behavioral economics and project management knowledge. Knowledge and skills are imparted by lectures, flipped classroom teaching, individual and group project work, peer discussions, and individual coaching sessions; the learning methods are definition and solving of problems, collaborative work, group discussions, prepare and hold presentations, report writing.

Media:
Books, case descriptions, academic papers, presentation slides, online resources

Reading List:
tbd

Responsible for Module:
Mohnen, Alwine; Prof. Dr.

Courses (Type of course, Weekly hours per semester), Instructor:

For further information in this module, please click campus.tum.de or here.

Module Description

WI001293: Theoretical and applied basics of mindfulness practice | Theoretische und anwendungsbezogene Grundlagen der Achtsamkeitspraxis

Version of module description: Gültig ab winterterm 2020/21

Module Level: Master	**Language:** German	**Duration:** one semester	**Frequency:** winter/summer semester
Credits:* 3	**Total Hours:** 90	**Self-study Hours:** 60	**Contact Hours:** 30

Number of credits may vary according to degree program. Please see Transcript of Records.

Description of Examination Method:
Die Prüfungsleistung wird in Form eines elektronischen Lernportfolios erbracht und nach vorher festgelegten Kriterien benotet. In diesem Lernportfolio weisen die Studierenden nach, dass sie sich mit den Inhalten des Moduls vertieft und über das Modul hinaus auseinandergesetzt haben. Dafür müssen die Studierenden nachweisen, dass sie sowohl die Plichtliteratur als auch weiterführende Literatur gelesen, zusammengefasst, verstanden und kritisch hinterfragt haben. Hierfür stehen den Studierenden eine Reihe unterschiedlicher Leitfragen (inkl. Transferfragen) und Materialien (überwiegend wissenschaftliche Artikel) zur Verfügung. Weiterhin dient das Lernportfolio zur Unterstützung der Integration und Umsetzung der Achtsamkeitspraxis in den Alltag. Das Lernportfolio bietet somit eine optimale Kontrollmöglichkeit des Lernfortschritts- und ergebnisses durch die Lehrenden.

Repeat Examination:
End of Semester

(Recommended) Prerequisites:

Content:
Gemessen an den mittlerweile über 1.000 wissenschaftlichen Publikationen (Van Dam et al., 2018), hat sich die Achtsamkeitsforschung in den letzten zwanzig Jahren zu einem "hot topic" entwickelt. Es scheint kaum ein Problem zu geben, dass mit Achtsamkeit nicht gelöst werden kann.

Ein solcher makelloser Ruf der Achtsamkeit nährt jedoch den Verdacht auf Übertreibung. Ein wesentlicher Bestandteil dieser Lehrveranstaltung stellt daher die kritische Auseinandersetzung

mit den wichtigsten aktuellen Forschungsbefunden der Achtsamkeitspraxis dar: Wo liegen die Herausforderungen und Limitationen bei der empirischen Untersuchung von Achtsamkeit? Was wissen wir und was wissen wir nicht? Diese kritische Auseinandersetzung erfolgt sowohl im Rahmen der Lehrveranstaltung als auch im Rahmen des Lernportfolios.

Darüber hinaus erhalten die Studierenden die Möglichkeit, unter Anleitung eines erfahrenen und zertifizierten Achtsamkeitstrainers (Günter Bubbnik) Praktiken und Techniken der Achtsamkeit zu erlernen und damit ihre eigenen Kompetenzen weiterzuentwickeln. Studierende stellen eine vulnerable Gruppe dar, die unter erhöhter Stressbelastung steht (Stichwort: Burnout). Leistungsdruck und Prüfungssituationen u.ä. gehören zum Alltag der Studierenden. Durch die Vermittlung und das Praktizieren von Achtsamkeitsübungen werden den Studierenden validierte Methoden zur Stressreduktion, Prüfungsangstbewältigung und Konzentrationssteigerung vermittelt und Sozialkompetenzen gestärkt. Im Vordergrund steht dabei:

- Achtsamkeit ins Alltagsleben integrieren
- Methoden zur Stressreduktion
- Methoden zur Prüfungsangstbewältigung
- Methoden zur Konzentrationssteigerung
- Reflexion eigener Verhaltensmuster
- Persönlichkeitsentwicklung
- Entspannungstechniken
- Stärkung des Umgangs mit Gefühlen
- Selbstmanagement
- Zeitmanagement

Intended Learning Outcomes:
Nach der Teilnahme an der Lehrveranstaltung kennen die Studierenden die wichtigsten und aktuellen Forschungsbefunde der Achtsamkeitspraxis. Damit sind sie in der Lage, wissenschaftlich fundierte Modelle, Befunde und Techniken der Achtsamkeitspraxis abzurufen, zu verstehen und sowohl in Hinblick auf die Theorie als auch die Praxistauglichkeit kritisch zu hinterfragen ("Mind the Hype").

Des Weiteren sind die Studierenden in der Lage, neu erlernte Kompetenzen und Techniken der Achtsamkeitspraxis selbst anzuwenden. Sie können Stress in seinen verschiedenen Ausführungen bewusst wahrnehmen und eigene Reduzierungsmöglichkeiten sowie Selbststrukturierungsmechanismen entwickeln. Dies umfasst die...
- Integration von Achtsamkeit in den Studienalltag
- Auseinandersetzung mit stressbedingten Ängsten
- Anregung und Ermutigung zu stetigen Reflexionen
- Stärkung von Sozialkompetenzen (insbes. der Emotionsregulation)

Teaching and Learning Methods:
Zur Erreichung der angestrebten wissenschaftlichen Kenntnisse werden theoretische Inhalte über Präsentationen vermittelt und in Plenum/Kleingruppen diskutiert. Praktische Kompetenzen

werden über deduktive Achtsamkeitsübungen und induktiven Methoden veranschaulicht und vermittelt. Schwerpunkt liegt auf dem Erfahrungsaustausch in der sensiblen Umgebung der Lehrveranstaltung und der Ausarbeitung konkreter Fragestellungen in Form von Gruppen- und Zweierübungen. Die Vermittlung der relevanten Inhalte erfolgt zudem über die Erstellung eines Lernportfolios (Prüfungsleistung).

Media:
Zoom, PowerPoint, SosciSurvey (Online Umfragen zur Reflexion), OnlineTED, Reader, Filme, Tagebuch

Reading List:
- Donald et al. (2020): Mindfulness and Its Association With Varied Types of Motivation
- Leyland et al. (2019): Experimental Effects of Mindfulness Induction on Self-Regulation: Systematic Review and Meta-Analysis
- van Dam et al. (2018): Mind the Hype
- Hanley et al. (2021): Modeling the Mindfulness-to-Meaning Theory`s Mindful Reappraisal Hypothesis

Responsible for Module:
Kehr, Hugo; Prof. Dr. phil.

Courses (Type of course, Weekly hours per semester), Instructor:
Theoretische und anwendungsbezogene Grundlagen der Achtsamkeitspraxis (WI001293) (Seminar, 2 SWS)
Bubbnik G, Jais M
For further information in this module, please click campus.tum.de or here.

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