

双语版

教育部高等学校心理学教学指导委员会推荐用书

*Study Guide and Solutions Manual*

# 心理统计学习指南

[美] 戴维·皮滕杰 (David J. Pittenger) 著 林丰勋 译注

英文版

教育部高等学校心理学教学指导委员会推荐用书

Fundamentals of Behavioral Statistics

## 心理统计

第九版

[美] Richard P. Runyon 等著  
理查德·鲁尼恩

 人民邮电出版社  
POSTS & TELECOM PRESS

# 心理统计学习指南

〔美〕戴维·皮滕杰 著  
林丰勋 译注

 人民邮电出版社  
POSTS & TELECOM PRESS

## 图书在版编目(CIP)数据

心理统计学习指南/(美)皮滕杰(Pittenger D. J.)著;林丰勋译注.

-北京:人民邮电出版社,2007.10

ISBN 978-7-115-15103-2

I. 心… II. ①皮… ②林… III. 心理统计-教学参考资料 IV. B841.2

中国版本图书馆 CIP 数据核字(2006)第 090859 号

David J. Pittenger

Study Guide and Solutions Manual to accompany

FUNDAMENTALS OF BEHAVIORAL STATISTICS, NINTH EDITION

ISBN 0-07-232406-6

Copyright © 2000 by The McGraw-Hill Companies, Inc.

Original language published by The McGraw-Hill Companies, Inc. All Rights reserved. No part of this publication may be reproduced or distributed by any means, or stored in a database or retrieval system, without the prior written permission of the publisher.

Authorized English language bilingual edition jointly published by McGraw-Hill Education (Asia) Co. and Posts & Telecom Press. This edition is authorized for sale in the People's Republic of China only, excluding Hong Kong, Macao SAR and Taiwan. Unauthorized export of this edition is a violation of the Copyright Act. Violation of this Law is subject to Civil and Criminal Penalties.

本书双语教学版由人民邮电出版社和美国麦格劳—希尔教育出版(亚洲)公司合作出版。此版本仅限在中华人民共和国境内(不包括香港、澳门特别行政区及台湾)销售。未经许可之出口,视为违反著作权法,将受法律之制裁。未经出版者预先书面许可,不得以任何方式复制或抄袭本书的任何部分。

本书封底贴有 McGraw-Hill 公司防伪标签,无标签者不得销售。

北京市版权局著作权合同登记号:01-2006-4897

版权所有,侵权必究。

## 心理统计学习指南

◆ 著 (美)戴维·皮滕杰  
译 注 林丰勋

策 划 刘 力 陆 瑜  
责任编辑 范 颖 陈浩莺

◆ 人民邮电出版社出版发行 北京市崇文区夕照寺街 14 号 A 座  
邮编 100061 电子函件 315@ptpress.com.cn  
网址 <http://www.ptpress.com.cn>  
电话 (编辑部)010-84937150 (市场部)010-84937152  
北京圣瑞伦印刷厂印刷  
新华书店经销

◆ 开本: 787×1092 1/16  
印张: 22.25  
字数: 500 千字 2006 年 8 月第 1 版 2007 年 10 月第 2 次印刷  
著作权合同登记号 图字: 01-2006-4897

ISBN 978-7-115-15103-2/F

定价: 49.00 元

本书如有印装质量问题,请与本社联系 电话:(010)84937153

# 总序

王 垒

中国心理学有一个很早的开端,却有不长的历史。从1900年京师大学堂开设“心理学概论”课程,1917年北京大学成立中国第一个科学心理学实验室,到随后清华大学、杭州大学等一批学校成立心理学系,说起来有一个多世纪了。但由于20世纪战争与和平的较量以及文化意识形态领域里的跌宕起伏,相当多的时间被耽误了,学科发展被拖了后腿,算起来,真正用心做学问的时间大约不过半个世纪。

中国心理学有一个不错的开端,却有坎坷的历程。早在1908~1910、1912~1913年,蔡元培先生两度在德国游学,两度选修了冯特的“实验心理学”课程,这对他后来极力推动北京大学心理学的发展起了很大的影响。更有20世纪20~30年代,唐钺、孙国华、陈立、潘菽、曹日昌、朱智贤、周先庚等一批学者在美国哈佛、斯坦福、康奈尔、芝加哥大学等名校留学归来,投入国内心理学建设,形成了北方、南方诸多学校心理学齐发展的格局。但由于经费困难,后来的战乱,20世纪50~60年代一些对心理学的不公正对待和后来的文化大革命,中国心理学“几起几落”。

改革开放以来,中国心理学迎来了大发展的春天,教学和研究迅速普及,师资队伍和学生规模始终呈加速度扩张。在1980年,国内只有北京大学、北京师范大学、华东师范大学和杭州大学4所学校设有心理学系,到20世纪90年代初中期增加到了约20余所学校,再到21世纪初这几年增加到了100多所学校,几乎是每10年翻两三番!发展速度可谓惊人。

然而,高速发展也产生发展中的瓶颈。一方面,众多学校建设心理学系,开展心理学教学和研究,同时国内社会经济与文化的发展对心理学的需求越来越旺盛;另一方面,国内心理学的总体水平相对西方发达国家还比较落后,教学研究队伍并不强大,教学研究水平仍亟待提高。这种需求与供给、速度与质量的矛盾不断激化,要保证国内心理学的健康发展,必须寻求一些有效的方法和途径。

“西学东渐”、“洋为中用”是可以推荐的诸多方法之一。教育部高教司近年来大力提倡引进外版教材和开展双语教学,这无疑对我国心理学教学的发展产生巨大的推动作用。心理学诞生在西方。据统计,美国每年授予博士学位人数最多的学科是心理学,可见心理学在美国的重要和普及程度。心理学的高等教育在西方积累了较丰富的经验,教材在内容、形式上都比较成熟,而且快速有效地跟进国际心理学科学发展的前沿趋势,对于保持高

等教育的水平有举足轻重的作用。相比来看,我国内地一些地区心理学师资匮乏,一些自编教材低水平重复,对教、学质量均有很大负面影响,情况堪忧。

教育部高等学校心理学教学指导委员会是国家教育部设立的心理学高等教育指导、咨询机构,负责制定国家心理学高等人才培养的宏观战略和指导规范。根据教育部发展高等教育的有关精神,我们与国内外多家出版机构合作,作为一个长期的工程,有计划、分期分批地引进外版教材,以期推动我国心理学教学的快速高效发展。

麦格劳-希尔出版公司在出版心理学教材方面富有经验,此次引进的教材均是麦格劳-希尔多年再版,被实践证明为适合高等学校教学的优秀教材。特别是这些教材均经过国内著名专家学者鉴定并大力推荐,这对引进教材的质量起到了重要的把关作用。在此谨对这些专家学者表示特别的感谢和敬意!

希望这套教材对高校的心理学教学有所帮助,并祝愿我国的心理学高等教育事业蓬勃发展!

王 垒

北京大学心理学教授  
教育部高等学校心理学教学指导委员会主任

## 序

纵观整个心理学的发展史不难发现,心理学研究的每一次重大进展,似乎都与研究方法和手段的发展密不可分,正所谓“科学是随着研究方法所取得的成就向前的。研究方法每前进一步,随之我们面前也就开拓了一个充满种种新鲜事物的更辽阔的远景。”正因此,心理统计学作为心理学研究方法的一个重要组成部分,对于心理专业的学生而言,其重要性无论怎么强调都不过分,但同时,我们又必须正视一个现实,这就是心理统计学常常是学生感觉学习最为困难的课程之一。那么,如何才能学习和掌握好心理统计学呢?根据近20年研究和讲授心理统计学的经验,我认为,要想学习和掌握心理统计学,最重要的有两点,一是注意掌握心理统计学的基本思想,形成科学的统计观;二是注意创造性地将统计思想用于实际研究,从而能够根据研究需要,准确地选择科学有效的统计方法。对于前者,按照布鲁纳的观点,最重要的就是要掌握心理统计学的基本结构,即心理统计学的基本概念和基本原理。只有掌握了心理统计学的基本概念和基本原理,才能更好地理解和记忆心理统计学的基本内容,才能更好地在日后的运用中举一反三,增强迁移能力。对于后者,学生在本科期间,直接从事心理学实际研究的机会并不是很多,因此,取而代之的便是模拟练习,通过模拟练习,增强学生的实际应用能力。因此,我认为,一本好的心理统计学教材或学习指导手册应当满足以上两种要求。

戴维·皮滕杰著的《心理统计学习指南》正是这样一本优秀的学习指导用书。该书每一章由五部分组成。第一部分为“行为目标”,通过对行为目标的界定,明确告诉学生通过学习本章应该达到什么样的目的;第二部分为“研究问题”,通过对研究问题的回答,有助于帮助学生阅读和复习教材中的有关内容;第三部分为“统计术语”,学生藉此可以检验自己对心理统计学基本概念的了解情况;第四部分为“每章温习”,在这一部分,作者提纲挈领地对每一章的主要内容进行总结;第五部分为模拟练习,在这一部分,作者根据每章内容的不同,恰当地设计各种有效的模拟练习题。通过这些模拟练习题,读者一方面可以检验自己对心理统计学基本概念基本原理的了解情况,另一方面也可以检验和提高自己利用心理统计学解决实际问题的应用能力。此外,每一章的最后还附有练习答案。

鉴于该书的上述特点,有理由坚信,无论是对心理统计学的初学者,还是对已经学过又欲进一步提高心理统计学理论水平和应用能力的人,这本学习指南都是一本不可多得的优秀学习指导用书。“工欲善其事,必先利其器”。愿广大读者通过本书的学习,能够达到利器的目的。

本书的译注工作得到了麦格劳—希尔教育出版公司北京代表处和北京新曲线公司的大力支持,在此,深表感谢。

限于译注者水平,译注不当之处,敬请读者和各位专家批评指正。

林丰勋 博士

2006年7月

---

## TO THE STUDENT

---

Statistics is a fascinating topic that will serve you well regardless of your career plans. The 19<sup>th</sup> century author, H. G. Wells, predicted that "Statistical thinking will one day be as necessary for effective citizenship as the ability to read and write." That prediction has come true. Knowing more about statistics will provide you with many insights about the world around you and is a skill that will serve you well. We hope that our efforts as authors and teachers will help make learning about statistics a useful and pleasure-full experience.

Statistics is a language. As with any language, statistics is a form of communication that uses abstract symbols to refer to concepts, events, and places in an efficient manner. As you will learn in this text, behavioral scientists use statistics to communicate to others the results of their research. Our responsibility as the authors of the textbook is to help you learn this language and to help you understand and talk about research using the language of statistics.

I designed this study guide to help you learn and practice statistics. Each chapter of the study guide corresponds to a chapter in *Fundamentals of Behavioral Statistics*, Ninth Edition. I have included exercises, reviews, and other materials to help you become more conversant with statistics. Let's review each of the sections in the study guide and discuss how you should use these aids.

### BEHAVIORAL OBJECTIVES

This list includes the most important skills to develop for each chapter. These objectives are the focus of the exercises in each chapter of this study guide.

### STUDY QUESTIONS

These questions will:

- 1) help you understand why you are reading the material,
- 2) serve as a guide to important material,
- 3) help you understand the context for the material you are reading, and
- 4) help you understand the material.

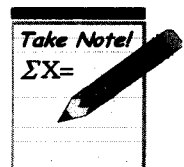
### CHAPTER REVIEW

This section:

- 1) provides a brief review of the material presented in the text,
- 2) condense the main points presented in the textbook, and
- 3) provides additional examples and explanations.

### TAKE NOTE SECTIONS

Throughout the Chapter Review section, you will find the "Take Note" icon like the one to the right. These markers are next to material that is extremely important and the most likely to be troublesome for students to learn. Pay special attention to these sections.



**SELECTED PROBLEMS**

These problems require you to practice skills mastered in the current and preceding chapters, and will contain a combination of calculation and writing. In all cases, you will need to use your logical skills and knowledge of statistics to solve the problems.

**PRACTICE TESTS**

There are two forms of Practice Tests:

- 1) True-False Test
- 2) Multiple-Choice Test

For both practice tests, it is a good idea to write a brief statement of why you believe your answer to be true. This extra effort will help you practice and remember this important material. The answers to the quizzes are printed at the end of each chapter.

**GOOD LUCK!**

Many students make the mistake of studying the material they understand and avoiding the material that confuses them. If you find that you are having trouble with a specific set of problems or questions, spend your time trying to resolve the confusion. Compare your rationale for an incorrect answer with the material presented in the book. With practice, you will overcome your confusion and master the material.

As with any language, you can become proficient only if you practice. Listening to your instructor talk about statistics and reading through your book will help you to learn about statistics, but these alone are not enough for you to become conversant in statistics. The only way to learn any language, and statistics is no exception, is to immerse yourself into its use daily. You must practice the skills often. In time, you will become comfortable with this new means of communication and begin to speak with authority. Indeed, you will even be able to "think" in statistical concepts and terms.

I wish you the best of luck in your statistics course.

A handwritten signature in black ink, appearing to read "D. J. Pittenger", with a long horizontal flourish extending to the right.

David J. Pittenger



# 目 录

第 1 章 统计：处理不确定性问题的算术	1
第 2 章 基本概念	27
第 3 章 探索性数据分析、频数分布及百分位数	49
第 4 章 集中趋势的度量	71
第 5 章 离中趋势的度量	89
第 6 章 标准正态分布	103
第 7 章 统计图与统计表	115
第 8 章 相 关	137
第 9 章 回归与预测	161
第 10 章 概率：推论统计的基础	177
第 11 章 统计推论概述	195
第 12 章 统计推论：单样本	213
第 13 章 统计推论：双样本	237
第 14 章 方差分析概述	259
第 15 章 二因素方差分析	279
第 16 章 相关样本的方差分析	301
第 17 章 类别数据分析：检验和基于二项分布的检验	317
第 18 章 统计推论：顺序变量	337

---

# 1

## Statistics: The Arithmetic of Uncertainty

---

统计：处理不确定性问题的算术

---

## 行为目标

---

在《学习指南》的每一章开始，都将列出本章所要完成的学习目标。这些目标囊括了你通过学习教材和《学习指南》的相应章节后所应掌握的所有主要技能。

1. 举例说明统计分析的各种功能。
2. 指出本书以及原始研究报告中的自变量和因变量。
3. 定义和辨别研究被试和实验变量。
4. 定义并举例说明：常量，变量，数据，总体，样本，参数和统计量。
5. 简述描述统计和推论统计的目的及其区别。
6. 定义实验研究的一般特点，包括实验问题、操作定义和系统观察。
7. 简述研究目标大体上可以分为哪几类。
8. 区分相关研究、完全组研究、准实验和真实验。

---

## STUDY QUESTIONS

---

These study questions are designed to help you read and review the material presented in the textbook. Each question is open-ended and requires a brief written answer. As you read and review the book chapter, take the time to answer the questions in your own words. You may find it helpful to write the question in the margin of the book next to the material that contains the answer to the question. The exercise will help you examine many of the important facts and distinctions presented in each section.

### What is Statistics?

- In what ways do you already use statistics and statistical reasoning?
- What do we expect you to learn about statistics through reading this book?
- Define statistics.
- What is the link between statistics and behavioral sciences such as psychology?

- What are the differences between statistics and personal experience?
- Why do we believe statistics are superior to personal experience?
- What does H. G. Wells' comment about the importance of statistics mean to you?

### **Definitions of Terms Used in Statistics**

- In what ways are variables and constants similar to and different from one another?
- What are dependent and independent variables?
- What is a way of determining which variable is the independent variable and which is the dependent variable?
- What are subject and manipulated variables?
- What is a way of determining which variable is a subject variable and which is a manipulated variable?
- What are the differences and similarities between a population and a sample?
- How are parameters and statistics similar to and different from one another?
- What are the differences between random sampling and random assignment?
- What are the three primary functions of descriptive statistics?
- How do we define induction?
- How do behavioral scientists use inferential statistics?
- What are three types of inferences behavioral scientists make from statistics?

### **Fundamentals of Research**

- What are three primary features of all scientific research?
- Define research design.
- What is the purpose of an operational definition?
- What are direct replication and systematic replication, and what are their roles in scientific research?

### **Types of Research**

- What are the four general categories of research?
- What is the purpose of research that examines the correlation between two variables?
- When conducting a correlational design, what statistical conclusions can the researcher make?
- What is an intact group?

- What is the goal of conducting research where intact groups are used?
- When conducting an intact group design, what statistical conclusions can the researcher make?
- Why is it that researchers cannot infer cause and effect from either correlational research or intact group design research?
- What is a confounding variable?
- What is the importance of random assignment of subjects for inferring cause and effect?
- Why are double-blind procedures important in research with humans?

### Experimental Methods

- What are the three essential features of a true experiment?
- How are random assignment and random selection similar to and different from one another?
- What is the difference between a true experiment and an intact group design with respect to the independent variable?

---

### 统计术语

---

下列术语贯穿教材的第一章。在阅读教材时，要确信自己已经理解这些术语的专业定义。

cause and effect	原因和结果	nuisance variable	干扰变量
comparison	比较	population	总体
confounding	混淆	operational definition	操作定义
constant	常量	variable	变量
correlation	相关	random assignment	随机分派
data	数据	random sample	随机样本
dependent variable (DV)	因变量	replication	复制
descriptive statistics	描述统计	research design	研究设计
direct replication	直接复制	sample	样本
experiment	实验	statistic	统计量
experimental variable	实验变量	statistics	统计学
extraneous variable	无关变量	subject variable	被试变量
independent variable (IV)	自变量	systematic replication	系统复制
inferential statistics	推论统计		
intact group	完整组		

---

**CHAPTER REVIEW**

---

**What Is Statistics?**

For many people, statistics is a collection of numerical facts and general trivia about people and the world in which we live. These people may believe that statistics include such information as: Mark McGuire hit 70 home runs in 1998, Rhode Island is the smallest state, and the Sears Tower in Chicago is 1,454 feet tall. Many people also believe that statistics is a dull and boring topic that has no relation to their lives and is unrelated to any of the behavioral or social sciences. They find it hard to believe that the study of probability and the mathematics of chance can help them in their day-to-day lives or can be used as a way to learn more about human behavior.

Our definition of statistics is much different from these common beliefs about statistics. Statistics is the process of collecting data and making decisions based on those data.

**Statistics is a set of procedures for:**

- measuring behavior,
- collecting data,
- organizing, summarizing, and describing the data, and
- making decisions or inferences from those data.

**Why Should You Learn Statistics?**

A course in statistics is one of the most common courses in the behavioral sciences. Almost all students studying psychology, sociology, or any other social science major will complete at least one statistics course before they graduate. Saying this, however, is like saying you have to take statistics because all the other kids have to take statistics. There has to be a better reason to take this course. We believe that there are several good reasons to study statistics. They are:

**Psychology is the scientific study of behavior and mental processes.**

Psychologists use the scientific method to study why people do the things they do.

**Statistics are very much a part of the scientific method.**

Statistics help us remain objective when analyzing information.

Statistics help talk about the results of a research project.

Statistics help us make rational decisions about our research results.

**Statistics are very much a part of every day life.**

Many people use statistics in their career regardless of their profession.

**Important Terms to Master:**

The following are important terms that researchers use when they talk about research and statistics. Work on mastering these terms.

### What Are Data?

**Data** is a plural noun that represents a set of scores or observations. In statistics, we typically consider data to be a set of numbers we have collected as a part of our research project.

### What Are Populations and Samples?

How are samples and populations similar to and different from each other?

The **population** represents all the individuals we want to describe and understand. A population is a complete set of individuals, objects, or measurements having some common observable characteristics.

A **sample** is a subset of a population. We assume that the sample represents the population.

### What Are Constants and Variables?

How are constants and variables different from each other?

A **constant** is a value that does not change. For example,  $\pi$ , the ratio of the circumference of a circle to its diameter is always 3.1416.

A **variable** is a value that can change. For example, each person can have a different weight. In addition a person's weight can change over time.

### What Are Independent and Dependent Variables?

The difference between the independent and dependent variable is a distinction that many students find troublesome. Make sure that you understand the difference between these important variables.



Be sure you understand the difference between the independent and dependent variable.

What is the main difference between a subject variable and a manipulated variable?

Why are subject and manipulated variables both forms of independent variable?

The **independent variable** is the variable that the experimenter manipulates or controls in order to explain the differences in the dependent variable or to cause changes in the dependent variable.

The **dependent variable** is the outcome of interest that the researcher observes or measures. The data of the research represent the dependent variable.

### What Are Subject Variables and Manipulated Variables?

**Subject variables** are characteristics of the subject that the researcher cannot change.

**Manipulated variables** are variables that the researcher can control.

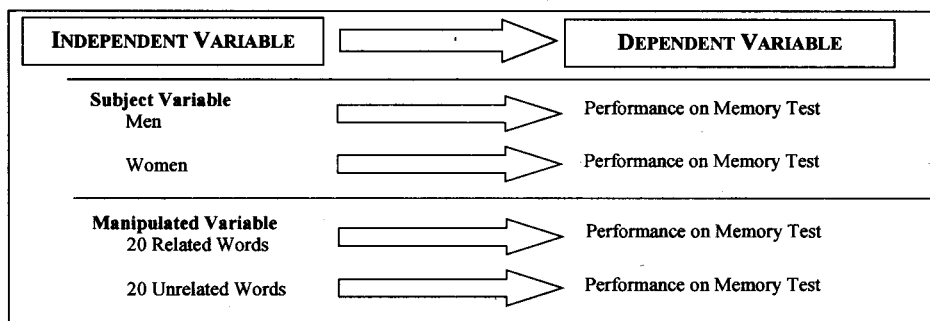
## What Are Random Sampling and Random Assignment?

**Random Sampling** is a process of creating a sample in such a way that each member of a population has an equal likelihood of being selected.

**Random Assignment** is a process of putting subjects into different treatment conditions in such a way that each subject has an equal likelihood of being placed in any condition.

How are random sampling and random assignment similar to and different from each other?

The following figure illustrates the difference between independent and dependent variables and between subject and manipulated variables. There are several things to remember:



The researcher uses the *independent variable* to explain the *dependent variable*.

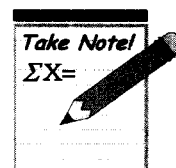
A *subject variable* represents something about the subject that the researcher cannot change as a part of the experiment.

- The researcher **cannot** use random assignment with a subject variable.
- In the first example, the researcher uses gender (men vs. women) as the independent variable.

A *manipulated variable* is a condition that the researcher can control as a part of the experiment.

- The researcher **can** use random assignment with a manipulated variable.
- In the first example, the researcher uses gender (men vs. women) as the independent variable.

How are subject variables and manipulated variables similar to and different from each other?



Many students confuse the difference between subject and manipulated variables.



## What are Parameters and Statistics?

How are samples and statistics related?

A **statistic** is a number resulting from the manipulation of sample data according to rules and procedures.

- ♦ Statistics are variable.
- ♦ Statistics describe characteristics of the sample.
- ♦ Use Roman letters (e.g.,  $r$ ,  $X$ ,  $t$ ,  $F$ ) to represent statistics.

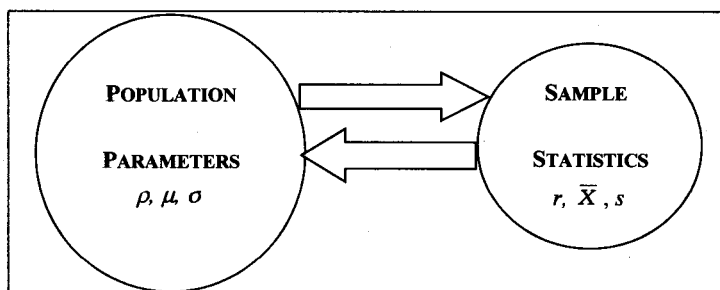
How are populations and samples related?

A **parameter** refers to a characteristic of a population.

- ♦ Parameters are constant.
- ♦ Statistics estimate the value of a parameter.
- ♦ Use Greek letters (e.g.,  $\rho$ ,  $\mu$ ,  $\sigma$ ) to represent parameters.

Here is a simple diagram that may help you understand the difference between populations and parameters, and samples and statistics. The figure illustrates that we take a sample from the population. Using sample data, we calculate sample statistics. From the statistics, we infer the value of population parameters.

How are statistics and parameters related?



How are samples and populations related?

## What Are Descriptive and Inferential Statistics?

There are two general types of statistics: descriptive statistics and inferential statistics. You will learn about both in the textbook. Following is a brief description of the two.

**Descriptive statistics** help us:

- ♦ **organize** the data,
- ♦ **summarize** the data, and
- ♦ **present** the data.

**Inferential statistics** are procedures to accomplish one of three tasks:

- ♦ **generalize** about the value of a population parameter using sample statistics.
- ♦ determine if there is a **systematic relation** between the independent and dependent variable.
- ♦ determine if there is a **cause and effect relation** between the independent and dependent variable.