ITEMS
Instructional Topics in Educational Measurement Series

NCME national council on measurement in education

# Digital Module 12: Think-aloud Interviews and Cognitive Labs

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## Module Overview

In this digital ITEMS module, Dr. Jacqueline Leighton and Dr. Blair Lehman review differences between think-aloud interviews to measure problem-solving processes and cognitive labs to measure comprehension processes. Learners are introduced to historical, theoretical, and procedural differences between these methods and how to use and analyze distinct types of verbal reports in the collection of evidence of test-taker response processes. The module includes details on (a) the different types of cognition that are tapped by different interviewer probes, (b) traditional interviewing methods and new automated tools for collecting verbal reports, and (c) options for analyses of verbal reports. This includes a discussion of reliability and validity issues such as potential bias in the collection of verbal reports, ways to mitigate bias, and inter-rater agreement to enhance credibility of analysis. A novel digital tool for data-collection called the ABC tool is presented via illustrative videos. As always, the module contains audio-narrated slides, quiz questions with feedback, a glossary, and curated resources.

**Keywords:** ABC tool, cognitive laboratory, cog lab, cognitive model, interrater agreement, kappa, probe, rubric, thematic analysis, think-aloud interview, verbal report

## Prerequisite Knowledge

Learners should have working knowledge of:

- human research ethical protocols
- basic psychological perspectives on human learning (e.g., constructivist and information-processing theory)
- professional standards such as the *Standards for Educational and Psychological Testing*
- foundational research designs / methods
- basic introductory statistics

## Learning Objectives

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

- differentiate between historical events and theoretical concepts underlying think aloud interviews and cognitive labs
- distinguish methods and procedures for conducting think aloud interviews and cognitive labs along with the research situations where each applies
- use tools such as the ABC tool to collect verbal reports
- understand how to analyze verbal reports using pre-existing models or thematic analysis
- evaluate evidence for substantiating claims about specific forms of response processes
- understand the importance of inter-rater agreement indices for interpreting verbal reports

## Module Structure

The digital module is divided into the following six sections, which can be reviewed sequentially or independently.

- Module Introduction [*5 minutes*]
- Section 1: Conceptual Foundations [*15 minutes*]
- Section 2: Collecting Verbal Reports [*15 minutes*]
- Section 3: Analyzing Verbal Reports [*15 minutes*]
- Section 4: Automated Collection of Verbal Protocols with the ABC Tool [*10 minutes*]
- Section 5: Reflecting on Design of Automated Verbal Protocols [*10 minutes*]
- Section 6: Quizzes [*15 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 material.

**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*):

- integrated content slides that provide a structured walk-through of the content
- embedded didactic videos to explain and demonstrate tool implementation
- interactive quiz questions with diagnostic feedback
- interactive reflection activity to design automated collection of verbal protocols
- glossary of key terms
- supplementary digital resources

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

**Instructors**

**Jacqueline P. Leighton, Professor at University of Alberta**

Jackie is a Registered Psychologist and Professor of School and Clinical Child Psychology at the University of Alberta. She completed her graduate degrees in Psychology at the University of Alberta and postdoctoral fellowship studies in Psychology at Yale University. Her research and teaching is driven by the overarching goal to enhance fairness in testing. In pursuit of this goal, she has increasingly focused her research on investigating the interplay between cognitive and emotional processes underlying learning and academic achievement. For example, she investigates variables that can cognitively or emotionally bias participants' response processes in testing situations, leading to misrepresentations in performance and weaknesses in validity arguments of test inferences. Overall, she is interested in methods designed to enhance diagnosis of achievement, validation of test inferences, and theoretical understanding of human learning.

**Blair Lehman, Research Scientist at Educational Testing Service**

Blair is a research scientist at Educational Testing Service. She completed her graduate degrees in Cognitive Psychology and certificate in Cognitive Science at the University of Memphis. Her research focuses on understanding students' emotional and motivational processes during educational activities to design activities that maximize the experience for all students. Her research has focused on the task design of learning and assessment activities as well as the design of adaptive systems that consider both student cognition and motivation. For example, she has explored specific design features of game-based assessments in an effort to understand how to maintain measurement validity while also maximizing student motivation.

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**Instructional Design Team**

**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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**André A. Rupp**, *Research Director at 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: Theory into Practice*. His synthesis- and framework-oriented research 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.

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