Quantitative Research in Education

Intermediate & Advanced Methods

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This book offers a comprehensive presentation of quantitative research design and statistical methods in the context of education and related fields. The text is intended primarily for use by students who take intermediate and advanced quantitative research courses as a part of their graduate degree program, but it can be a useful resource for researchers in education, counseling, rehabilitation, psychology, sociology, social work, and human development as well.

The main purpose of this book is to provide the readers with an in-depth conceptual and methodological understanding of intermediate and advanced quantitative research methods, as well as the skills necessary to apply such methods using SPSS and to interpret the results. This is achieved by building layers of context-based understanding of research concepts and methods, their statistical translation, methodological principles, computer-based data analysis, presentation of the results in APA style format, and contextual interpretations. The text allows people who experience difficulties with analytic representations of statistical concepts to capitalize on conceptual understanding and still be able to master the research tools necessary for their work on theses, dissertations, and professional research.

While there are many excellent introductory books on research design and statistics in education and the social sciences, most books at the intermediate and advanced levels tend to be either too technical and mathematical or too simplistic. Typically, claiming to have an "applied orientation," such books are dominated by presentations of SPSS dialog boxes and printouts at the expense of theoretical and methodological rigor. To bridge the gap between these extremes, this book attempts to provide a balance between conceptual meaning and its statistical translation by developing understanding and application skills in a spiral exposure to quantitative concepts and methods. For example, the comparison of groups on variables of interest is addressed in a sequence from univariate cases of $t$-tests, nonparametric methods, and analysis of variance (ANOVA) to scenarios illustrating the use of multivariate analysis of variance (MANOVA) and structural equation modeling (SEM). As another example, the concept of validity is addressed in the framework of measurement, research design, and structural equation modeling. Particular attention is devoted to potential problems associated with violation of assumptions, common misconceptions (e.g., conducting MANOVA versus separate ANOVAs), effect sizes, confidence intervals, and sample size. The book is organized in four parts comprising 24 chapters. Each chapter ends with a summary and study questions.

**Part I** *[Measurement in Educational Research]* consists of three chapters. Chapter 1 presents variables and measurement scales in the context of education. The focus is on the nature of measurement in education, types of variables, types of scales and their transformations, permissible arithmetic operations with scale values, summation symbols, and basic rules of summation. Chapter 2 introduces the classical model of reliability of scores, types of reliability, and reliability of composite scores. Chapter 3 deals with the concept of validity for measurement instruments (e.g., tests, questionnaires, or inventories) and types of validity (content-related validity, criterion-related validity, and construct-related validity).

**Part II** *[Research Design]* consists of two chapters. Chapter 4 deals with research problems, hypotheses, and types of quantitative research: nonexperimental research, experimental research, and threats to internal and external validity. Chapter 5 presents pre-experimental and true experimental research designs that involve quantitative methods of data analysis. The focus is primarily on conceptual understanding and methodological principles underlying the application of such designs in educational research.
Part III [Univariate Statistics in Educational Research] consists of fourteen chapters. The first five of these chapters (6, 7, 8, 9, and 10) cover introductory statistics and prepare the ground for understanding and practical applications of intermediate statistics in educational research. The next six chapters (11 through 16) provide intermediate treatment of correlation, regression, and analysis of variance (ANOVA) including some nonparametric methods. The last three chapters in this section (17, 18, and 19) provide more advanced treatment of multiple regression, analysis of variance, and the relations between them.

Part IV [Multivariate Statistics in Educational Research] consists of five chapters. This part covers the topics of logistic regression, multivariate analysis of variance (MANOVA), exploratory factor analysis, confirmatory factor analysis, and elements of structural equation modeling (SEM). The analytic framework of these topics is simplified and tailored to conceptual understanding, computer-aided applications, and interpretations in the context of educational research.

Supplements
Data sets for computer-based applications in examples using SPSS can be downloaded from the online supplement to this book [http://cehd.gmu.edu/book/dimitrov]. This supplement provides also (a) answers to the study questions for each chapter, (b) addendum to some topics discussed in the book, (c) syntax for confirmatory factor analysis, path analysis, and group comparison on latent variables in the framework of major computer programs — LISREL, AMOS, EQS, and Mplus [used for illustrations in Chapters 23 and 24], and (d) additional references (books, articles, and online products) related to the content of this book.

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Dimiter M. Dimitrov
2.5 Reliability Estimation with SPSS 25
  2.5.1 Calculation of Cronbach’s alpha 25
  2.5.2 Calculation of Cohen’s kappa 26
2.6 Summary 27
2.7 Study Questions 28

Chapter 3
VALIDITY 29
3.1 What is Validity? 29
3.2 Aspects of Construct Validity 30
  3.2.1 Content Aspect of Validity 30
  3.2.2 Substantive Aspect of Validity 31
  3.2.3 Structural Aspect of Validity 31
  3.2.4 Generalizability Aspect of Validity 32
  3.2.5 External Aspect of Validity 33
  3.2.6 Consequential Aspect of Validity 34
3.3 Summary 35
3.4 Study Questions 35

PART II RESEARCH DESIGN 37

Chapter 4
QUANTITATIVE RESEARCH 39
4.1 Research Questions and Hypotheses 39
4.2 Types of Quantitative Research 41
  4.2.1 Nonexperimental Research 41
    4.2.1.1 Descriptive research 41
    4.2.1.2 Correlational research 42
    4.2.1.3 Ex post facto research 43
    4.2.1.4 Meta-analysis research 43
  4.2.2 Experimental Research 45
    4.2.2.1 True experimental research 45
    4.2.2.2 Quasi-experimental research 46
    4.2.2.3 Single-case research 46
4.2.3 Internal and External Validity in Experimental Research 47
  4.2.3.1 Threats to internal validity 47
  4.2.3.2 Threats to external validity 48
4.3 Summary 50
4.4 Study Questions 51
Chapter 5

**BASIC RESEARCH DESIGNS** 53

5.1 Pre-experimental Designs 53
  5.1.1 One Group Posttest-Only Design 53
  5.1.2 One Group Pretest-Posttest Design 54
  5.1.3 Nonrandomized Control Group Posttest-Only Design 54

5.2 True Experimental Designs 55
  5.2.1 Randomized Pretest-Posttest Control Group Design 55
  5.2.2 Randomized Solomon Four-Group Design 56
  5.2.3 Randomized Control-Group Posttest Only Design 57

5.3 Quasi-Experimental Designs 58
  5.3.1 Nonrandomized Pretest-Posttest Control Group Design 58
  5.3.2 One Group Time-Series Design 59
  5.3.3 Control Group Time-Series Design 60

5.4 Summary 61
5.5 Study Questions 63

PART III  **UNIVARIATE DATA ANALYSIS** 65

Chapter 6

**REVIEW OF INTRODUCTORY STATISTICS** 67

6.1 Organizing and Graphing Data 67
  6.1.1 Frequency Table 67
  6.1.2 Basic Distribution Graphs 68

6.2 Describing Distributions 72
  6.2.1 Percentiles 72
  6.2.2 Measures of Central Tendency 74
    6.2.2.1 Mode 74
    6.2.2.2 Median 74
    6.2.2.3 Mean 74
    6.2.2.4 Properties of the mode, median, and mean 75
  6.2.3 Measures of Variation 75
    6.2.3.1 Variance 76
    6.2.3.2 Standard deviation 76
    6.2.3.3 Pooled variance 77
    6.2.3.4 Some basic rules 77
  6.2.4 Standard Scores 78
  6.2.5 Scale Transformation 79

6.3 Summary 80
6.4 Study Questions 82
Chapter 7

BASIC DISTRIBUTIONS 83

7.1 Normal Distribution 83
  7.1.1 What is a Normal Distribution? 83
  7.1.2 Basic Properties of the Normal Distribution 85
  7.1.3 Determining Percentiles and Percentile Ranks 86
  7.1.4 Sampling Distribution of the Mean 87
  7.1.5 Normal Q-Q Plot 89

7.2 Student’s t-Distribution 91
7.3 F-Distribution 92
7.4 Chi-square Distribution 93
7.5 Summary 94
7.6 Study Questions 95

Chapter 8

HYPOTHESIS TESTING 97

8.1 What is Hypothesis Testing? 97
8.2 When To Reject (or Not) the Null Hypothesis? 98
8.3 Testing Hypotheses about the Mean 100
  8.3.1 One-sample Case for the Mean 100
  8.3.2 Two-sample Case for the Mean: Independent Samples 106
  8.3.3 Two-sample Case for the Mean: Dependent Samples 111
8.4 Summary 113
8.5 Study Questions 114

Chapter 9

HYPOTHESIS TESTING FOR PROPORTIONS 117

9.1 One-Sample Case for Proportion 117
9.2 Testing H0: \( P_1 = P_2 \) for Independent Samples 122
9.3 Testing H0: \( P_1 = P_2 \) for Dependent Samples 127
9.4 Summary 131
9.5 Study Questions 132

Chapter 10

CORRELATION AND SIMPLE REGRESSION 135

10.1 Correlation between Two Variables 135
  10.1.1 What is Linear Relationship (Correlation) between Two Variables? 135
  10.1.2 The Pearson Product-Moment Correlation Coefficient 138
10.2 Simple Linear Regression 144
  10.2.1 Correlation, Prediction, and Causation 144
  10.2.2 The Regression Line 144
10.2.3 Interpretation of the Slope 147
10.2.4 Conditional Distributions of Y-scores 149
10.2.5 Assumptions with Simple Linear Regression 152
10.3 Summary 154
10.4 Study Questions 155

Chapter 11
PARTIAL AND PART CORRELATION 159

11.1 Partial Correlation 159
11.2 Part Correlation 163
11.3 Summary 165
11.4 Study Questions 166

Chapter 12
NONPARAMETRIC TESTS 167

12.1 The Man-Whitney U Test 167
12.2 The Wilcoxon Signed-Rank Test for Dependent Samples 170
12.3 Chi-Square Goodness-of-fit Test 172
12.4 Chi-Square Test for Association 177
12.5 Summary 182
12.6 Study Questions 183

Chapter 13
MULTIPLE REGRESSION 185

13.1 The Concept of Multiple Regression 185
13.2 Comparison of Full and Restricted Regression Models 191
13.3 Multicollinearity 194
13.4 Cross-validation 197
13.5 Statistical Power, Effect Size, and Sample Size 197
13.6 Outliers and Influential Data Points 199
13.7 Categorical Predictors in Multiple Regression 201
13.8 Interaction between Predictors in Multiple Regression 203
  13.8.1 What is Interaction between Predictors? 203
  13.8.2 Testing for Interaction between Predictors 206
  13.8.3 Centering Predictors 207
13.9 Selection of Predictors in Multiple Regression 209
13.10 APA Style for Multiple Regression Results 210
13.11 Summary 211
13.12 Study Questions 214
Chapter 14

ONE-FACTOR ANALYSIS OF VARIANCE 217

14.1 The Concept of One-Factor Analysis of Variance 218
14.2 Assumptions in ANOVA 219
14.3 Effects in One-factor ANOVA 220
14.4 Within-groups and Between-groups Variance 221
14.5 Linear Model for One-factor ANOVA 223
14.6 Testing the ANOVA Null Hypothesis 223
14.7 Multiple Comparisons 225
  14.7.1 Post Hoc Comparisons 225
  14.7.1.1 The Tukey method of multiple comparisons 225
  14.7.1.2 Bonferroni method of multiple comparisons 226
  14.7.2 Planned Comparisons 227
  14.7.2.1 Contrasts for planned multiple comparisons 227
  14.7.2.2 Dunnett method of multiple comparisons 228
14.8 Determining Effect Size 230
  14.8.1 Effect Size of Mean Differences 230
  14.8.2 Omnibus Effect Size 230
14.9 Determining the Sample Size 234
14.10 Consequences of Violating the ANOVA Assumptions 234
14.11 Interpretation of SPSS Output for One-factor ANOVA 236
14.12 Summary 238
14.13 Study Questions 239

Chapter 15

TWO- AND THREE-FACTOR ANOVA 241

15.1 Two-factor ANOVA 241
  15.1.1 Null Hypotheses in Two-factor ANOVA 241
  15.1.2 Assumptions in Two-factor ANOVA 242
  15.1.3 Effects in Two-factor ANOVA 243
  15.1.4 Linear Model for the Data in Two-factor ANOVA 245
  15.1.5 Sum of Squares in Two-factor ANOVA 246
  15.1.6 Mean Squares in Two-factor ANOVA 247
  15.1.7 Testing the Null Hypotheses in Two-factor ANOVA 248
  15.1.8 Omnibus Effect Size in Two-factor ANOVA 249
  15.1.9 Types of Interaction in Two-factor ANOVA 251
  15.1.10 Testing for Simple Main Effects 252
  15.1.11 Using SPSS for Two-factor ANOVA 252
15.2 Three-factor ANOVA 257
15.3 Summary 264
15.4 Study Questions 265
Chapter 16

**ANALYSIS OF COVARIANCE** 267

16.1 The Logic Behind ANCOVA 267
  16.1.1 Basic Concepts in ANCOVA 267
  16.1.2 Adjusted Group Means in ANCOVA 268
  16.1.3 Increased Test Power with ANCOVA 270
  16.1.4 Assumptions in ANCOVA 271

16.2 Performing ANCOVA and Interpreting the Results 271

16.3 ANCOVA versus ANOVA on Gain Score 277

16.4 Summary 279

16.5 Study Questions 280

Chapter 17

**MULTIPLE REGRESSION AND ANOVA** 281

17.1 One-Factor ANOVA via Multiple Regression 281
  17.1.1 Contrast Coding for ANOVA with Two Groups 281
  17.1.2 Contrast Coding for One-factor ANOVA with Three Groups 282
  17.1.3 Orthogonal Contrasts 284

17.2 Two-Factor ANOVA via Multiple Regression 286

17.3 Summary 293

17.4 Study Questions 293

Chapter 18

**ANOVA WITH RANDOM FACTORS** 295

18.1 ANOVA with One Random Factor 295
  18.1.1 Random Effects 295
  18.1.2 Assumptions of the Random-factor ANOVA 296
  18.1.3 Expected Mean Square in the Random-factor ANOVA 296
  18.1.4 The Primary Question in a Random-factor ANOVA 297

18.2 Two-factor Mixed-Effects ANOVA Model 299
  18.2.1 The Concept of a Mixed-effects Model 299
  18.2.2 Assumptions of the Two-factor Mixed ANOVA Model 300
  18.2.3 Expected Mean Square in the Two-factor Mixed ANOVA 301
  18.2.4 Effect Size of Mean Differences among Levels of the Fixed Factor 304
  18.2.5 Generalizations with the Two-factor Mixed ANOVA 305

18.3 Summary 306

18.4 Study Questions 307

Chapter 19

**REPEATED-MEASURES ANOVA** 309

19.1 A Simple Repeated-Measures ANOVA 309
### Part IV  Multivariate Data Analysis  

#### Chapter 20  
**Logistic Regression**  

- The Concept of Logistic Regression  
  - Probability, Odds, and Odds Ratio  
  - The Logistic Model  
  - Logit Form of the Logistic Regression Model  
  - Interpretation of the Regression Coefficients  
- Tests and Interpretations of Logistic Regression Results  
  - Goodness-of-fit Tests  
  - Hosmer-Lemeshow Goodness-of-fit Test  
  - Test for Significance of Predictor Variables  
  - Effect Size Information with Logistic Regression  
  - Classification Table  
- Coding Categorical Predictors  
- Using SPSS for Binary Logistic Regression  
- Comparison of Full and Restricted Models  
- Selection of Predictors in Logistic Regression  
- Assumptions in Logistic Regression  
- Summary  
- Study Questions  

#### Chapter 21  
**Multivariate Analysis of Variance**  

- The Concept of MANOVA  
- MANOVA versus Separate ANOVAs  
- When to Use Separate ANOVAs?  
- When to Use MANOVA?  
- Assumptions in MANOVA  
- MANOVA with Discriminant Analysis  
- MANOVA with Planned Comparisons  
- Sample Size in MANOVA  

21.9 Summary 367
21.10 Study Questions 368

Chapter 22

**EXPLORATORY FACTOR ANALYSIS** 369

22.1 Correlated Variables and Underlying Factors 369
22.2 Basic Concepts in Exploratory Factor Analysis 370
22.3 Communalities and Eigenvalues 372
22.4 The Principle Factor Method of Extracting Factors 373
22.5 Rotation of Factors 374
22.6 Determining the Number of Factors 376
  22.6.1 “Eigenvalues of one or higher” Criterion 376
  22.6.2 Scree Test 377
  22.6.3 Parallel Analysis 378
22.7 Using SPSS for Exploratory Factor Analysis 379
22.8 Summary 383
22.9 Study Questions 384

Chapter 23

**CONFIRMATORY FACTOR ANALYSIS** 387

23.1 Differences between EFA and CFA Models 387
23.2 Basic Steps for CFA 389
  23.2.1 Specification of the CFA Model 389
  23.2.2 Evaluation of the CFA Model Adequacy 390
23.3 Summary 397
23.4 Study Questions 398

Chapter 24

**ELEMENTS OF STRUCTURAL EQUATION MODELING** 401

24.1 Path Analysis 401
  24.1.1 Path Coefficients 402
  24.1.2 Exogenous and Endogenous Variables 403
  24.1.3 Assumptions 404
  24.1.4 Decomposition of Correlation Coefficients 404
  24.1.5 Testing the Causal Model for Data Fit 406
    24.1.5.1 Just-identified models 406
    24.1.5.2 Overidentified models 407
24.2 Elements of Structural Equation Modeling 412
  24.2.1 Upgrading Models for Path Analysis to Typical SEM Models 412
  24.2.2 Comparing Groups on Latent Variables (Constructs) 413
    24.2.2.1 SEM versus MANOVA 413
    24.2.2.2 Factorial invariance across groups 414
24.2.2.3 Partial measurement invariance 415
24.2.2.4 Structured means modeling 416
24.2.2.5 Group-code (MIMIC) modeling 419

24.3 Summary 425
24.4 Study Questions 427

REFERENCES 429

Statistical Tables 434

Table A-1  Standard normal distribution: z-scores and upper-tail probabilities 434
Table A-2  Critical values of the Student's t-distribution 435
Table A-3  Critical values of the chi-square distribution 436
Table A-4  Critical values of the F-distribution 437
Table A-5  Critical U-values of the Mann-Whitney distribution 442
Table A-6  Critical T-values of the Wilcoxon matched-pairs signed-ranks test 443

Author Index 444

Subject Index 446
Quantitative Research in Education: A Primer, Second Edition is a brief and practical text designed to allay anxiety about quantitative research. Award-winning authors Wayne K. Hoy and Curt M. Adams first introduce readers to the nature of research and science, and then present the meaning of concepts and research problems as they dispel notions that quantitative research is too difficult, too theoretical, and not practical. Rich with concrete examples and illustrations, the Primer emphasizes conceptual understanding and the practical utility of quantitative methods while teaching strategies a Quantitative methods in education engages in the science and practice of educational measurement and evaluation, primarily through the development and application of statistical methods, informed by the study of teaching and learning statistics. In this program, you’ll study quantitative and qualitative research on the methods and uses of educational measurement, evaluation, and statistics to address practical problems. Our students and faculty explore new ways to improve teaching and learning and to meet the demands of practice, policy, and accountability. Areas of emphasis. Your curriculum in Education. Quantitative research requires statistical modeling and statistical modeling requires EDA. There are studies on student performance (particularly international comparative studies like the Programme for International Student Assessment (PISA)). There are investigations of the effects of social background and school type.