
Up until a few years ago, outside of Schumacker and Lomax (1996), there was a paucity of texts that were suitable for gingerly introducing the graduate student to structural equation modeling (SEM). Even though Hayduk (1987) and Bollen (1989) were both excellent in their comprehensive review of SEM, for the student who was being introduced to covariance modeling for their first time, and especially if SEM was being instructed as part of a semester length multivariate statistics course, their texts were a bit difficult to digest given the temporal and pedagogical constraints. However, recently there has been a flourish of introductory texts (e.g., Byrne, 1998; Kelloway, 1998; Mavryna, 1997) that may prove to be appropriate as introductory windows into SEM. One recent addition is Principles and Practice of Structural Equation Modeling authored by Rex Kline. Kline makes clear in his preface that "although this book is written for applied researchers and not statisticians and assumes only familiarity with very basic statistical concepts . . . complex topics are not avoided" (p. ix). Hence, even though there may be passages in this text that the seasoned modeler could readily bypass, there is enough substantive material that will intrigue both novice and expert.

In his introductory chapter, Kline assures the reader that advanced quantitative skills will not be needed for this text, even though a background in elementary statistics (e.g., correlation) will be fruitful. An egalitarian approach is employed in the notation, hence, not favoring any one particular software (e.g., Greek subscripts for LISREL). Besides briefly delineating the outline of the text, the bulk of this chapter covers some very general principles (e.g., SEM can be applied to nonexperimental and experimental data, the SEM family also includes many standard statistical procedures, and so forth). Even though one of the principles, "SEM is a large-sample technique" (p. 12), has generally been the normative guideline, a text that has since been released—Statistical Strategies for Small Sample Research (Hoyland, 1999)—may have others give some pause to small sample issues and is a useful citation for Kline's subsequent edition of this text.

Chapter 2 ("Basic Statistical Concepts") reviews some of the fundamental statistical topics associated with the correlational or regression approach. For the see-
tation maximization). Multicollinearity, normality, transformations, and outliers are other assumed domains covered in this chapter. Especially relevant univariate and multivariate normality is the investigation of some skewness reduction it is necessary to keep in mind that in the context of Smallest i.e., the (s) in the (t-test, DeCarlo t's) 1979 estimator, which I highly recommend makes clear that positive kurtotic distributions are heavy tailed whereas negative kurtosis implies a light-tailed distribution. This is a point that is frequently misunderstood in many other chapters.

Chapters 5 and 6 encompass both recursive and nonrecursive path models. Chapter 5, the tenets of assessing causality are initially reviewed as a prerequisite fuller exposition on the specification of path models. Model development a measurement issues are briefly delineated, even though for the novice modeler it imperative that they access the psychometric literature, e.g., Nunnally (1994) to develop the requisite knowledge base in this area. Instruct using this text will be pleasurable with Kline's treatment of identification. Even though Bollen (1989) provided a coverage of this subject matter that is examples Kline provides a very intelligible review of identification, a subject area that is relatively complex. Sample size issues are discussed in a subsequent section with the oft-recommended recommendation that there be at least a 10:1 ratio of participants to parameters. Even though published after Kline's book went to press, this sampling size convention has come under some scrutiny, with some rather counterintuitive findings by Marsh, Hau, Balla, and Grayson (1998). Estimation and interpretation of a path model in a regression context and the decomposed effects, using a structural equation set, is discussed in detail. This segues into a nontechnical description of estimation and the attendant assumptions when employing ML. The various type of fit indices (e.g., incremental fit indices) are described, with a necessary elaboration on the caveats associated with interpretation as well as what constitutes good fit. With the plethora of fit indices now available in most of the software packages, it is not the exception that in many modeling efforts there is bound to at least one fit index (e.g., Goodness-of-Fit Index) that may be indicative of one model fitting the data. Hence, in that context it was encouraging that Kline emphasized that "model fit is a multifaceted concept" (p. 131) and reliance on one type of fit index is problematic. Testing path models, model trimming, and nice discussion of equivalent models follows, with the chapter on recursive vs. model finishing up with a brief review of alternative estimation procedures (e.g., generalized least squares, unweighted least squares, etc.). Kline's comment that unweighted least squares and generalized least squares may be advantageous over ML in that they require "less computation time and presumably less comput memory" (p. 144) probably should not be a crucial determinant in the selection of estimation procedures given the relative accuracy in the quality and speed of present-day computers. Rather, statistical or theoretical considerations should drive the engine (a recent article by Olson, Troy, & Howell 1999) further coin tributes to the ML vs. GLS literature.
Reise and Widman (1999) that explored "similarities and differences in person-fit assessment under item response theory (IRT) and covariance structure analysis (CFA) measurement models" (p. 3).

Chapter 8 brings together the measurement and structural models, with Kline arguing the term hybrid model to describe this synthesis of model testing. Much of the beginning of this review is patterned after the CFA chapter, including model characteristics and issues related to model identification. For the purpose of identification and testing strategy, Kline also delineates the step-by-step procedure (model specification, model estimation, and model evaluation), which has been an accepted practice in the testing of hybrid models. However, as mentioned earlier, Hayduk's (1996) chapter on one-step vs. two-step modeling (which emphasized much discussion on SEMNET) provides an option that argues against the sole reliance on the two-step process. A detailed example of the two-step process is provided using a clinical example (i.e., familial risk for psychopathology and child adjustment). The results of alternative specifications (e.g., three-factor vs. four-factor models) are also contrasted and discussed in sufficient detail. A brief description of a two-wave longitudinal model follows, which for some introductory texts might be included in a chapter of advanced topics.

As with any statistical tool, whether it be a simple 2 x 2 contingency analysis (as I for a more advanced modeling endeavor (e.g., SEM, hierarchical linear modeling), an understanding of the fundamental assumptions and properties of the technique at hand is imperative. As the researcher pursues methods requiring higher levels of sophistication, such as SEM, even more background knowledge is necessary. Hence, Chapter 9 (How to Fool Yourself with SEM) will provide for the introductory student a much-needed checklist of pitfalls, cautions, and do's and don'ts. This set of guidelines is demarcated by four major topics: specification (e.g., fail to have sufficient numbers of indicators of latent variables), admissibility or measurement error correlation (e.g., if two or more factors are highly correlated, then the model is identified) (p. 255). Even though that description might be lacking, there have been many discussions in SEMNET, part, and parcel based on a chapter by Hayduk (1996), challenging the requirement for four indicators in the context of the one-step versus two-step modeling process. To avoid these pitfalls, the implications for nonnormality are given a nice treatment. A variety of CFA models are presented next, including single factor and multifactor models, equivalent models, multiple-group CFA, and so on. Kline provides the necessary statistics and data set for each of the CFA examples; hence, this could lead to an appropriate homework assignment if this text is used in a classroom environment. The chapter finishes with a brief but essential review of models with ordinal or categorical indicators. Within this section, readers who are intrigued by Kline's reference to item response theory as an alternative to CFA may also be interested in a recent article by
ademic environment, the book is written clearly enough that the interested reader can readily absorb the material on his or her own initiative.

REFERENCES


Rex B. Kline, PhD, is Professor of Psychology at Concordia University in Montréal. “This book is unique in that it treats structural equation models for what they are—carriers of causal assumptions and tools for causal inference. Gone are the inhibitions and trepidation that characterize most SEM texts in their treatments of causal inference. - 427 pages. This bestselling text provides a balance between the technical and practical aspects of structural equation modeling (SEM). Using clear and accessible language, Rex B. Kline covers core techniques, potential pitfalls..."