Module title	Design and Analysis of Experiments
Code	D2
Degree Programme	Master of Science in Life Sciences
Workload	3 ECTS (90 student working hours) - Lessons contact (total 42 of which 28 central teaching): 32 h - Self-study: 58 h
Module Coordinator	**Name**: Lorenzo Tanadini **Phone**: +41 (0)31 910 21 20 **Email**: lorenzo.tanadini@bfh.ch **Address**: Berner Fachhochschule, HAFL, Länggasse 85, 3052 Zollikofen
Lecturers	Lorenzo Tanadini, BFH
Entry requirements	Attending the module "Handling and Visualizing Data" is required. 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 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, • make use of the basics of the Design of Experiments such as randomization and blocking, • 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 different types of designs, including unbalanced data sets, • perform post hoc tests, • interpret the model and report the findings scientifically.
Module contents	• Introduction to statistical inference (population and sample, statistical hypothesis testing, confidence regions) • Experiments and other methods (i.e. observational studies); the place of a single experiment in a research plan • General principles of experimental design (blocking, randomization), how to translate research questions in statistical terms • Important particular experimental designs (e.g. fully randomized designs, randomized block designs; incomplete designs; factorial designs, fractional factorial designs; split-plot designs); when to use which design (feasibility, compare efficiency, power and sample size calculations) • Statistical analysis of all the particular designs that were introduced (including interpretation of e.g. block effects or interaction effects, adapted to the design) • Post hoc tests (also for ordinal factors) e.g. to compare subsets of treatments to each other • Interpretation and visualization of the results; scientific reporting of the results, back-translation from statistical terminology to the original research question

Teaching / learning methods	Tentative schedule:									
	Week	**<1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**>7**
	Central		4L	4L	4L	4L	4L	4L	4L	
	Local		2L	2L	2L	2L	2L	2L	2L	
	Self-study	10h				38h				10h

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 minor brush-up of the course software R.

The students receive preparatory as well as follow-up <u>self-study</u> 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.

<u>Central</u> teaching is a blend of classical lectures with more interactive teaching approaches such as exercise sessions.

<u>Local</u> coaching consists of students actively solving exercises and old exams 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	1. Final written individual exam (open book, using individual laptop computers to run statistical analyses using the course software) (80%) 2. Individual exercises spread over the entire module (20%)
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	For ZHAW and FHNW: Olten For BFH and HES-SO: Fribourg
Bibliography	Material will be provided on Moodle.
Language	English
Links to other modules	This module builds on D1 and complements D3.
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	04.02.2021