Three Stages of Construct Definition

The development of construct definition follows a process that is articulated by its source of knowledge.

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Stage 1) Instrument calibration based on personal knowledge, intuition, and subjective analysis.

Pre-Galilean discussions of temperature measurement are interspersed with references to subjective "scales" of measurement anchored by terms like "as cold as when it snows" or "too hot to touch." A recent example is the attempt to measure "health risks of exposure to ionizing radiation." The observation (quantity of ionizing radiation) is converted into a measure (health risk) via calibrations based on the observer's value system. Objective measurement of constructs in their formative stages is difficult because theory is weak.

Stage 2) Data-based instrument calibration.

17th Century temperature measurement employed databased calibration. In Europe, two dozen "scales" competed for favor. Calibrations of thermometers were done on an instrument-by-instrument basis in the laboratory of the instrument maker. The particular readings of the thermometer, when exposed to states with known temperatures (e.g., human temperature), were used to calibrate each thermometer as it was manufactured. Measures from the same instrument maker were consistent and "specifically objective," i.e., two instruments from the same maker produced basically the same numbers. Measures from thermometers built by different instrument makers differed, and there was no common frame of reference to permit a measure's reexpression in another metric.

A recent example of second stage construct definition is "mathematics achievement." Numerous instruments (tests) exist for measuring "mathematics ability," each with its own

scale. Fifty years of factor-analytic research imply that all instruments measure something in common, but there is no shared framework that permits reexpressing one measure (e.g., NAEP) in terms of another (e.g., CAT). The confusion produced by multiple metrics contributes to the lack of consensus about what is, or should be, measured under the label of "mathematics ability." M

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Stage 3) Theory-based instrument calibration.

Thermometers made today are manufactured and shipped to customers without reference to data on the performance characteristics of the particular instrument. Instrument calibration is accomplished via theory-based equations and tables. Manufacturing proceeds with total reliance on theory. Theory enables any measure to be reexpressed in the metric of another instrument maker (e.g., Celsius to Fahrenheit). Measures calibrated by theory are "generally objective." Any two observers given the same observation (volume displacement of mercury in a tube) will report back the same number as a measure.

The only behavioral science construct that approaches third stage development is "reading comprehension." This is because the Lexile Framework enables generally objective, theory-based measurement of reading comprehension. Reading comprehension tests can be calibrated on the same metric, without reference to the performance of actual readers. The only reference required is the Lexile equation.

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"Applying the Rasch model in test development gives us new versions of the old statistics. These new statistics contain all of the old familiar information, but in a form which solves most of the measurement problems that have always beset traditional test construction" (Wright and Stone 1979: 24).

Wright, Benjamin D. and Mark Stone. 1979. Best Test Design. Chicago: MESA Press.

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