

Handbook of Research Methods in Clinical Psychology

Edited by

Michael C. Roberts and Stephen S. Ilardi

Handbook of Research Methods in Clinical Psychology

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To Our Wives:

Karen, whose bemused tolerance of the mess in the basement office and of my general distraction when a book is in progress permitted its development.

Michael

Maria, whose love, friendship, and encouragement made this project possible.

Steve

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PART I

Clinical Psychology Research

CHAPTER ONE

Research Methodology and Clinical Psychology: An Overview

Michael C. Roberts and Stephen S. Hirdi

Scientific and Professional Foundations of Clinical Psychology

The field of clinical psychology has a rich history of empirical research across a number of domains: assessment, diagnosis, psychotherapy, experimental psychopathology, and many others (Reisman, 1981; Routh, 1994; Routh and DeRubeis, 1998; Walker, 1991). In fact, an emphasis on the generation of clinically relevant knowledge through rigorous research has been a hallmark of clinical psychology from its inception as a distinct field. Many of the earliest clinical psychologists came to the field with a background in the natural sciences, integrating their scientific proclivities with an interest in generating practical knowledge as a means of addressing an array of clinical problems. Such a foundational merging of science and clinical practice was fortuitous, and it has resulted in a robust empirical foundation for the field. In fact, we would argue that the continued existence of clinical psychology as a vital discipline is contingent upon both the enduring soundness of the field's scientific framework and the demonstrable application of its scientific knowledge as a means of improving human lives.

The founder of clinical psychology, Lightner Witmer, established the first psychology clinic and training program in 1896. Later, Witmer founded and edited the first scientific and professional journal for the developing field, *Psychological Clinic*. Thus, even at the outset, there was an implicit recognition of the value of integrated science and practice. Nevertheless, the research methodologies which characterized most early clinical psychology investigations (and many of the conclusions derived therefrom) are generally regarded as flawed, even primitive, by today's standards. Clinical psychology has benefited from an ongoing process of scientific development and advancement, a process which has tended over time to correct for many methodological and

conceptual foibles (even those vigorously embraced, at one time or another, by most of the field). In fact, the sensibility of employing scientific scrutiny to critically evaluate and refine existing concepts and practices has permeated the history of clinical psychology.

There are three principal professional roles which have emerged in clinical psychology – that of *clinical scientist* (with a primary emphasis on conducting clinical research), that of *scientist–practitioner* (reflecting an equal emphasis on science and clinical practice), and that of *applied clinical scientist* (with a preeminent focus on the application of existing scientific knowledge) – and despite their differing emphases, each role reflects the field’s intrinsic balance between the scientific generation of knowledge and the applied aspects of clinical assessment and intervention. Clinical science and practice are inextricably interwoven and reciprocally inform one another, and (fortunately) many areas of clinical psychology emphasize their integration rather than bifurcation.

The need for extensive research training of aspiring clinical psychologists is a point repeatedly stressed in the field’s historic training conferences (e.g., the famous Boulder Conference of 1949: Raimy, 1950) and the ensuing reports which have come to define clinical psychology as a discipline (American Psychological Association Committee on Accreditation, 2002; Belar and Perry, 1992; Korman, 1976; Roberts et al., 1998; Trierweiler and Stricker, 1998). This sensibility is also reflected in the stated program philosophies, goals, and educational curricula of master’s-level and doctoral programs in clinical psychology and allied fields. For example, the Clinical Child Psychology Program at the University of Kansas (which one of us, MCR, directs) affirms in its philosophy statement that graduates should be “ready for future changes and needs, to produce original contributions to clinical child psychology, and to evaluate their own work and others . . . Equally important in the program is the preparation of students to contribute to and evaluate the scientific knowledge base guiding psychological practice” (www.ku.edu/~clchild). Variations on this and related themes are endorsed by clinical psychology programs of many different orientations and foci. The consensus view is that all clinical psychology graduates should be the beneficiaries of research training sufficient to enable them – at a minimum – to critically evaluate the existing research literature and to engage in informed applications thereof in an array of practice activities.

Today’s clinical psychologist likely will have more formal training than his or her predecessors, inasmuch as the amount of material to be mastered has grown commensurate with growth in the field’s scientific underpinnings. Due in large part to the increasingly rigorous research methodology which has come to characterize clinical psychology, the field has witnessed many important advances in recent decades, including the introduction of novel interventions of high demonstrated efficacy, concurrent with the occasional identification of less effective or even detrimental clinical procedures. Consequently, professionals in the field – regardless of their level of experience – are wise to remain abreast of all new developments in the discipline’s science and practice, and continually to evaluate their own work and that of others in light of relevant scientific advances.

Professional and Research Challenges for Clinical Psychology

Numerous challenges confront today's clinical psychologist, regardless of his or her theoretical orientation or area of activity, and it is our view that such challenges can be met successfully only in tandem with a clear research emphasis. Because the full delineation of all such challenges would be formidable, we will briefly highlight several which appear especially noteworthy. First, research is needed to facilitate a deeper understanding of the fundamental processes of psychological development (normal and abnormal; prenatal to senescence), as an essential precursor to the field's development of more comprehensive models of human behavior. Such enhanced understanding, we believe, will lead to improved preventive and therapeutic interventions on the part of psychologists and other healthcare professionals. While developmental considerations might naturally seem most applicable to clinical child practice, adult clinical psychologists are increasingly recognizing that the process of psychological development continues throughout adulthood. Thus, improved models of psychological change for adult clinical psychology are also needed. Moreover, just as child-oriented researchers and practitioners have long recognized the complexity of families and peers in influencing the process of change over time – as observed, for example, in psychotherapy outcomes – so too will adult-oriented clinical psychologists need to develop such comprehensive multi-person systemic conceptualizations. Second (but relatedly), there remains a need for greater emphasis upon examination of the mediators and moderators of psychological change (including, of course, therapeutic change) as a means of advancing the field beyond overly simplistic understandings (e.g., this therapy *somehow* seems to lead to some improvement for some individuals) toward increasingly sophisticated models which reflect more adequately the full complexity of human functioning.

A third contemporary challenge to clinical psychology to be met by research is to develop clinical assessment devices and methods of greater reliability and validity. Correspondingly, existing diagnostic schemes and taxonomies of psychological disorder are in considerable need of refinement on the basis of applied scientific investigation. Fourth, research can help identify valid and invalid psychotherapies, psychological interventions, and prevention efforts. Improvements in therapy techniques, and in the more precise identification of the processes by which psychotherapies exert their effects, can be accomplished through targeted research informed by the methodologies outlined in this handbook. Measurement of treatment procedures, treatment integrity, behavioral changes, functional performance, objective measurements, perceptions of change, and satisfaction from a variety of sources, follow-up assessment, etc., are needed to establish the “scientific credentials” of each therapeutic approach. Fifth, measurement of the range of outcomes following psychotherapies and preventive interventions can help establish the associated costs and benefits associated with each. Relevant outcomes can include all aspects of a patient's life, such as personal perceptions and functioning, work, and significant relationships (parents, spouses, friends, siblings, offspring). Additionally, research is required to determine the costs, benefits, and harm of clinical psychology activities (e.g., assessment, prevention, therapy) – both with respect to direct as well as indirect effects of such

activities (e.g., practice patterns and charges for psychologist's time; medical cost offsets, insurance reimbursement patterns). The effects of psychological practice (and research) on society in general stand in great need of more rigorous investigation.

A sixth domain of professional challenge and research effort concerns evaluation of the organization and delivery of a variety of clinical services through *program evaluation*. There is an ongoing need within the field for evaluative frameworks, methodologies, and instruments that may be applied across the wide variety of settings (e.g., inpatient/outpatient units; clinics and hospitals; private practice) and problems faced by clinical psychology (e.g., different sets of psychologically related symptoms and diagnoses). At this time, clinical psychology is no longer a single specialty, but is now an amalgam of more specialized substantive foci: clinical child, pediatric, adult clinical, clinical neuropsychology, geropsychology, health, and others. The varieties of these foci require development and acceptance of a multitude of approaches within the scientific traditions of the overarching field of clinical psychology.

A seventh challenging issue, as noted by the Clinical Treatment and Services Research Workgroup (1998) of the National Institute of Mental Health, is reflected in the fact that improvement in research and clinical practice requires an iterative investigational process across a continuum of treatment research emphases: *efficacy* (i.e., demonstrated treatment-related improvements as observed in controlled research studies), *effectiveness* (i.e., the degree to which the treatment is efficacious across the wide array of individuals and therapists found in real-world settings), *practice* (i.e., how services are delivered), and *service systems* (i.e., how mental health services are structured). The translation of research to applied clinical settings with the aim of improving practice is clearly important; equally important, however, is the principle that the research itself be informed by psychology practice. Finding the appropriate mechanisms by which to accomplish such translating/informing actions poses an ongoing challenge for clinical researchers. Finally, informing each of the aforementioned current and future challenges is the fact that clinical psychologists conduct research and practice in an increasingly diverse society, especially in the United States. Populations underserved by mental health service providers are typically those which have been under-researched as well. Finding ways to increase the representativeness of participants in clinical research will enhance the field's ability to respond effectively to each of its principal challenges.

Numerous commentators have highlighted these and other complex challenges facing clinical psychology at present (e.g., Compas and Gotlib, 2002). For example, similar issues have been articulated specifically for the area of pediatric psychology (e.g., Brown and Roberts, 2000; Roberts, Brown, and Puddy, 2002) and clinical neuroscience (Ilardi, 2002), areas in which we have personal interests. We encourage readers of this handbook to remain alert both to the delineation of such challenges as they are outlined in detail in the chapters to follow, and to the many exciting future research opportunities discussed in the book's final chapter. It is our hope that the highlighting of such challenges and opportunities will serve to help catalyze research in such areas for decades to come. We recognize, however, that some of the field's current assumptions and enthusiasms – even some of those emphasized in this text! – will likely be replaced over time as the evidence mounts (as it inevitably does). Indeed, new and completely unanticipated questions will doubtless arrive at the offices, clinics, and laboratories of clinical researchers and practi-

tioners. Nevertheless, the research methods and principles outlined in this handbook, we believe, will remain important to the field's advancement in the years ahead.

Purpose and Overview of this Handbook

Some students (and even some graduated professionals) approach the general topic of “research” with a groan, a dread of boredom, or even with unmitigated fear and loathing – this despite perhaps a grudging recognition of the necessity of research training as a means of fulfilling requirements of courses and/or theses and dissertation projects. Still others view research and the scientific process as interesting detective work, a means of solving important problems and resolving questions tinged with the thrill of discovery. It is this latter sense of excitement at the prospects of discovery which we seek to emphasize in this handbook, though with a clear recognition that individual results may vary. The organization of this handbook reflects the editors' attempt to be comprehensive in coverage, i.e., not providing merely a collection of essays related to research, but an integrated framework allowing the reader to see a broad range of methodologies and their respective applications in advancing the science and practice of clinical psychology. In developing this book we wanted the contributors to convey the excitement of conducting empirical research, utilizing a variety of methodologies, to answer a broad range of enormously important questions facing clinical psychology at present. As noted, such questions may be regarded as challenges to be met through the use of evidence-based approaches outlined herein.

We hope that this book meets the needs for a concise textbook for students, instructors, professionals, and scientists interested in expanding their base of knowledge regarding research methods in clinical psychology. The chapters cover the major approaches to research and design for clinical psychology, with attention to both child and adult populations. In addition, brief research vignettes describe examples of projects with exemplary designs and methodologies as a means of illustrating the essential elements of many of the research topics covered herein. This handbook consists of twenty chapters, each covering a different facet of clinical research. The first two parts of the text examine important issues which affect all clinical researchers – areas such as ethics, research validity, research designs, methodology, and data analysis; the third part focuses on specific topical areas of application in clinical psychology. For many of the latter topics, separate discussions are provided for research with adult and child populations, inasmuch as the research with these populations has become increasingly specialized and independent (although common questions and methods are highlighted as well).

Part one on *Clinical Psychology Research* covers topics of important relevance to all aspects of scientific work in the field. In fact, these are areas which require the researcher's continual attention when applying the content of later chapters on methodology and focal research topics. In a foundational chapter, Michael S. Finger and Kevin L. Rand describe the manner in which confidence in the professional psychologist's findings (and clinical activities) is contingent upon careful attention to numerous validity issues. The authors define and illustrate four principal types of research validity concerns (internal,

external, construct, and statistical conclusion) and illustrate ways of addressing them. They also elucidate many common potential threats to validity in clinical psychology research, and discuss strategies for addressing in simultaneous fashion internal and external validity concerns in research projects. In chapter 3, Michael C. Roberts, Keri J. Brown, and Julianne M. Smith-Boydston outline issues germane to moving research through the review process to the publication end stage. They discuss how to determine what is publishable, how to select a publication outlet, how to prepare a manuscript, and many possible outcomes of the editorial review process. In chapter 4, William A. Rae and Jeremy R. Sullivan elucidate ethical considerations in clinical psychology research. These authors articulate important ethical concerns that may arise in each of four phases of the research process: research planning, institutional review boards, informed consent, and analysis and write-up for publication. They focus special attention on issues of confidentiality, research with vulnerable populations (including children), and use of deception and recording (e.g., audio/video).

In part two of this handbook the focus shifts to the foundational research designs and statistical approaches requisite to conducting appropriate research on the central questions posed in clinical psychology. In chapter 5, Cynthia M. Anderson and Christine Kim describe specific strategies for examining data obtained from the individual psychotherapy client, as opposed to larger groups of participants. Derived from applied behavior analysis, these single-case techniques are particularly applicable to heuristic, exploratory investigations in the early stages of intervention research, as well as for practicing clinicians attempting to evaluate the effects of their therapeutic activities. Anderson and Kim note that single-case approaches are widely applicable to clinical psychology practice, regardless of the theoretical orientation of the practitioner. Next, in chapter 6, Andrea Follmer Greenhoot discusses the design and analysis of experimental and quasi-experimental investigations. She presents the principal types of experimental designs and the set of related statistical techniques commonly used to investigate between-group differences on key variables (e.g., to evaluate the effects of a psychotherapy intervention versus a control condition). In chapter 7, Charles M. Judd and Melody S. Sadler focus attention on the analysis of datasets in which the variables of interest are measured as they are found (*observational data*); i.e., the key variables are not manipulated in an experiment. These authors address the conceptualization of correlational research, the pragmatic concerns of correlational data analysis, and strategies for the resolution of interpretational difficulties. In chapter 8, Samuel B. Green and Marilyn S. Thompson describe a specific form of statistical analysis which has become widely used by psychological scientists over the past two decades: structural equation modeling. Clinical psychology research involves the examination of human behavior and change via increasingly complex theoretical models capable of representing causal interrelationships among a large number of variables over time; structural equation modeling provides one such useful modeling approach. In chapter 9, Gloria L. Krahn and Michelle Putnam describe the applicability of qualitative research in clinical psychology. They demonstrate how qualitative research, if undertaken systematically and with proper training, may constitute a useful scientific approach. They outline principles involved in selecting qualitative techniques, the practical applications of the various qualitative methods, and optimal ways to resolve challenges of sampling, data collection techniques, and analyses. Part two

concludes with chapter 10, Joseph A. Durlak's treatment of the basic principles of meta-analysis as applied to clinical psychology topics. He notes that meta-analytic techniques are useful statistical methods of reviewing and summarizing clinical psychology research that may be dispersed across many studies. Durlak describes the basic methodology of meta-analysis and provides examples to illustrate his points. He also notes that meta-analytic studies help elucidate problems with extant research studies and indicate where further work is needed.

In the third and final part of this handbook, a wide range of more focal *topics of research* is considered. Many of these topics are covered across two separate chapters, with emphases on child and adolescent versus adult populations, respectively. In chapter 11, Eric M. Vernberg and Edward J. Dill outline developmentally oriented research frameworks for examining the manner in which psychological problems emerge, intensify, and remit. Although the term *developmental psychopathology* is often thought to refer exclusively to child/adolescent disorders, developmental approaches are those based on consideration of change over time (and thus applicable to adults as well). Vernberg and Dill present the core research issues in this area by means of a series of "research tasks" for research in developmental psychopathology. Chapter 12 has a parallel focus on psychopathology research among adult populations. Written by John P. Kline, Steven D. LaRowe, Keith F. Donohue, Jennifer Minnix, and Ginette C. Blackhart, this chapter describes the manner in which experimental psychopathology encompasses the investigation of causal mechanisms associated with psychological disorders across multiple intersecting levels of analysis (e.g., neurophysiological, cognitive, affective, interpersonal, etc.). As the term implies, experimental psychopathology derives from the tradition of lab-based experimental psychology, and involves the application of experimental principles and methods to the study of psychological disorders. Both psychopathology chapters demonstrate the importance to clinical psychology of the ongoing development of a scientific knowledge-base regarding the processes through which psychological problems develop and progress.

In the book's next two chapters, the emphasis shifts to the assessment and diagnosis of children and adults, respectively, with extensive coverage given to research methodologies used to develop assessment instruments and to conduct empirical evaluations thereof. Diagnostic assessment has always been an important aspect of clinical psychology, and the field continues to witness important new conceptualizations and evaluative approaches in this area. In chapter 13 on child and adolescent assessment and diagnosis research, Paul J. Frick and Amy H. Cornell demonstrate the techniques of psychological assessment with children and the applicability of scientific research techniques in evaluating the instruments used in assessment. Throughout their chapter, Frick and Cornell indicate that, all too often, instruments used in psychopathology research are different from those which are useful in applied clinical assessment settings with children and adolescents. In chapter 14, Thomas E. Joiner, Jr., and Jeremy W. Pettit describe the primary conceptual issues germane to research in the area of clinical assessment and diagnosis, and they suggest several strategies for implementing research with the existing array of clinical assessment techniques. In particular, they highlight three common approaches used in this work – structured clinical interviews, symptom scales, and projective tests – and discuss the degree to which the extant empirical literature which supports (or fails

to support) major assessment instruments within each of these domains. The authors also highlight limitations associated with the field's DSM-based diagnostic classification system, and suggest ways of facilitating research progress in assessing and diagnosing psychopathology.

Another significant area of activity for clinical psychologists has been the development, evaluation, and application of psychotherapeutic interventions for the various clinical concerns. In chapter 15, Ric G. Steele and Michael C. Roberts detail therapy and interventions research with children, youths, and families. These authors emphasize empirically supported treatment approaches and discuss such issues as efficacy, effectiveness, treatment selection, study participant selection, internal and external validity, and treatment integrity. In chapter 16 on therapy and interventions research with adults, Anne D. Simons and Jennifer E. Wildes provide an overview of issues central to conducting psychotherapy research with adults. They explain that such research examines whether an intervention works, how and why it might work, factors which might affect its efficacy, and how long the effects might last. The authors also provide an overview of the methods and current trends in research regarding the effects of adult psychotherapy.

An important aspect of clinical psychology, sometimes neglected, is the fact that often the most efficient means of alleviating distress is to intervene *before* any problems are evident – for example, by creating healthier psychological environments for at-risk individuals, especially during temporal windows of vulnerability at key stages of development. Consequently, in chapter 17 on research in prevention and promotion, George C. Tremblay and Barbara Landon emphasize that a developmental perspective underlies most effective prevention approaches. They detail the salient issues facing prevention research in clinical psychology, and describe the prevailing methodologies for conducting scientifically sound research on prevention programs. In an overview of material germane to each of the aforementioned topics in part three, in chapter 18 Yo Jackson explicates research in ethnic minority communities. She calls for greater multicultural competence among clinical psychology researchers, and describes the research challenges raised by an ethnically diverse population in the need for more research with different groups. She attends to the conceptual and pragmatic issues of conducting such research in order to generate useful findings, while remaining attentive to the importance of accounting for cultural differences.

As clinical psychology has developed as a profession, it has increasingly examined a range of professional issues, such as training and education, ethics, licensing and credentialing, practice, and service activities. The methodologies requisite for the empirical investigation of such issues are described in chapter 19 by Michael C. Roberts, Jodi L. Kamps, and Ephi J. Betan. The authors report on existing research covering a range of topics and methodologies, such as surveys regarding outcomes of training (e.g., student placement) and attitudes about various issues affecting the field (e.g., managed care, ethics), clinical case analysis and practice pattern studies, and even research on the research activities of clinical psychologists.

Finally, in chapter 20, Stephen S. Ilardi and Michael C. Roberts focus attention on a number of important windows of opportunity for scientific discovery in the discipline of clinical psychology in the years immediately ahead. They give primary coverage to areas

of exploration which represent the extension of existing productive research programs that aim to address myriad important unresolved questions regarding psychotherapy, assessment, and experimental psychopathology. In addition, the editors discuss research which is likely to emerge in the context of clinical psychology's ongoing "prescription privileges movement." Finally, they provide a brief overview of groundbreaking statistical techniques which are likely to be of importance to the field for years ahead.

Throughout the chapters that constitute part three there are interwoven nine illustrative research vignettes by Anne K. Jacobs. These vignettes were chosen to highlight, by means of critical attention to actual published research articles, the principles discussed by each set of chapter authors. In addition to selecting and succinctly describing exemplary research articles, Dr. Jacobs explains the limitations and strengths of each in contributing to the science and practice of clinical psychology.

Conclusions

Clinical psychology has distinguished itself from other helping professions by an enduring and unabashed reliance on its foundation of scientific research. Accordingly, the chapters to follow in this handbook provide an in-depth overview of both the basic methods of research in clinical psychology and the principal research domains that continue to engage the field – with treatment, assessment, and psychopathology pre-eminent among them. Considerable attention is accorded throughout the text to a description of new developments and cutting-edge advances in knowledge and research methodology, with an eye toward both equipping and inspiring the next generation of clinical researchers. To this end, we are pleased and honored to have obtained for this handbook the contributions of an eminent and talented set of scholars, who have provided herein insightful coverage of leading-edge methodologies and an overview of the areas of inquiry which continue to command the attention of clinical psychological researchers throughout the world. As scientist–practitioners ourselves, we anticipate a bright future for the discipline of clinical psychology, but only to the extent that clinical psychologists remain committed to the century-old process of strengthening and building upon the field's scientific foundation.

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CHAPTER TWO

Addressing Validity Concerns in Clinical Psychology Research

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Validity concerns are pervasive in psychological research, from simple correlational investigations to the most complex experimental studies. Research in clinical psychology is no exception, as clinical researchers must address validity issues ranging from the demonstrated construct validity of clinical treatment manipulations to the generalizability of findings from the laboratory to applied settings. Generally speaking, the researcher's confidence in his or her findings will be commensurate with the degree to which he or she has adequately addressed validity concerns. Moreover, the process of addressing validity issues during the design phase of a study will help the investigator identify potential flaws in study design (e.g., treatment manipulation, variable measurement, etc.) that could confound the interpretation of any observed causal relationships.

Arguably, the four most common types of research validity addressed in the literature are *internal*, *external*, *construct*, and *statistical conclusion*. This chapter will describe and explicate each of these types of validity. In addition, it will identify potential confounds that threaten each type of validity in any given study. It is often the case that internal validity is maximized at the sacrifice of external validity, or vice versa. Accordingly, a discussion on the optimal balancing of internal and external validity concerns is included in the final section of this chapter.

Four Types of Research Validity

Defining the validity of research

Within the domain of psychological measurement, the concept of validity generally refers to the theorized relationship between a psychological inventory and its associated

hypothetical construct(s). An instrument is said to be *valid* to the extent that it actually reflects the construct that it purports to measure. Valid conclusions regarding the theoretical constructs are possible if empirical observations are obtained from construct-valid measures of the variables.

While *measurement validity* is a central concern in the development of psychological tests, the need to demonstrate *research validity* arises in the context of empirical investigations. For example, to what extent does an employed treatment manipulation accurately reflect the theoretical treatments or therapies under investigation? To what extent are the conclusions drawn from statistical analysis of empirical data appropriate? To what extent do the results of the study at hand generalize to a different setting or population? Each of these questions pertains to research validity, and by asking and addressing such questions, the researcher strengthens the justification of results and conclusions from psychological investigations.

A research study on optimism training

To help elucidate the present discussion of research validity, we will reference the following hypothetical research scenario throughout the chapter; it will be referred to as the *Optimism Study*.

A team of academic researchers, affiliated with a mental health center in a large, midwestern city, investigated the effects of a novel psychotherapy technique – *optimism training* – for the treatment of unipolar major depression. *Optimism training* was provided concurrently with a standard cognitive-behavioral therapy protocol (CBT; Beck, Shaw, Rush, and Emery, 1979). Initial assessment at the center entailed administration of the SCID-I (Spitzer, Williams, Gibbon, and First, 1993), a structured diagnostic interview. Clients, who were self- or physician-referred to the center after the initial start date of the investigation, and who met the criteria for unipolar depression based on the SCID-I, were recruited to participate in the study. Study participants were randomly assigned either to the combined treatment condition (CBT and optimism training) or to the standard condition (CBT only). Over a 12-week period, one clinic psychotherapist treated all clients from the treatment condition, while a different clinic psychotherapist treated the clients from the control condition. All study participants were administered the Beck Depression Inventory-II (BDI-II; Beck, Steer, Ball, and Ranieri, 1996) prior to treatment, again at the completion of treatment, and once more during a 6-month follow-up visit.

Internal validity

Accounting for changes in a dependent measure by group membership or treatment manipulation is common in psychological research. Thus, it is important that certainty

can be placed on any research conclusions that draw causal inferences from one or more independent variables (IVs) to a dependent variable (DV). *Internal validity addresses whether changes on a DV are attributable to the IVs*, or due to alternative, extraneous variables, called confound variables. Confounds of the IVs present competing explanations for a study's findings and they diminish confidence in the observed effects of the given IVs. By addressing such threats to internal validity before commencing data collection, the researcher may take into account possible confound variables and exclude alternative explanations for results (i.e., other than the effect of IVs).

For present purposes, an IV is any variable that is manipulated or that could potentially be manipulated. IVs may also include preexisting groups from which participants can be sampled. A true experimental IV, such as drug dosage, is actively varied or manipulated across participants in a study. On the other hand, persons from preexisting populations are sampled to form a quasi-experimental IV, sometimes because active manipulation on such a variable is undesirable and/or harmful to participants. Examples of quasi-experimental IVs based upon group membership include smoking, marital status, and reported history of sexual abuse.

Threats to internal validity will be grouped based on the categorization of research designs of Campbell (1957). A unique set of internal validity threats is associated with each design. Such organization will demonstrate how potential threats to internal validity can be identified through attention to experimental design.

Correlation and quasi-experimental designs

One-group pretest–posttest

In the one-group pretest–posttest design, a single group of individuals receives a single form of experimental manipulation. An initial measurement or observation of the dependent variable(s) is taken prior to the manipulation, and a second measurement is taken after its completion. Often helpful in behavioral research and applications, the one-group pretest–posttest design can be used to demonstrate the efficacy of a specific treatment intervention, although without regard to the effects of alternative treatments (including the option of *no treatment*). The *Optimism Study* would have been a one-group pretest–posttest design if a single group of clients received CBT and optimism training (and the 6-month follow-up assessment was not conducted). The following five confounds can threaten the internal validity of a study using the one-group pretest–posttest design: history, maturation, testing, instrumentation, and regression to the mean.

History. Specific events can occur in the lives of participants during an investigation, aside from treatment or experimental manipulation that participants receive. Such events present possible explanations for changes in the DV. These events can occur within or outside of the research setting. In the one-group version of the *Optimism Study*, suppose that the mean depression level among participants was significantly lower after treatment than at the beginning of treatment. However, suppose further that over the course of the study, a long-standing economic recession in the area lifted, dramatically easing a local unemployment crisis. Such economic events would compete with the treatment as an

explanation for the observed reduction in mean depression levels. However, history effects can be accounted for in an experimental design by the inclusion of a control group, i.e., a group receiving no treatment at all. If the average change in DV scores in a control group was statistically similar to the change observed in the treatment group, then some variable, aside from the treatment manipulation, would be influencing levels on the DV.

Maturation. Developmental changes that occur over time within the participants can compete with treatments in explaining changes in the DV. These developmental changes include not only factors associated with growth, as maturation implies (e.g., growing older, getting stronger, etc.), but also with degeneration (e.g., growing tired or getting annoyed from extended participation, unexpected brain damage, etc.). In the example of the optimism training study, although the improvement in clients' mood appears likely due to the treatment intervention, it is also the case that most clients experience spontaneous remission of depressive symptoms in the absence of any intervention (American Psychiatric Association, 1994). As was the case for the threat of history, maturation effects can be controlled for with the use of a control comparison group.

Testing. The method of observation, or testing, can itself lead to changes in the dependent variable. Taking a test once can influence a participant's performance on subsequent administrations of that test. For example, a participant who completes the BDI-II may report fewer depressive symptoms merely on the basis of having been previously exposed to the BDI-II. In fact, the repetition of assessments can directly lead to an improved score on any measure of personality pathology or maladjustment (Kazdin, 1998).

Thus, it becomes important to distinguish between reactive and nonreactive measures (e.g., Campbell, 1957, 1977). The reactivity of a psychological measure can be considered to lie on a continuum, ranging from a relatively nonreactive measure (e.g., measuring someone's height) to a considerably reactive measure (e.g., observing someone's eating habits). Often, the optimal method for controlling the effect of testing is to select the most nonreactive measure possible. Note that assessing the degree of reactivity for a measure is a subjective decision, which can depend on the setting and use of a particular instrument.

Instrumentation. Instrumentation, or *instrumental decay*, refers to any changes in the measurement instruments, procedures, or observers used during a study that might lead to changes in the dependent variable(s). Changes in observers, such as fatigue, may threaten the internal validity of a study through instrumentation. (In contrast, the threat of maturation is specific to changes only within the participants.) Longitudinal studies are especially susceptible to this threat, as changes in technology and knowledge may lead to changes in measurement devices. The threat of instrumentation also occurs when the instructions for a questionnaire change over time.

In the *Optimism Study*, giving different instructions for completing the BDI-II – such as changing the rating scales of the items – between the first and second administration could affect the obtained BDI-II scores. Alternatively, if the BDI-I (Beck, Shaw, Rush, and Emery, 1979) had been used for the first administration and the BDI-II for the second administration, the differences in scale construction between forms could have caused unintentional (artifactual) differences in the obtained scores.