NARODOWA AGENCJA WYMIANY AKADEMICKIEJ

STRATEGIC PARTNERSHIPS

Teaching guidelines

Structural Equation Modeling (SEM)- Introduction

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Material information

This teaching material provides an introduction to Structural Equation Modeling (SEM), one of the most widely used methods for testing theoretical models in management, economics, social sciences, and related disciplines. It has been developed primarily for PhD candidates, especially those in the early years of their doctoral programmes, who are beginning to design empirical research projects and require a practical understanding of theory-driven quantitative research.

The material introduces SEM within the context of confirmatory research, explaining how researchers move from theory development and hypothesis formulation to conceptual model construction and empirical testing. Special attention is devoted to the operationalization of theoretical concepts through latent variables, measurement items, and survey scales, helping doctoral students understand how abstract constructs can be measured and analyzed.

A substantial part of the resource focuses on the design and evaluation of SEM studies. Participants are introduced to key concepts such as Confirmatory Factor Analysis (CFA), construct reliability, convergent validity, and discriminant validity. The material discusses commonly reported quality indicators, including factor loadings, Average Variance Extracted (AVE), Composite Reliability (CR), Cronbach's alpha, and McDonald's omega, emphasizing their role in ensuring rigorous and publishable research.

The resource also addresses practical aspects of SEM research, including questionnaire design, sample-size requirements, data collection strategies, and the differences between Covariance-Based SEM (CB-SEM) and Partial Least Squares SEM (PLS-SEM). Rather than focusing exclusively on statistical computations, the material highlights how SEM supports the development, testing, and validation of theoretical models.

By combining conceptual foundations with practical guidance on research design, this teaching resource equips early-stage doctoral researchers with the knowledge needed to critically evaluate SEM-based studies and begin applying SEM in their own dissertation projects and academic research. It may also serve as supplementary material for master's-level courses in research methods, management, entrepreneurship, international business, and related social science fields.

Learning objectives and outcomes

This teaching material focuses onSEM and the measurement of latent constructs in contemporary management and social science research. It examines how abstract theoretical concepts can be operationalized into measurable constructs and how researchers can ensure that these constructs are reliable and valid representations of the phenomena under investigation. Its core objective is to help students understand the theoretical foundations of construct measurement, the role of questionnaire design and data collection, and the contribution of Confirmatory Factor Analysis (CFA) and SEM to theory testing and empirical research. Through the integration of conceptual frameworks and practical research examples, the material demonstrates how SEM studies are designed, how measurement quality is assessed through indicators such as reliability and validity, and how researchers can evaluate relationships among constructs. Rather than focusing on model estimation and statistical computations, the material emphasizes methodological reasoning and research design decisions, encouraging students to critically evaluate the assumptions, requirements, and research choices involved in conducting rigorous SEM-based studies.

Learning outcomes are categorized as follows:

Knowledge

- The student understands when Structural Equation Modeling (SEM) is an appropriate method for addressing a research problem and can identify research situations in which its application is justified.
- Student is able to explain the principles of Structural Equation Modeling (SEM) and distinguish between exploratory and confirmatory research approaches.
- Student is able to identify and operationalize latent constructs using measurement scales, measurement items, and survey questionnaires.

Skills

- Student is able to design a theory-driven SEM research model, including the specification of constructs, measurement items, and hypothesized relationships.

Social Competences

- The student is able to recognize the importance of rigorous construct development, measurement quality, and methodological transparency in producing reliable and valid research findings.
- The student is able to demonstrate awareness of the theoretical, practical, and ethical implications of measurement decisions, including the consequences of poor construct operationalization, inadequate data quality, and inappropriate methodological choices.

Overview

The provided teaching materials, comprising a PowerPoint presentation and a video lecture, are designed to support doctoral-level instruction in research methods, with a particular focus on Structural Equation Modeling (SEM) as a theory-testing approach in management, business, economics, and the social sciences. The materials are intended primarily for PhD candidates in the early stages of their doctoral programmes, providing a foundation for designing and conducting rigorous empirical research. Both resources follow an identical structure, allowing instructors to deliver the content through either classroom-based teaching or asynchronous learning formats.

The lecture begins by introducing the distinction between exploratory and confirmatory research, explaining how different research objectives influence methodological choices. Students learn why SEM is considered a confirmatory research method and how it supports the testing and validation of theoretical models. The material emphasizes the importance of establishing a theoretical foundation, formulating research hypotheses, and developing conceptual models before proceeding to data collection and analysis.

The next section focuses on the fundamental building blocks of SEM research. Participants are introduced to latent variables, measurement items, and measurement scales, learning how abstract theoretical concepts can be operationalized and measured using survey questionnaires. Practical examples are used to demonstrate the relationship between constructs and indicators, as well as the role of questionnaire design in ensuring high-quality empirical data. The material also discusses the advantages and limitations of custom-developed and previously validated measurement scales.

The core part of the lecture addresses the development and evaluation of SEM models. Students learn how researchers assess the quality of measurement models using Confirmatory Factor Analysis (CFA) and a range of reliability and validity indicators. Particular attention is given to factor loadings, Average Variance Extracted (AVE), Composite Reliability (CR), Cronbach's alpha, McDonald's omega, and discriminant validity. Rather than focusing primarily on statistical calculations, the material demonstrates how these measures are used to establish the credibility and rigor of empirical research.

The lecture subsequently examines practical considerations in SEM research design, including questionnaire development, respondent selection, and sample-size requirements. Students are introduced to commonly accepted recommendations regarding data collection and learn about the methodological differences between Covariance-Based SEM (CB-SEM) and Partial Least Squares SEM (PLS-SEM). The discussion highlights how the choice of SEM approach should be aligned with research objectives, theoretical maturity, and data characteristics.

The session concludes by discussing the growing popularity and interdisciplinary application of SEM in contemporary academic research. Students learn how SEM enables researchers to investigate complex relationships among constructs while integrating theory development, measurement validation, and hypothesis testing within a single analytical framework. By combining methodological foundations with practical research-design guidance, the materials equip doctoral candidates with the knowledge required to critically evaluate SEM-based studies and begin incorporating SEM into their own dissertation projects and scholarly research.

Pre-lecture preparation

Before attending the lecture, students should familiarize themselves with the distinction between exploratory and confirmatory research and understand how research methodologies are selected based on the objectives of a study. Particular attention should be paid to the role of theory in scientific research, including how theoretical concepts are transformed into research questions, hypotheses, and empirical models. Students are encouraged to review fundamental concepts related to theory testing, construct measurement, questionnaire-based research, reliability, validity, and hypothesis evaluation. A basic understanding of how abstract concepts can be operationalized and empirically assessed will facilitate engagement with the lecture content and provide a stronger foundation for understanding SEM as a tool for empirical research.

Suggested usage

The provided teaching materials, comprising a PowerPoint presentation and a video lecture, can be used both in traditional classroom settings and as asynchronous learning resources, allowing doctoral students to engage with the content at their own pace. The combination of a presentation and a recorded lecture provides instructors with flexibility in incorporating the material into doctoral courses on research methodology, quantitative methods, and empirical research design.

The material is most suitable as an introductory module on SEM and theory-testing research. It provides PhD candidates with a conceptual understanding of confirmatory research, model development, construct measurement, and the role of SEM in empirical studies before they engage with more advanced methodological topics or conduct their own dissertation research.

Depending on the structure of the doctoral programme, the content can be delivered during a single seminar as a general introduction to SEM or distributed across several sessions. In the latter case, individual sections can be expanded with practical

exercises related to theory development, hypothesis formulation, questionnaire design, construct operationalization, measurement validation, and can be extended with the interpretation of SEM results.

Because the lecture combines methodological foundations with practical research-design guidance, it helps students understand SEM as more than a statistical technique. The material emphasizes the links between theory, measurement, data collection, and hypothesis testing, enabling learners to appreciate how rigorous empirical research is developed and evaluated.

This flexibility makes the resource particularly suitable for doctoral courses in research methods, management, entrepreneurship, international business, economics, and related social science disciplines, where students are expected to critically assess research designs and develop the methodological skills needed for their own academic research projects.

Engagement activities

This lecture can be supplemented with a range of interactive activities designed to enhance student engagement and deepen understanding of the topic. These activities are flexible and can be used either before the lecture to activate prior knowledge, or after to reinforce key concepts and encourage critical thinking. They are suitable for both live and asynchronous teaching formats.

Activity	**Description**
From theory to conceptual model	**Objective:** To develop the ability to identify relevant theories and translate them into a conceptual SEM model. **Activity**: Students are provided with a short research problem (topic depends on the programme). Working individually or in small groups, they identify the theoretical perspective that best explains the phenomenon and propose several latent constructs. Based on these constructs, students create a simple conceptual model and formulate preliminary hypotheses describing the expected relationships among variables. The activity concludes with a discussion of alternative theoretical perspectives and model specifications.
Construct and item evaluation	**Objective:** To develop the ability to operationalize theoretical constructs and assess the quality of measurement items. **Activity:** Students are provided with several latent constructs and asked to independently propose a set of questionnaire items that could be used to measure each construct. Working individually or in small groups, they justify their choices based on the theoretical definitions of the constructs and discuss potential issues related to item wording, overlap, and construct coverage. In the second stage of the exercise, students conduct a literature review to identify validated measurement scales that have previously been used to measure the same constructs. They then compare the items they initially selected with those reported in the literature and evaluate the similarities and differences. The activity concludes with a reflection on how closely

	their proposed measures align with established scales and a discussion of the importance of theoretical grounding and scale validation in SEM research.

Post-lecture activities

This lecture provides only an introduction to Structural Equation Modeling. While it presents the fundamental concepts, terminology, and logic of SEM, it covers only a small portion of the methodological knowledge required to conduct a full SEM study.

Students interested in applying SEM in their own research should recognize that a wide range of additional topics remain to be explored. These include data preparation procedures such as missing data treatment, assessing normality, detecting outliers, and evaluating common method bias. Researchers must also learn how to use SEM software, specify models correctly, interpret measurement and structural model outputs, assess model fit, and evaluate direct, indirect, and moderating relationships among constructs.

Further topics include model refinement and respecification, multi-group analysis, subgroup comparisons, mediation and moderation testing, longitudinal applications, and the interpretation of competing models. Researchers must also understand how empirical findings can lead to revised conceptual models, additional hypotheses, and the extension of existing theories. In practice, SEM is not a single analytical procedure but rather a comprehensive research framework that requires both methodological and theoretical expertise.

For doctoral candidates who believe SEM may be an appropriate method for their dissertation research, this lecture should be viewed as the beginning of a much longer learning journey. There is still much to learn before SEM can be applied confidently and rigorously in academic research. At the same time, even students who ultimately decide that SEM is not the most suitable approach for their own projects should become familiar with its principles, applications, strengths, and limitations. As SEM is widely used across management, business, economics, and the social sciences, the ability to critically evaluate SEM-based studies is an important competency for any researcher.