

LUFTIG & WARREN[™]

INTERNATIONAL



EXPERIMENTAL DESIGN AND INDUSTRIAL STATISTICS

1999 SERIES UPDATES

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Introduction

This publication outlines the changes, modifications and improvements that have been made to the Luftig and Warren International seminar series in Experimental Design and Industrial Statistics. The series has undergone considerable upgrading. What follows in this Introductory Section is a brief explanation of those upgrades.

Description of Changes

General Changes

All of the software used in the series is Windows-based. We use SPSS and MVPstats. Both programs have been upgraded significantly over the past several years. Virtually all of the analyses in the series are produced with the friendly “point and click” convenience of Windows applications. In addition, sampling and computational simulations have been added using Excel spread sheets.

Sample size and power discussions are incorporated into the presentations of all statistical tests. This is made easy because of the MVPstats software. In addition, because in today’s world of easy access to computers and statistical software, we have replaced approximate tests with the proper exact tests where appropriate. And, there is virtually no “hand calculations” in the series. Everything is done on computers.

The materials for each of the courses are in 3-ring binders. This allows participants to add pages of notes, etc. And, each course manual has a common set of appendixes to reduce confusion.

Level I

Level I begins with a newly included introductory section which provides a context for understanding data, research in general, the design of experiments, sampling, and statistical analysis of research data. The fundamentals of data presentation and descriptive assessments have been expanded to include exploratory techniques, and multiple additional descriptive measures to include percentiles, and additional measures of center and spread. A critically needed section on Measurement and Measurement Scales has been added which addresses the issues of data types (ratio, interval, ordinal, and nominal scales) and also includes issues of resolution and measurement error. The probability material has been simplified and counting rules necessary for calculating probabilities have been added. The material on probability distributions and on sampling distributions has been upgraded to include simulation exercises. Sample size computations are now done with software and have also been incorporated into the discussion of all statistical tests in the series. Finally, distribution analysis and fitting has been incorporated into Level I. This material contains a full discussion of how to test for many distributions (e.g. Normal, Exponential, and Poisson) and when fitting alternative distributions for “continuous” data is necessary.

Level II

An obvious change to the Level II material is the expansion of the “Seven Step Hypothesis Testing Procedure”. This procedure now contains 11 steps and expands the links from the research to the practical world of business decision making. Statistical tests are grouped by the hypotheses they test. Non-parametric tests have been integrated into the one-sample and two-sample procedures. This assures that the practitioner is able to perform appropriate analyses of any kind of experimental data. The material on measures of association and correlation has been simplified. An integrating table has been provided

showing the relationship between the types of hypotheses the researcher is testing, the type of data, and the appropriate statistical test.

Level III

There is a new and comprehensive presentation of post-hoc procedures presented in the Level III material. In addition, the material on the analysis of dispersion has been completely updated. It includes new test procedures that provide far greater robustness to the violation of the normality assumption than previous test procedures. The material on repeated-measures models and their analysis has been updated. In addition, analysis procedures for Ordinal and Nominal scale data and their post-hoc procedures are incorporated into the new material.

Two-way (and higher) models are presented in a manner that stresses their commonality. The material on random effects models and mixed (fixed and random) models has been incorporated into the text material. And, significantly, the use of Expected Mean Squares for determining the procedures for the analysis of complex models (random and mixed models, nested factor models, and “complex repeated measures models”) has been included. In addition, instructions on the use of MVPstats to produce the proper expected mean squares and how to identify appropriate error terms for any complex model are provided. And, with reference to complex models, procedures for analyzing dispersion data and for analyzing any data type (ratio, interval, ordinal, and nominal) are also presented.

Level IV

Level IV is rather much as it was before, but one significant change has been made. All of the analyses are now conducted with SPSS, the GLM procedure. There are tremendous advantages to this, not the least of which is simplicity in that the analysis files can be easily constructed (in Excel for example) and imported directly into SPSS. In addition, the specification of the design and the analysis is much easier with SPSS.

An additional feature in using SPSS is it provides protection against performing analyses in which model effects might be confounded in the analysis. (The other software would let you make this type of mistake and not “tell you”.) With regard to the analysis, data files are created and stored for use in the class. Therefore, data files need not be “typed in” during the class.

Summary

The foregoing material has provided a brief verbal description of the modifications to the course content for the four levels of the five-week Experimental Design series. In the course materials you will find detailed tables of contents and section summaries for each of the four courses (levels) in the series.