
Digital Module 17: Data Visualizations: Effective Evidence-based Practices

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Module Overview

In this digital ITEMS module, Nikole Gregg and Dr. Brian Leventhal discuss strategies to ensure data visualizations achieve graphical excellence. Data visualizations are commonly used by measurement professionals to communicate results to examinees, the public, educators, and other stakeholders. To do so effectively, it is important that these visualizations communicate data efficiently and accurately. These visualizations can achieve graphical excellence when they simultaneously display data effectively, efficiently, and accurately. Unfortunately, measurement and statistical software default graphics typically fail to uphold these standards and are therefore not suitable for publication or presentation to the public. To illustrate best practices, the instructors provide an introduction to the graphical template language in SAS and show how elementary components can be used to make efficient, effective and accurate graphics for a variety of audiences. The module contains audio-narrated slides, embedded illustrative videos, quiz questions with diagnostic feedback, a glossary, sample SAS code, and other learning resources.

Key words: data visualization, graphical excellence, graphical template language, SAS

Prerequisite Knowledge

This ITEMS module assumes no prior knowledge of data visualization methods. However, to get the most out of this module, it might be beneficial to have:

- Basic knowledge of descriptive statistics
- Basic knowledge of foundational display types (e.g., bar charts, scatterplots)
- Practical experience with analyzing data with SAS
- Practical experience with writing SAS base syntax
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Reading the following NCME ITEMS module may serve as a useful introduction to the prerequisite knowledge for some examples shown:

- Module 7: Dichotomous IRT Models I: A comparison (Harris, 1989)

This module and others are available for free in the ITEMS portal.

Learning Objectives

Upon completion of this ITEMS module, learners should be able to:

- Explain how graphical excellence guidelines help properly convey information
- Assess the efficiency, effectiveness, and accuracy of data visualizations and suggest appropriate modifications for improvement
- Evaluate whether a visualization should display patterns or details depending on the purpose of the graphic
- Apply the guidelines of graphical excellence to their own research
- Construct SAS graphics (e.g. scatterplots, bar graphs, line graphs) using the internal language
- Write SAS syntax to align graphics with the guidelines for graphical excellence in order to make graphics more efficient, effective, and accurate

Module Structure

The digital module is divided into the following sections, which can be reviewed sequentially or independently [*approximate completion times in parentheses*].

- Module Introduction [*5 Minutes*]
- Section 1: Conceptual Foundations [*15 Minutes*]
- Section 2: Graphical Excellence [*20 Minutes*]
- Section 3: Template Language in SAS [*55 Minutes*]
- Section 4: Video Examples for SAS [*55 minutes*]
- Section 5: Quizzes [*10 Minutes*]

In the portal site, you can also find a video version of the core content as well as a handout with all core slides along with other materials.

Module Components

This ITEMS module includes the following components, which are delivered within a web-delivered unified design shell that is compatible across platforms (i.e., laptops, desktops, tablets, cell phones) and was created with modern course development software (*Articulate 360*):

- audio-narrated slides that provide a structured walk-through of the content
- embedded didactic videos to demonstrate software implementations
- interactive quiz questions
- sample SAS code and annotated videos reviewing the syntax
- glossary of key terms
- supplementary digital resources

Additional materials may be added over time so check back periodically!

Instructors

Nikole Gregg, *Doctoral Candidate at James Madison University*



Nikole Gregg is a doctoral student in the Assessment & Measurement program at James Madison University, where she has taken on many roles, including various assessment and measurement consulting experiences at JMU and in K-12 settings. Through her work, she has refined and developed skills necessary to present sophisticated data analyses to non-technical audiences. Her research interests include the application of multidimensional item response theory to account for response styles, fairness in testing, and validity theory. Nikole is passionate about improving fairness and equity within assessment, measurement, and policy.

Brian C. Leventhal, *Assistant professor at James Madison University*



Brian is an assistant professor in the Assessment and Measurement PhD program in the Department of Graduate Psychology at James Madison University as well as an assistant assessment specialist in the Center for Assessment and Research Studies at James Madison University. There, he teaches courses on quantitative methods. Brian received his Ph.D. from the University of Pittsburgh. His research interests include multidimensional item response models that account for response styles, response process models, and classification errors in testing. Brian is passionate about teaching and providing professional development for graduate students and early-career practitioners.

Instructional Design Team

André A. Rupp, *Research Director at the Educational Testing Service (ETS)*



André is a research director in the psychometrics, statistics, and data sciences area at ETS. He is the co-author and co-editor of two award-winning interdisciplinary books entitled *Diagnostic Measurement: Theory, Methods, and Applications* (2010) and *The Handbook of Cognition and Assessment: Frameworks, Methodologies, and Applications* (2016); he is currently working on the *Handbook of Automated Scoring*. His research synthesis- and framework-oriented work has appeared in a wide variety of prestigious peer-reviewed journals. Among other things, he is passionate about improving processes for interdisciplinary collaborations during the development and implementation of scoring solutions for digitally-delivered assessments. Consequently, he is very excited to serve as the associate editor / lead instructional designer of the ITEMS portal for NCME whose mission is to provide free digital resources to support self-directed learning and professional development.

Xi Lu, *Doctoral Candidate at Florida State University*



Xi is a doctoral candidate in the Instructional Systems and Learning Technologies program at Florida State University. Her current research interest focuses on designing and developing optimal learning supports to facilitate STEM learning in digital interactive environments. She also works as a research assistant with Dr. Val Shute on an NSF project targeted at designing various learning supports for a 2D physics game called *Physics Playground* to help middle school kids learn physics. Before coming to FSU, Xi taught Chinese for six years in Monterey Bay, California.

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