Module title	**Design and Analysis of Experiments**
Code	D2
Degree Programme	Master of Science in Life Sciences
Workload	3 ECTS (90 student working hours) - Asynchronous and synchronous distance learning, decentralized teaching: 32 h - Self-study: 58 h (10 h self-study before module starts)
Module Coordinator	**Name**: Dr. Stefanie Feiler **Email:** stefanie.feiler@fhnw.ch **Address**: FHNW School of Life Sciences, Hofackerstrasse 30, 4132 Muttenz
Lecturers	Dimitri Stucki (BFH), Stefanie Feiler (SLS FHNW)
Entry requirements	Advanced knowledge of R (level D1) is required – thus attending the module "Handling and Visualizing Data" is highly recommended. Prior to this module, additional preparatory materials will be made available to facilitate student preparation for the module. Students are advised to start five weeks before the module with the required preparatory work.
Learning outcomes and competences	After completing the module, students will be able to: • Apply the basics of statistical inference (estimation, testing, confidence regions) in the course setting, • Identify common and important types of experimental designs with respective advantages and disadvantages, • Choose an appropriate design in a given research setting, • Perform a correct statistical analysis of experimental data, including unbalanced data sets, • Perform post hoc tests, • Interpret the model and report the findings scientifically, including visualisation.
Module contents	• Repetition: Basics of statistical inference (population and sample, statistical hypothesis testing, confidence regions) • General principles of experimental design (randomization, blocking) • Important particular experimental designs (e.g., fully randomized designs, randomized block designs; (fractional) factorial designs; designs for response surface modelling); when to use which design • Statistical analysis of the experimental data (including interpretation of e.g., block effects or interaction effects, adapted to the design), using linear regression / linear mixed models, including: - Model diagnostics - Transformations - Model selection - Prediction (confidence/prediction intervals) • Post hoc tests (e.g., to compare subsets of treatments to each other) • The strategic approach of sequential DoE • Outlook: special applications (e.g., binary outcomes, computer experiments)

	• Interpretation and visualization of the results; scientific reporting of the results, back-translation from statistical terminology to the original research question
Teaching / learning methods	In the weeks before module start, students are expected to do preparatory work to prepare themselves for the module: preparations for the statistical topics as well as a brush-up of the course software R. The students receive preparatory and/or follow-up self-study work for each course day (regardless of whether it is a central or local day). The self-study consists e.g. of preparatory reading/videos, follow up exercises, examining case studies, etc. Central teaching is offered in a distance learning mode consisting of a combination of asynchronous activities (e.g., script, videos) and live online sessions. Local coaching consists of physical presence sessions where students actively solve exercises together with the local coaches. These exercises are meant to deepen the understanding of the material, give an opportunity to practice, provide extensions etc.
Assessment of learning outcome	• 80% of the final points: Final written individual online exam using the Safe Exam Browser (SEB) on individual laptop computers (open book, no online access). • 10% of the final points: Attendance and active participation at the local sessions (minimum 4 out of 7 local session) OR submission of all weekly "Part I" exercises. • 10% of the final points: Small applied project in groups of 3-4 students. This implies that the maximal mark of 6 can only be reached by participating in all of these activities.
Format	7-weeks
Timing of the module	For ZHAW and FHNW: Autumn semester, CW 45-51 For BFH and HES-SO: Spring semester, CW 15-21
Venue	Distance learning (central teaching) and in-presence teaching at respective school (local coaching)
Bibliography	Material will be provided on Moodle.
Language	English
Links to other modules	This module builds on module D1 "Handling and Visualising Data" and complements the module D3 "Modelling and Exploration of Multivariate Data".
Comments	Material treated during local teaching is relevant for the exam. Students have to make sure that an updated version of R is installed. Details will be communicated in advance.
Last Update	15.04.2024