

## Teachers

- **Guest teacher:** Professor **E. David Ford**, College of Forest Resources, University of Washington; USA.
- **Guest teacher:** Professor, **Klaus Hinkelmann**, Department of Statistics, Virginia Tech, USA.
- **Guest teacher:** Researcher **Emlyn Rhys Williams**, Commonwealth Scientific and Industrial Research Organisation, Australia.
- **Lauri Jauhiainen**, Data and Information Services, Agrifood Research Finland.
- Senior Lecturer, **Hannu Rita** (course responsible), Department of Ecology and Systematics & Faculty of Agriculture and Forestry, University of Helsinki, Finland.

## Language

The language of the course will be English

## National contact persons

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## Contact information

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## Course homepage:

<http://www.dina.dk/phd/s/s5/>

## Mustiala Faculty of Agriculture



Mustiala Faculty of Agriculture is situated in a rural environment in Tammela, about 120 km from Helsinki. Agricultural knowledge has been given at Mustiala since 1840. Today Mustiala Faculty of Agriculture forms one of the nine units in Häme Polytechnic and can offer a higher agricultural education, after four years of education a bachelor degree in agriculture.

Mustiala also has an active co-operation with several agricultural colleges and universities in Europe. Education in small-scale brewing was started in Finland first in Mustiala 1995. The unit has its own pub and a training brewery, which also produces high quality beer commercially.

The Faculty of Agriculture and Forestry in the University of Helsinki was founded in 1924. University level agricultural and forestry teaching had, however, started already in 1896. The faculty has around 3000 students and a staff of 300 persons.

## Teaching facilities

Lecture room with AV-facilities and computer room with 12 computers are reserved for the NINA course.



**Accommodation** will be in the student dormitory in double rooms. The dormitory has well-equipped kitchen and bathroom facilities.

## The Food

Breakfast, lunch and dinner will be served in "Huttula", the staff restaurant of Mustiala and afternoon coffee will be available in the lecture room.

## Leisure time

During the 3<sup>rd</sup> and 4<sup>th</sup> of August is the annual 17th century weekend held in Mustiala, with food and crafts market, music and drama. In the attractive park areas of the college there is a museum of agriculture, the pub "Iso Piippu", sauna by the lake, swimming place etc.

More info <http://www.mustiala.hamk.fi>

# Design of Data Generation Experimental Design

Nordic PhD course  
financed by  
NOVA and NorFA



Mustiala Faculty of Agriculture  
Häme Polytechnic, Finland

28 July - 9 August, 2002

Organized by

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# Design of Data Generation - Experimental Design

## The problem

Partly due to easy-to-use software, extensive use of statistical analysis of data takes place in today's empirical research. Publishing without statistical analysis is practically impossible. The analysis, however, often seems to be more a ritual than a severe attempt of argumentation. To understand the reasoning behind the designs is vital in increasing efficient use of the existing huge statistical arsenal.

Experimental designs are typically described and taught using statistical terminology only. This neglects the other relevant part: the design must be flexible with respect to the requirements of the research object under study. Ideally, each component in the analysis has an interpretation in terms of the substance under study. This is seldom met.

A third problem is of more general character and is connected with the two preceding ones: an essential proportion of the ongoing statistical consulting work has to be allocated to make the researchers clarify their research problems before any statistical help can be given. In other words, successful experimentation is not possible without a clearly formulated research problem. Thus, there is an overarching problem of general methodological nature behind the two previous problems in applying statistical methods. Without solving it the statistical arsenal can not be used in an efficient way.

## A solution

To solve the problem above requires that the students should, in addition to their own discipline, master a sufficient amount of statistical skills and understand basics of general methodology. But both of these topics are abstract and formal in their character and as such, difficult to learn. Especially teaching them from the standpoints of statistics and philosophy will take very long, with a lot of motivation problems for students of agriculture.

From the students point of view, the most appealing topic of application for the statistical and the general methodological approach is probably his or her own research problem. Practising with the abstract concepts of the two methodological approaches in a familiar environment allows the students to

build a firm understanding of their meaning and way of application. Attacking the statistical and methodological aspects of the research problems in small groups under guidance of expert teachers will offer a good opportunity to this. During such a period, the student will also learn the statistical and methodological language to be able to cooperate with representatives of these sciences.

## The teachers

David Ford has given courses on methodology of empirical research. His approach is interactive and aims in making the student think himself. Klaus Hinkelmann is a wellknown statistician, maybe from the theoretical side, whereas the expertise of Emlyn Williams leans more on applications.

## The leading idea

The leading idea on which the course is based is to help the student approach an empirical research problem of an agricultural discipline from two directions: from philosophico-methodological and from statistical. The creative process induced by interaction between these three will give the student an opportunity to build a holistic view of his or her research problem especially, and of empirical research in general. The intellectual environment introduced allows specialists in statistical experimental design, general methodology and specific sub-disciplines in agriculture meet, equipping the student with communicative skills.

## Prerequisites

Understanding of basic statistical concepts, such as mean, variance and covariance, logic of statistical hypothesis testing, point and interval estimation. A general idea of linear models and analysis of variance/experimental design will be helpful.

## Day-by-day themes

### Structure

The course will cover two main topics, the statistical theory of experimental design and the methodological analysis of empirical research problems. These components will be interwoven by the research problems of the participants during the project works.

For the project work, the students will be divided into two or three small groups on basis of their research problems. In each of the groups, the problems will be first tackled from the methodological point of view, the aim being a well defined empirical question. After this clarification, the statistical features of the appropriate empirical activity will be studied.

Various experimental designs will be evaluated with respect to their applicability in solving the problem. The ultimate aim is the make best possible use of the statistical tool in answering a well-defined research problem using experimental approach. At the end of the course, the results of the project works will be presented and discussed.

## Daily schedule

On the average, each day will include a lecture covering a statistical and/or a methodological theme. The themes of the lectures will be connected to the research problems of the participants in small groups led by the guest teachers. At the group level, lectures on specific topics may take place, if needed. Finally, on a typical day, statistical software exercises will take place. Daily, each of these activities will take at least two hours on the average, with some daily variation. In addition, specific questions may be tackled even on personal basis.

## Preliminary program

**Theme 1:** Introduction, Aims, Research. problems of participants.

**Theme 2:** Introduction to the methodology of empirical research. Basic statistics: Randomization, replication and blocking.

**Theme 3:** The art of measurement: Validity, reliability, and conceptual efficiency. Threatment structure: Factorial designs.

**Theme 4:** The art of experimentation I: clarifying the original research question. Repeated measurements I: analysis of follow-uo designs.

**Theme 5:** The art of experimentation II: analysis of the data generation conditions. Repeated measurements II: covariance structures.

**Theme 6:** Individual research filosofies and their methods. Unbalanced designs I: forms and reasons of unbalance.

**Theme 7:** reasoning in research I: principles of formal logic and their use in scientific reasoning. Unbaalanced designs II: implications to analysis and interpretation.

**Theme 8:** Reasoning in research II: the hypothetico-deductive method and use of falsification in scientific reasoning.

**Theme 9:** Working in the research community. Finalization of projects.

**Theme 10:** Presentation of projects. Evaluation

## Financial support

The course in general is financed by NOVA and NorFA. Thus travel costs and course fee as well as accommodation and meals for Ph.D. students are covered by these general grants.