

BUSI 808
Applied Research Methods I
Spring 2014
Course Syllabus

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Course Description:

This course is the first of a two-course sequence (BUSI 808, BUSI 809) that covers fundamental issues in conducting empirical research in the social sciences, focusing on business administration (e.g., organizational behavior, corporate strategy, marketing, international business, operations management, behavioral accounting) and allied disciplines (e.g., psychology, sociology, communications). This course sequence is designed for doctoral students who intend to conduct empirical research publishable in scholarly journals. The course sequence is organized according to stages in the research process, from the initial framing of a research question through design, measurement, and analysis, and culminating in publishing the results of one's work. This first course begins with the selection and framing of a research question, the philosophy of different research approaches, choices in method and design, the role of theory, and how to take stock of knowledge in your area. The course then moves to measurement, covering instrument design, reliability, validity, exploratory factor analysis, and confirmatory factor analysis. For each topic, students are assigned core readings, and, when appropriate, are given empirical data to apply the methods under discussion. Students also receive an extensive bibliography on each topic and a detailed written synopsis of key issues. As a prerequisite, students should have a solid foundation in basic statistics, correlation, and regression analysis.

Course Requirements:

Students are required to fully participate at weekly class meetings. Each meeting will include a discussion of the assigned readings and homework, including the results of any data analyses. Students are expected to read all materials and complete all homework *prior to class*. Before each class, students should submit written answers to the assigned homework questions. These answers should be brief (usually 2-4 pages, single spaced) and to the point. When analyses are involved, written answers should include supporting results, excerpts from computer output or brief summary tables (*not* raw computer output). These written answers serve two purposes. First, this course emphasizes hands-on application of various methods, and for learning purposes, there is no substitute for using these methods and summarizing the results in writing. Second, written answers to homework questions provide an important means of monitoring learning throughout the course. When these answers show that certain topics are not well understood, these topics will be reviewed in class. Students may consult with each other regarding the concepts and principles underlying the methods used. However, *written answers should represent the work of each individual student*. Moreover, *students must not obtain answers to homework questions from students who have previously taken this course*. Drawing from the work of current or past students is considered a violation of the honor code and carries the risk of failing the course and other appropriate sanctions. Written answers to homework assignments will constitute 100% of the final grade. Students are also strongly encouraged to bring questions of their own to raise in class for discussion. These questions help us collectively address points of confusion and pursue issues that extend beyond the assigned readings.

For assignments that require data analysis, students must have access to statistical software. I will conduct analyses using windows versions of SPSS, STATA, SYSTAT, SAS, and LISREL (all but SYSTAT are available on the business school network). I will provide guidance regarding the use of this software (e.g., sample input files, answers to basic questions). However, students also find it useful to seek help from documentation provided with this software, the helpdesk of the UNC Information Technology Services (962-5261, help@unc.edu), and web pages and listservs devoted to the software, which include the following:

SPSS: http://www-947.ibm.com/support/entry/portal/product/spss/spss_statistics

STATA: <http://www.stata.com/support/>

SYSTAT: <http://www.systat.com/Support.aspx>

SAS: <http://support.sas.com/techsup/intro.html>

LISREL: <http://www.ssicentral.com/lisrel/resources.html>

Students may use other software but will be responsible for converting the data files provided and for running the software.

Required Reading Materials:

Required reading materials for the course include books, book chapters, and journal articles. Books for the course are the following:

Booth, W. C., Colomb, G. G., & Williams, J. M. (2008). *The craft of research* (3rd ed.). Chicago: University of Chicago Press.

Pedhazur, E. J., & Schmelkin, L. P. (1991). *Measurement, design, and analysis: An integrated approach*. Hillsdale, NJ: Erlbaum.

Singleton, R. A., Jr., & Straits, B. C. (2009). *Approaches to social research* (5th ed.). New York: Oxford University Press.

Williams, J. M., & Bizup, J. (2013). *Style: Lessons in clarity and grace*. New York: Longman.

Pedhazur and Schmelkin (1991) and Singleton et al. (2009) will be the primary texts for the course. The books by Booth et al. (2008) and Williams and Bizup (2013) provide background that will be useful for written assignments for this class and papers for other degree requirements and for publication. Other reading material will consist of chapters and journal articles, which I will distribute via email.

Summary of Topics:

1. **Overview of the Research Process:** The nature of science; the meaning of programmatic research; stages in the research process; characteristics of an interesting, important, and relevant research question.
2. **Philosophy of Science:** Fundamentals of the scientific method; philosophy of science; causality; normal science vs. social science; positivism, postpositivism, critical theory, and constructivism.
3. **Choices in Method and Design:** Choices in research design; comparing the strengths and weaknesses of different research designs and methodological approaches; laboratory versus field methods; qualitative versus quantitative methods.
4. **Developing and Evaluating Theory:** The role of theory in social science research; elements of a theory; criteria for evaluating theory; using theory to develop propositions and hypotheses.
5. **Reviewing and Integrating Research:** Locating relevant research; computerized and ancestral literature search; integrating research findings using narrative reviews and meta-analysis.*
6. **Sampling:** Populations versus samples; methods of sampling; representativeness vs. practicality; sampling bias; determining required sample sizes using power analysis.*
7. **Instrument Design:** Conceptual and operational definitions; generating an item pool; evaluating item characteristics; determining measurement format and type of scale.
8. **Interviewing Techniques:** Designing an interview schedule; setting the stage for the interview; motivating the respondent; using probes and follow-up questions.
9. **Reliability and Classical Test Theory:** Essentials of classical test theory; sources of measurement error; methods for estimating reliability; correction for attenuation.*
10. **Validity:** Distinguishing between different forms of validity; the central importance of construct validity; the assessment of convergent and discriminant validity using multitrait-multimethod matrices.*
11. **Exploratory Factor Analysis:** Principal components vs. common factor analysis; extracting and rotating factors; construction of factor scales and scores.*
12. **Confirmatory Factor Analysis I:** Comparisons between exploratory and confirmatory factor analysis; model specification, identification, and estimation; assessment of model adequacy and fit.*
13. **Confirmatory Factor Analysis II:** Comparing congeneric, tau-equivalent, and parallel measurement models, modeling method factors, assessing convergent and discriminant validity.*

*Indicates classes that involve data analysis.

Session 1: Overview of the Research Process

Required Reading:

Singleton et al. (1993, 1999, 2004, or 2008), ch. 2

Walsh et al. (2007), pp. 129-132

Bennis and O'Tolle (2005)

Huff (2000), pp. 53-56

Tushman and O'Reilly (2007)

Davis (1971)

Assignment Questions:

1. Singleton et al. (1993, 1999, 2004, 2008) discuss social science research, framing it as a four-stage process that links theory, prediction, observation, and empirical generalization. Ideally, research involves a balanced emphasis on these four stages. However, in some areas, research places excessive emphasis on one stage (e.g., empiricism with little guiding theory, theory that is not subjected to empirical test), or some stages in the process are not adequately linked (e.g., research emphasizes deductive, theory-driven inquiry to the exclusion of inductive, exploratory research, or vice-versa). Identify an area in which you plan to conduct research. Does research in this area place equal emphasis on the four stages described by Singleton et al.? Has it deviated from the cyclical process that Singleton et al. describe? If so, what corrective steps should be taken to advance knowledge in your area?
2. The excerpt from Walsh et al. (2007) frames what has become an ongoing debate concerning rigor and relevance in management research. Read this excerpt, followed by the position expressed by Bennis and O'Toole (2005) and March, as given in the excerpt from Huff (2000). What is your position on this debate? Do you consider rigor or relevance more important? Next, read Tushman and O'Reilly (2007). Is Pasteur's quadrant a feasible and desirable resolution to the debate?
3. Davis (1971) emphasizes the importance of developing theories that are interesting and presents 12 criteria for judging the extent to which theories are interesting. What are the common themes underlying these criteria? Which criteria do you consider most important, and why?
4. Write a research question that represents your current interests. Consider the extent to which your research question is rigorous and relevant, drawing from Figure 1 of Tushman and O'Reilly (2007). Next, evaluate your question using the principles you identified as most important from Davis (1971). Overall, what is your assessment of your research question in terms of being rigorous, relevant, and interesting? Assign your question a score on each of these three properties using a 10-point scale in which 1 means your question demonstrates none of the property and 10 means your question fully demonstrates the property. Be sure to explain the rationale behind the scores you assign.

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Session 2: The Philosophy of Science

Required Reading:

Bechtel (1988), chs. 2 and 3 (chs. 1 and 4 are optional)

Cook and Campbell (1979), ch. 1, pp. 9-36.

Guba and Lincoln (1982)

Behling (1980)

Platt (1964)

Delanty (1997), ch. 6.

Assignment Questions:

1. Read the chapters from Bechtel (1988) and Cook and Campbell (1979), followed by the articles by Platt (1964), Guba and Lincoln (1982), and Behling (1980), and the chapter by Delanty (1997). Bechtel (1988) and Cook and Campbell (1979) provide background on philosophies of science and other fundamental issues (e.g., theories of causation). Guba and Lincoln (1982) advocate naturalistic inquiry as an alternative to the normal science (i.e., rationalistic) model, whereas Behling (1980) defends the normal science model, and Platt (1964) describes how it can be fashioned to accelerate scientific progress. Delanty (1997) frames the debate between rationalistic and naturalistic inquiry in terms of realism and social constructionism and attempts to offer a resolution to this debate.
2. There is an ongoing debate in the social sciences regarding the applicability of the “normal science” model (also termed “natural science,” “rationalism,” and in some cases, “logical positivism”). Some researchers have staunchly criticized the use of this model in the social sciences, whereas others have defended the model by espousing its merits or arguing that critics of the model misunderstand its basic tenets. Based on your reading, what are the primary arguments for and against the normal science model in the social sciences? Which arguments make the most sense to you, and for what reasons? What alternative models do you advocate, and why? In summary, what philosophical position do you personally hold (i.e., do you support logical positivism, critical realism, social constructionism, naturalistic inquiry, or some combination thereof), and what implications does your position have for conducting science? Be prepared to support your position in a formal debate, which we will conduct in class.

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Session 3: Choices in Method and Design

Required Reading:

McGrath (1982, pp 69-80)

Dipboye and Flanagan (1979)

Mook (1983)

Excerpts from Locke (1986)

Miles (1979)

Yin (1981)

Sechrest and Sidani (1995)

Assignment Questions:

1. Consider the three-horned dilemma described by McGrath (1982). Do you agree that all methods are flawed? If so, how do you explain the dominance of certain methodological approaches in various fields (e.g., laboratory experiments in chemistry and physics, survey research in sociology, case studies in clinical psychology)? More fundamentally, how is useful and valid knowledge gained in any area of inquiry?
2. Read the articles by Dipboye and Flanagan (1979) and Mook (1983) and the excerpts from Locke (1986) written by Locke, Ilgen, and Campbell. Do you believe field settings yield results that are more generalizable than those from laboratory studies? Alternately, do you believe laboratory studies can capture all that is essential for generalization of results to the field? In sum, what is your position on the debate regarding the relative merits of laboratory versus field research?
3. Read Miles (1979). Do you think his dismal assessment of the scientific value of case study analysis is overstated? Can you think of ways that case study data can be rigorously analyzed? Compare your ideas with those of Yin (1981). Does Yin (1981) provide some useful suggestions beyond those you generated? Does he exaggerate the rigor with which case study data can be analyzed? Finally, read Sechrest and Sidani (1995). Do you believe these authors provide a useful integrative position regarding quantitative and qualitative methods?

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Session 4: Theory Development and Evaluation

Required Reading:

Whetten (1989)

Bacharach (1989)

Sutton and Staw (1995)

Weick (1995)

Edwards and Berry (2010)

Hambrick (2007)

Assignment Questions:

1. Whetten (1989), Bacharach (1989), and Sutton and Staw (1995) describe the basic features of theory along with criteria that theories should satisfy. What are the common themes among these criteria? In what ways do the criteria differ from one another? Which criteria make the most sense to you, and why?
2. Weick (1995) questions several of the arguments advanced by Sutton and Staw (1995), and some of these questions also apply to criteria specified by Whetten (1989) and Bacharach (1989). Do you agree or disagree with the position taken by Weick (1995)? Elaborate your answer.
3. Based on your answers to the preceding two questions, develop a list of what you believe are the most important criteria for evaluating theory. Using these criteria, evaluate a theory in your area of research, based on your understanding of the literature in that area. Ideally, this theory should pertain to the research question you developed at the beginning of this course. In what ways is the theory adequate? In what ways is the theory deficient? Suggest some ways to modify the theory to overcome its deficiencies.
4. Edwards and Berry (2010) document the imprecision of management theories and describe ways in which theories can be made more precise. Is the theory you evaluated in the preceding question as imprecise as the theories reviewed by Edwards and Berry (2010)? Describe how the theory you chose could be made more precise by applying the approaches recommended by Edwards and Berry (2010) for increasing theoretical precision.
5. Hambrick (2007) argues that the devotion to theory in management research has become an obsession that is counterproductive to scientific progress. To what extent do the concerns raised by Hambrick (2007) apply to the way theories are treated in your area of research? What steps should be taken to address these concerns?

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Session 5: Reviewing and Integrating Research

Required Reading:

Hunter and Schmidt (1990), chs. 1 and 3

Wanous et al. (1989)

Aguinis et al. (2011)

Supplemental Reading:

Tranfield et al. (2003)

Assignment Questions:

1. Read ch. 1 of Hunter and Schmidt (1990), paying particular attention to problems with narrative reviews (pp. 23-29) and the purposes and advantages of meta-analysis (pp. 33-40). Next, read ch. 3, making sure you understand how to perform a “bare-bones” meta-analysis (pp. 100-114). According to Hunter and Schmidt, what are the primary advantages of meta-analysis relative to narrative reviews? Do any of these advantages seem overstated? Do you see any problems with meta-analysis?
2. Read Wanous et al. (1989) and Aguinis et al. (2011). In what ways do the issues raised by these authors supplement or modify the problems you identified in response to question 1? Overall, what do you consider the primary advantages of narrative reviews and the primary advantages of meta-analysis? List three or more advantages of each approach.
3. Using computer-based and ancestral search methods, locate approximately ten empirical studies in a research area that is of interest to you. If you locate more than ten studies, focus on the most recent studies. If you locate fewer than ten studies, consider including studies using contexts or samples other than those you intend to investigate (e.g., international, government, or nonprofit organizations; student or adolescent samples), or broaden the definition of your focal constructs (e.g., broaden customer satisfaction to include satisfaction in general or other forms of positive affect). Create a spreadsheet that summarizes essential information from these studies (i.e., sample size, effect size expressed as a correlation) as well as other information that may explain variability in the findings of the studies (e.g., quality of design or measurement, type of sample). Summarize your impressions of the studies as you would for a narrative review by visually inspecting the information you assembled and drawing any conclusions you feel are warranted. Then, conduct a “bare-bones” meta-analysis, as outlined on pp. 100-117 of Hunter and Schmidt (1990). Look for moderation by testing the variance of the population correlations, using the chi-square test described by Hunter and Schmidt (1990) and noting the drawbacks of this test. If you find evidence for moderation, perform separate meta-analyses for subgroups of studies. What conclusions can you draw from your meta-analyses? How do these conclusions differ from those you obtained from your narrative review?

Note: The following equations will help you convert test statistics into correlation coefficients.

Equations for converting various test statistics to r

$$t \quad r = \pm \sqrt{\frac{t^2}{t^2 + df}}$$

$$F \quad r = \pm \sqrt{\frac{F}{F + df(\text{error})}}$$

$$\chi^2 \quad r = \pm \sqrt{\frac{\chi^2}{n}}$$

$$d \quad r = \frac{d}{\sqrt{d^2 + 4}}$$

Note: The sign of the computed r should match the sign of the parameter or comparison being tested. For instance, if the t -statistic is negative, then the sign of the computed r should also be negative. Likewise, if the F -statistic refers to a regression coefficient, then the sign of the computed r should match the sign of the regression coefficient. If the F -statistic refers to a mean difference, then the direction of the mean difference should be used to assign the correct sign to the computed r . Similarly, if the χ^2 statistic refers to a negative cross-tabulation (e.g., greater frequency at higher levels of one variable correspond to greater frequency at lower levels of the other variable), then the sign of the computed r should be negative. For d (i.e., the effect size for the difference between two means), the direction of the effect is captured by the sign of d , and the sign of the computed r will be correct. If the F -statistic or χ^2 statistic refer to effects that are not distinguished according to sign (e.g., tests of R^2 or change in R^2 , an omnibus test in ANOVA, an overall contingency in a table larger than 2×2), then the sign of the computed r should be positive.

References for Reviewing and Integrating Research

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Session 6: Sampling and Statistical Power

Required Reading:

Singleton et al. (1993), ch. 6

Cohen (1992)

Verma and Goodale (1995)

Cascio and Zedeck (1983)

Optional/Supplemental Reading:

Pedhazur and Schmelkin (1991), ch. 15

Cohen (1990)

Assignment Questions:

1. Consider the sampling designs described by Singleton et al. (1993). How well does each design balance the trade-off between representativeness and practicality? Display your thinking by plotting the designs in a 2-dimensional space defined by representativeness and practicality axes drawn orthogonal (i.e., at right angles) to one another, with each axis ranging from “minimum” to “maximum.” Plot the sampling designs with your area of research in mind (e.g., some sampling designs may be more practical in some areas than in others, due to differences in the unit of analysis and other constraints), and explain the logic underlying your placement of the sampling designs.
2. Read Cohen (1992), focusing on the purposes and basic logic of power analysis, and Verma and Goodale (1995), focusing on pp. 141-148. What are the implications of power analysis for the tension between Type I and Type II error? What is the importance of statistical power for studies attempting to confirm the null hypothesis, showing that no effect exists (e.g., automobile emissions have no effect on ozone concentration)?
3. Calculate the statistical power of each study included in your meta-analysis for detecting a small, medium, and large effect. Obtain these effect sizes from the results of your meta-analysis, with the population (i.e., weighted average) correlation serving as a medium effect and values one standard deviation below and above the population correlation as small and large effects, respectively, where the standard deviation is the square root of the variance of the population correlation. Using these three effect sizes, compute the statistical power of each study to detect a small, medium, and large effect, setting alpha at .05 (note that the power results will differ across studies depending on the sample size used in each study). Arrange these power values in a table with three columns for the low, medium, and large effect sizes and k rows where k equals the number of studies in your meta-analysis. The power calculations can be performed using the first website listed on the next page or by downloading and installing G*Power, which is also described on the next page. What power values did you obtain? What patterns do you see in the power values? What are the implications of these power values for research in the area represented by the studies you used for your meta-analysis? If power is low, what can be done in your area to increase power? For suggestions, see Cascio and Zedeck (1983).

Resources for Computing Statistical Power

Power calculator for correlations:

<http://www.quantitativeskills.com/sisa/statistics/correl.htm>

Insert the correlation (i.e., one of your three effect sizes) in the r1 box and the sample size for each study in the N2 box. Click Calculate, and power values will appear in the window to the right. For more details, click “Help Correlation.”

G*Power, a free program for conducting power analysis:

<http://www.psych.uni-duesseldorf.de/abteilungen/aap/gpower3/download-and-register>

After you download and install G*Power, launch the program, and from the top menu, select Tests, Correlation and Regression, Correlation: Bivariate normal model. Under Test family, you should see Exact, and under Statistical test, you should see Correlation: Bivariate normal model. For Type of power analysis, choose Post hoc. You can then enter your three effect sizes one at a time in the window labeled Correlation ρ H1, and for each effect size, enter each of the sample sizes from the studies in your meta-analysis in the window labeled Total sample size. For the Tail(s) box, you should decide yourself whether to choose One or Two (you can try both if you would like). Make sure to explain your decision and interpret your results accordingly.

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Session 7: Instrument Design

Required Reading:

DeVellis (1991), ch. 5

Schwarz (1999)

Multimethod Job Design Questionnaire

Business Week Survey of Business Schools

Supplemental Reading:

Sudman and Bradburn (1982), chs. 5 and 6

Bass et al. (1974)

Assignment Questions:

1. Read the chapter by DeVellis (1991), paying particular attention to the eight steps in developing measurement scales. Next, read the article by Schwarz (1999), which provides a good summary of research on the effects of item wording, format, and context.
2. Review and critique the Multimethod Job Design Questionnaire (MJDQ) and the Business Week Survey of Business Schools. The MJDQ was developed by Campion (1988) to measure four approaches to work design: (a) *motivational*, which emphasizes how work can be intrinsically motivating; (b) *mechanistic*, which focuses on task specialization, work simplification, and repetition; (c) *biological*, which concerns ergonomics, task requirements, and the physical work environment; and (d) *perceptual-motor*, which emphasizes work characteristics that accommodate the mental and physical limitations of workers. The Survey of Business Schools is distributed every two years by Business Week, which publishes rankings of business schools based on the data. What problems do you see in terms of question wording, question ordering, response format, etc? What revisions would you suggest? Make sure your answers are specific, detailed, and reflect principles from the readings.
3. Select a construct that falls within your research interests. Write a conceptual definition of that construct, followed by an operational definition (i.e., a definition stated in terms of qualities that can be observed or measured). Generate at least 10 items that serve as indicators of the construct, complete with instructions for the respondent and a response scale. As you develop your items and response scale, you might find it helpful to consult Bass et al. (1974) and chapters 5 and 6 from Sudman and Bradburn (1982).

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Session 8: Interviewing Techniques

Required Reading:

Kahn and Cannell (1957), chs. 3, 4, 5, and 8

Employee Interview

Supplemental Reading:

Cannell et al. (1981)

Assignment Questions:

1. Read the chapters from Kahn and Cannell (1957). Chapter 3 describes techniques for motivating the respondent, focusing on ways to make the interview itself rewarding to the respondent and to link the interview to the respondent's own goals. Chapter 4 deals with identifying the purpose and objectives of the interview, chapter 5 concerns the formulation of interview questions, and chapter 8 focuses on the use of probes (i.e., follow-up questions) to help achieve interview objectives.
2. The Employee Interview is from a study of the effects of computer-aided manufacturing (e.g., robotics, computerized machine tools) on the nature of work and worker well-being. The interview was used at a General Motors assembly plant in Baltimore and was conducted with employees who worked with industrial robots that spot-welded and painted minivans. Most of these employees had at least a high-school education, and all belonged to the United Auto Workers union. Review and critique the interview. What specific strengths and weaknesses can you identify regarding the way the interview is designed? Summarize your reactions in writing and turn them in to me.
3. Write a short (e.g., 2-3 page) interview schedule designed to collect information pertaining to a research question of interest to you. The interview schedule should include a brief statement of its purpose, a short introduction, some relevant questions, and any applicable skip instructions or probes.
4. During class, we will role play some mock interviews, using both the Employee Interview and the brief interview schedules you will bring to class. Be prepared to serve as the interviewer for either the Employee Interview or the interview you construct.

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Session 9: Reliability and Classical Test Theory

Required Reading:

Pedhazur and Schmelkin (1991), ch. 5

Cortina (1993)

Edwards (2003), pp. 2-15, pp. 18-22, pp. 29-36

Supplemental Reading:

Nunnally (1978), chs. 6 and 7

Assignment Questions:

1. Read the chapter on reliability from Pedhazur and Schmelkin (1991). This chapter provides a reasonably comprehensive treatment of the meaning and estimation of reliability, and it is important that you have a good, solid grasp of this material. The article by Cortina (1993) offers further details regarding the meaning and uses of coefficient alpha as an estimate of reliability, and the sections from the chapter by Edwards (2003) give a chronological treatment of relationships between constructs and measures and their implications for reliability. The two optional chapters from Nunnally (1978) give further detail and also cover topics not addressed by Pedhazur and Schmelkin (1991), such as the domain sampling model and the reliability of linear combinations. You should concentrate Pedhazur and Schmelkin (1991), Cortina (1993), and the first section from the Edwards (2003) chapter. As time permits, look over the other two sections from Edwards (2003) and the Nunnally (1978) chapters.
2. Using formula 5.23 from Pedhazur and Schmelkin (1991), calculate a table of reliability coefficients for scales containing from 2 to 10 standardized items and average interitem correlations ranging from .10 to .90 at .10 increments (this table will contain 81 reliability coefficients and can be easily constructed in a spreadsheet). What does this table tell you? What implications does this information have for constructing measures?
3. The following page shows items from the Job Activities Questionnaire, which contains five 4-item scales (the scoring key is at the bottom of the page). Data on these items from 428 MBA students are in the files JAQ.SAV and JAQ.XLS. Examine the items assigned to each scale. Given that reliability is higher for scales composed of conceptually homogeneous items, which scales do you think will have higher reliabilities, and why? Calculate descriptive statistics (i.e., means, standard deviations), a covariance matrix, and a correlation matrix for the four items assigned to each scale. Then, using formula 5.17 in Pedhazur and Schmelkin (1991), calculate alpha for the five scales, noting how alpha is influenced by the item and composite variances. Verify your results by calculating alpha for the scales using the algorithm in your statistical package. Which scales are more reliable, and why? Do these results confirm your predictions based on the content of the items? Examine the correspondence between the obtained reliability estimates and the descriptive statistics and interitem correlations. What patterns do you see? What implications do your results have for the use of these scales? What specific modifications do you recommend to improve the scales with lower reliabilities?

Job Activities Questionnaire

This questionnaire asks the amount of each activity in the respondent's job, using a scale ranging from 0 (none at all) to 10 (a very great amount).

1. Gathering and communicating information requested by others.
2. Giving performance feedback to my subordinates.
3. Setting goals and objectives for my subordinates.
4. Personally handling day-to-day problems as they arise.
5. Organizing the work for my subordinates.
6. Routine financial reporting and bookkeeping.
7. Giving credit to my subordinates where due.
8. Attending meetings to exchange information with others.
9. Personally choosing between two or more alternative strategies.
10. Reading reports, memos, letters, etc.
11. Enforcing performance standards for my subordinates.
12. Solving problems myself.
13. Writing reports, memos, letters, etc.
14. Defining required tasks and activities for my subordinates.
15. Giving or receiving routine information over the phone.
16. General desk work.
17. Making decisions myself.
18. Reviewing the performance of my subordinates.
19. Assigning tasks and providing instructions to my subordinates.
20. Answering routine procedural questions.

Scoring Key:

- Planning & Coordinating: 3, 5, 14, 19
- Decision-Making: 4, 9, 12, 17
- Processing Paperwork: 6, 10, 13, 16
- Exchanging Information: 1, 8, 15, 20
- Motivating & Rewarding Others: 2, 7, 11, 18

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Session 10: Validity

Required Reading:

Nunnally and Bernstein (1994), ch. 3

Borsboom et al. (2004)

Campbell and Fiske (1959), pp. 81-85

Edwards (2003), pp. 2-7, pp. 15-18 (skim pp. 22-29 and pp. 36-41)

Assignment Questions:

1. The Nunnally and Bornstein (1994) chapter provides an excellent discussion of the definitions of and distinctions between content, criterion-oriented, and construct validity. Based on this information, how would you develop a measure that would ensure each of these three forms of validity? How would you determine whether you have been successful?
2. Borsboom et al. (2004) discuss the concept of validity and present several core ideas that differ from those of Nunnally and Bernstein (1994). What are your reactions to the concept of validity as presented by Borsboom et al.? What are some of the key differences between the discussions of validity given by Nunnally and Bernstein (1994) and Borsboom et al. (2004)? Which position on these differences make more sense to you, and why?
3. The Campbell and Fiske (1959) article is the classic source on convergent and discriminant validity and introduced the idea of the MTMM matrix. The sections from the Edwards (2003) chapter summarize different forms of validity and describe how to apply the Campbell and Fiske (1959) criteria to assess convergent and discriminant validity. What information do these criteria provide regarding the construct validity of measures? Do you see any limitations of these criteria?
4. Attached are items from three surveys used to measure Type A behavior: the Bortner Scale, the Framingham Scale, and the Jenkins Activity Survey (JAS). Based on factor analysis and item content, items from these three surveys were standardized and summed to form scales representing three components of Type A: speed and impatience, hard-driving and competitive behavior, and job involvement (these scales were then standardized, and the name assigned to the scales are listed on the following page). Data for these nine measures from a sample of 211 managers is in the files TYPEA.SAV and TYPEA.XLS. Construct a multitrait-multimethod (MTMM) matrix for correlations among these measures, inserting reliability estimates (alpha) along the diagonal. Using the Campbell and Fiske (1959) criteria, evaluate the convergent and discriminant validity of the measures. If you suspect the results would differ if measurement error was taken into account, calculate the disattenuated correlations among the measures and reexamine the Campbell and Fiske (1959) criteria. What conclusions can you draw about the convergent and discriminant validity of these measures? Based on these conclusions, how would you modify the measures to improve their convergent and discriminant validity?

Items from Type A Measures

Bortner Speed and Impatience (BORSI):

- 3. Anticipate what others say
- 4. Always rushed
- 5. Impatient while waiting
- 7. Does many things at once
- 10. Fast (walking, eating, etc.)

Bortner Hard-Driving and Competitive (BORHC):

- 2. Competitive
- 6. Goes all out
- 11. Hard-driving
- 14. Ambitious

Bortner Job Involvement (BORJI):

- 9. Wants good job recognized by others
- 13. Few outside interests

Framingham Speed and Impatience (FRASI):

- 2. Usually pressed for time
- 6. After work, feels pressed for time

Framingham Hard-Driving and Competitive (FRAHC):

- 1. Hard-driving and competitive
- 3. Bossy or dominating
- 4. Strong need to excel in most things

Framingham Job Involvement (FRAJI):

- 7. After work, think about work
- 8. After work, feel stretched to limits
- 9. After work, feel dissatisfied

JAS Speed and Impatience (JASSI):

- 9. Hurry other people along
- 10. Puts words in mouths of others
- 12. Hurry when there is plenty of time
- 23. Do most things in a hurry

JAS Hard-Driving and Competitive (JASHC):

- 16. Hard-driving and competitive when younger
- 17. Hard-driving and competitive now
- 18. Spouse says hard-driving and competitive
- 24. Enjoy competition and try hard to win

JAS Job Involvement (JASJI):

- 2. Job stirs you into action
- 20. People say you take work too seriously
- 30. Set deadlines or quotas at work or home
- 37. Bring home work at night

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Session 11: Exploratory Factor Analysis

Required Reading:

Pedhazur and Schmelkin (1991), ch. 22

Kim & Mueller (1984)

Fabrigar et al. (1999)

Assignment:

1. Read the Pedhazur and Schmelkin chapter and the excerpt from Kim and Mueller (1984), paying particular attention to the distinctions between principal components and common factor analysis, criteria for choosing the number of factors to retain, the distinction between a factor pattern matrix and a factor structure matrix, the relative merits of orthogonal and oblique rotation, and the logic underlying the reproduced correlation matrix. Then, read the article by Fabrigar et al. (1999) and carefully consider the decisions research make when conducting factor analysis and how these decisions affect results and conclusions.
2. Attached are items from the Job Activities Questionnaire (JAQ) used in the reliability assignment and the Minnesota Importance Questionnaire (MIQ), a measure of work values. The JAQ items are intended to assess five types of job activities, and the MIQ items are intended to measure four work values. SPSS files containing data for the JAQ and MIQ are in the files JAQ.SAV and MIQ.SAV, respectively. Based on the content of the items, discuss the extent to which you think the items for each measure will load on their intended factors as well as the other factors that underlie the measures. Next, conduct a factor analysis of both instruments. It is up to you to choose the extraction method, the number of factors to retain, and the method of rotation, although it would be wise to try several options. Whatever choices you make, be sure to explain your reasons. Based on your analyses, how well do the obtained factor structures match the *a priori* factor structures underlying the instruments (i.e., the five activities of the JAQ and the four values of the MIQ)?
3. Based on the results of your factor analyses, assemble the JAQ and MIQ items into scales. Create names for the scales that reflect the content of their items. Calculate reliability coefficients (both alpha and omega) for each of the scales. For alpha, use the statistical package of your choice. For omega, apply the following formula, which is an adaptation of the formula discussed in our session on reliability:

$$\omega = \frac{\left(\sum_{i=1}^k b_i \right)^2}{\left(\sum_{i=1}^k b_i \right)^2 + \sum_{i=1}^k (1 - b_i^2)}$$

where the b_i are the loadings for the items assigned to a particular scale and k is the number of items on the scale. What correspondence do you see between the reliability coefficients and the size and pattern of item loadings? What do your results tell you about the quality of items?

Job Activities Questionnaire

Respondents rated the amount of each activity in their job using a 10-point scale

Planning and Coordinating

1. Setting goals and objectives for my subordinates.
2. Organizing the work for my subordinates.
3. Defining required tasks and activities for my subordinates.
4. Assigning tasks and providing instructions to my subordinates.

Decision-Making

1. Personally handling day-to-day problems as they arise.
2. Personally choosing between two or more alternative strategies.
3. Solving problems myself.
4. Making decisions myself.

Processing Paperwork

1. Routine financial reporting and bookkeeping.
2. Reading reports, memos, letters, etc.
3. Writing reports, memos, letters, etc.
4. General desk work.

Exchanging Information

1. Gathering and communicating information requested by others.
2. Attending meetings to exchange information with others.
3. Giving or receiving routine information over the phone.
4. Answering routine procedural questions.

Motivating and Rewarding Others

1. Giving performance feedback to my subordinates.
2. Giving credit to my subordinates where due.
3. Enforcing performance standards for my subordinates.
4. Reviewing the performance of my subordinates.

Minnesota Importance Questionnaire

Respondents rated the personal importance of each item on a 5-point scale.

Coworkers

1. The people I work with would have a good spirit of cooperation
2. I could develop close friendships with my coworkers
3. My coworkers would be friendly
4. My coworkers would be easy to make friends with
5. My coworkers would get along with each other

Responsibility

1. I could have responsibility for planning my own work
2. I could make decisions on my own
3. I could be responsible for the work of others
4. I could be free to use my own judgment
5. I could have a very responsible job

Social Status

1. The job would carry high social position with it
2. I could be "somebody" in the community
3. I could "rub elbows" with important people
4. I could have a definite place in the community
5. The job would give me importance in the eyes of others

Compensation

1. My pay would be fair for the amount of work I do
2. I could make as much money as my friends
3. My pay would compare with that for similar jobs in other companies
4. The amount of work I do would be reflected in my pay
5. My pay would compare well with that of other workers

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Session 12: Confirmatory Factor Analysis I

Required Reading:

Anderson and Gerbing (1988)

Edwards and Bagozzi (2000)

Pedhazur and Schmelkin (1991, ch. 23, pp. 631-660, pp. 672-675, pp. 684-690)

Hu and Bentler (1999, pp. 27-28)

Jackson et al. (2009, pp. 9-11, pp. 17-20)

Supplemental Reading:

Kelloway (1998), chs. 4 and 5

Questions:

1. Read Anderson and Gerbing (1988). Review the distinctions between exploratory and confirmatory factor analysis, and pay particular attention to the correspondence between the confirmatory measurement model and the notion of true score and error variance in classical test theory, the meaning and importance of unidimensional measurement, and the concept of a two-step modeling approach. Then, read Edwards and Bagozzi (2001), which identifies various models relating constructs to measures and discusses criteria for choosing among those models. Consider the implications of these models for developing and evaluating measures in your area. Next, read the excerpts from Pedhazur and Schmelkin (1991), which will reinforce the basic ideas discussed in the articles and will prepare you to conduct a confirmatory factor analysis using LISREL. Refer to the Kelloway (1998) chapters as necessary to strengthen your understanding of LISREL.
2. The files MIQOBL.LS8 and MIQORT.LS8 contain LISREL commands to run oblique and orthogonal models, respectively, for the Minnesota Importance Questionnaire (MIQ; for your reference, the MIQ items are on the following page). Use these files to answer the following questions.
 - a. Conduct a confirmatory factor analysis of the MIQ, using the oblique model. In the output, the value in parenthesis below each parameter is its standard error, and the value below the standard error is the t-value of the parameter. The parameters reported as “LISREL estimates” are unstandardized, and the standardized parameters are reported in the “completely standardized solution” near the end of the output (the t-values for the LISREL estimates also apply to the standardized parameters). Refer to the unstandardized solution for significance tests, and use the completely standardized solution to evaluate the size of the parameters. Interpret the output, focusing on item loadings, measurement error variances, factor correlations, fitted and standardized residuals, modification indices, and overall fit. To evaluate model fit, refer to the criteria described in Hu and Bentler (1999) while noting the caveats discussed in Jackson et al. (2009). Do the results of the confirmatory factor analysis support the factor structure of the MIQ? Do the results reveal any problems with the MIQ?

- b. Compare the output from the oblique model to the output from the orthogonal model, which fixes the correlations among the factors to zero. Note that you can statistically compare the oblique and orthogonal models with a chi-square difference test. Does this comparison indicate that the factors should be allowed to correlate, such that the oblique model is more appropriate than the orthogonal model?
- c. Determine whether the four MIQ factors achieve discriminant validity (i.e., whether the 95% confidence intervals for the factor correlations exclude unity). Are the factors empirically distinct, thereby demonstrating discriminant validity?
- d. Using the oblique model, apply the tests described by Pedhazur and Schmelkin (1991, p. 688) to determine whether the MIQ items are congeneric, tau-equivalent, or parallel within each of the four factors. Note that the equality constraints that represent tau-equivalence and parallelism should be imposed within each factor, not across factor. You can conduct a single chi-square difference test for tau-equivalence and another chi-square difference test for parallelism. To what extent are the MIQ items tau-equivalent or parallel? What are the implications of these results?
- e. Overall, how well do the results of your analyses support the MIQ? In what ways do your conclusions differ from or go beyond those based on your exploratory factor analysis of the MIQ?

Minnesota Importance Questionnaire

Respondents rated the personal importance of each item on a 5-point scale.

Coworkers

1. The people I work with would have a good spirit of cooperation
2. I could develop close friendships with my coworkers
3. My coworkers would be friendly
4. My coworkers would be easy to make friends with
5. My coworkers would get along with each other

Responsibility

1. I could have responsibility for planning my own work
2. I could make decisions on my own
3. I could be responsible for the work of others
4. I could be free to use my own judgment
5. I could have a very responsible job

Social Status

1. The job would carry high social position with it
2. I could be "somebody" in the community
3. I could "rub elbows" with important people
4. I could have a definite place in the community
5. The job would give me importance in the eyes of others

Compensation

1. My pay would be fair for the amount of work I do
2. I could make as much money as my friends
3. My pay would compare with that for similar jobs in other companies
4. The amount of work I do would be reflected in my pay
5. My pay would compare well with that of other workers

Session 13: Confirmatory Factor Analysis II

Required Reading:

Edwards (2003, pp. 22-29, pp. 31-32, pp. 40-41)

Questions:

1. The attached pages list items from four subscales of the Minnesota Importance Questionnaire (MIQ), the Work Aspect Preference Scale (WAPS), and the Work Values Inventory (WVI). The subscales are intended to measure four work values: coworkers, independence, prestige, and rewards. You previously assessed the MIQ items. Examine the WAPS and WVI items. How well do you think the items assess the four work values? Compare the MIQ, WAPS, and WVI items intended to assess each work value. To what extent do the items seem to describe the same concept?
2. The file VALOBL.LS8 contains LISREL commands to run a 12-factor oblique model for the MIQ, WAPS, and WVI items. Evaluate the model, focusing on item loadings, measurement error variances, factor correlations, residuals, modification indices, and overall fit. As you interpret the output, note that the value in parenthesis below each parameter is its standard error, and the value below the standard error is the t-value of the parameter. The parameters reported as LISREL estimates are unstandardized, and the standardized parameters are reported in the completely standardized solution near the end of the output (the t-values for the LISREL estimates also apply to the standardized parameters). Are the parameter estimates acceptable? How well does the model fit the data? Do the residuals and modification indices suggest any important sources of misfit?
3. Given that the MIQ, WAPS, and WVI items are each intended to measure the same four work values, the items might conform to a second-order factor model in which the items load on 12 first-order factors of the oblique model, and these 12 factors in turn load on four factors representing coworkers, independence, prestige, and rewards. The file VALSO.LS8 contains LISREL commands to run this second-order factor model. The key difference between this model and the 12-factor oblique model is that the second-order factor model attempts to explain the 66 correlations among the 12 first-order factors with a four-factor structure. How well does the second-order factor model meet this objective? The information relevant to this question is reported in the GAMMA and PHI matrices. The GAMMA matrix contains the loadings of the first-order factors on the second-order factors, and the PHI matrix contains the correlations among the second-order factors. Again, the t-values for these parameters are reported with the LISREL estimates, and the standardized parameters are reported in the completely standardized solution. Are these parameter estimates acceptable? How well does the model fit the data? The second-order factor model is nested within the first-order oblique model, so you can compare the models with a chi-square difference test.
4. The correlations among the four work values measured by the MIQ, WAPS, and WVI can be arranged as a MTMM matrix in which the traits are the four work values and the methods are the MIQ, WAPS, and WVI. This matrix can be analyzed with confirmatory factor analysis. One approach to analyzing the matrix uses 12 scales constructed by summing the items for each work value for the MIQ, WAPS, and WVI. The first set of LISREL commands in file VALMTMM.LS8 produces this model. What is your assessment of this model? As before, examine item loadings, measurement error variances, factor correlations, residuals, modification indices, and overall fit. You can also partition the variance of each measure into trait, method, and error variance

components, whereby trait variance is the square of the standardized loading on the trait factor, method variance is the square of the standardized loading on the method factor, and error variance is the standardized measurement error (these three parameters should sum to unity, which is the variance of each measure in the completely standardized solution). What does this variance partitioning tell you about the measures?

5. The second set of LISREL commands in the file VALMTMM.LS8 estimates a MTMM model of the correlations among the 12 first-order factors rather than the 12 scales. The loadings on the trait and method factors are in the GAMMA matrix rather than the LAMBDA-X matrix, and the measurement error variances are in the PSI matrix rather than the THETA-DELTA matrix. Using the parameters from the completely standardized solution, partition the variance of each first-order factor into trait, method, and error variance. What do the results of this variance partitioning tell you about the measures? How do these variance partitioning values compare to those from the MTMM model that used the 12 scales?
6. What are your summary conclusions regarding the MIQ, WAPS, and WVI as measures of the four work values?

NOTE: Questions 1, 2, 3, and 6 are required, and questions 4 and 5 are extra credit.

Minnesota Importance Questionnaire

Respondents rated the personal importance of each item on a 5-point scale.

Coworkers

1. The people I work with would have a good spirit of cooperation
2. I could develop close friendships with my coworkers
3. My coworkers would be friendly
4. My coworkers would be easy to make friends with
5. My coworkers would get along with each other

Responsibility

1. I could have responsibility for planning my own work
2. I could make decisions on my own
3. I could be responsible for the work of others
4. I could be free to use my own judgment
5. I could have a very responsible job

Social Status

1. The job would carry high social position with it
2. I could be "somebody" in the community
3. I could "rub elbows" with important people
4. I could have a definite place in the community
5. The job would give me importance in the eyes of others

Compensation

1. My pay would be fair for the amount of work I do
2. I could make as much money as my friends
3. My pay would compare with that for similar jobs in other companies
4. The amount of work I do would be reflected in my pay
5. My pay would compare well with that of other workers

Work Aspect Preference Scale

Respondents rated the personal importance of each item on a 5-point scale.

Coworkers

1. Have pleasant people to work with.
2. Get to know your fellow workers quite well.
3. Are really liked by your fellow workers.
4. Enjoy the company of the people you work with.

Independence

1. Can work as fast or slowly as you like.
2. Can do your own work in your own way.
3. Can start and finish your work when you like.
4. Determine the way your own work is done.

Prestige

1. Know that other people think your work is important.
2. Get a good reputation for your good work.
3. Are looked up to by other people in society.
4. Can obtain a high status in the eyes of others.

Money

1. Are paid a high salary.
2. Receive more than your normal pay for good work.
3. Become quite wealthy.
4. Receive enough pay to live well.

Work Values Inventory

Respondents rated the personal importance of each item on a 5-point scale following the stem “work in which you . . .”

Associates

1. are one of the gang.
2. form friendships with your fellow employees.
3. have good contacts with fellow workers.

Independence

1. have freedom in your own area.
2. make your own decisions.
3. are your own boss.

Prestige

1. gain prestige in your field.
2. know that others consider your work important.
3. are looked up to by others.

Economic Return

1. can get a raise.
2. have pay increases that keep up with the cost of living.
3. are paid enough to live right.

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