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Methodology Matters

Measuring social science concepts in pharmacy education research: From definition to item analysis of self-report instruments

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ABSTRACT

My issue: Interpreting results from quantitative research can be difficult when measures of concepts are constructed poorly, something that can limit measurement validity.
Methods: Social science steps for defining concepts, guidelines for limiting construct-irrelevant variance when writing self-report questions, and techniques for conducting basic item analysis are reviewed to inform the design of instruments to measure social science concepts in pharmacy education research.
My recommendations and their applications: Based on a review of the literature, four main recommendations emerge: These include: (1) employ a systematic process of conceptualization to derive nominal definitions; (2) write exact and detailed operational definitions for each concept, (3) when creating self-report questionnaires, write statements and select scales to avoid introducing construct-irrelevant variance (CIV); and (4) use basic item analysis results to inform instrument revision.
Potential impact: Employing recommendations that emerge from this review will strengthen arguments to support measurement validity which in turn will support the defensibility of study finding interpretations. An example from pharmacy education research is used to contextualize the concepts introduced.

My issue

Research in quantitative pharmacy education often involves measurement of abstract concepts like student beliefs, motivation, and learning. When preparing to conduct a study, extensive reviews of the literature often reveal multiple perspectives on how concepts intending to be studied have been defined as well as an absence of validated instruments available to measure them. In my experience collaborating with and supporting peers to conduct pharmacy education research, issues of identifying, revising, and creating measures of ill-defined concepts consistently arise as major challenges.

For example, in a recent project initiated by a faculty member teaching in an infectious disease module, fourth-year students working in a research and directed studies course created an educational video designed to teach third-year students and the public about the influenza vaccine. As a part of this work, I was brought in to support development of a study to evaluate the impact of the educational video on learners' knowledge, beliefs and intentions regarding the influenza vaccine. A comprehensive literature review revealed a lack of well-defined measures of knowledge and beliefs about the influenza vaccine resulting in a need to develop new instruments to measure these concepts.

While creating instruments to measure concepts like *knowledge and beliefs about influenza vaccines* may seem trivial, if not done

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systematically with a strong foundation of explicit definitions as well as best practice in instrument design, the tremendous efforts of the researcher and study participants can easily go to waste. Poorly constructed instruments introduce questions about measurement validity which in turn are major threats to research validity, offering alternative explanations for study finding interpretations (e.g., measurement of concepts used as primary outcomes that represent concepts other than those targeted by the investigation).[1] A strong foundation in instrument design from conceptualization (defining concepts) to operationalization (measurement) is an essential element of interpretable quantitative pharmacy education research.

The purpose of this review is to describe a systematic approach for constructing instruments to measure social science concepts in pharmacy education research. The review will cover steps for defining concepts, writing self-report questionnaire items, and revising instruments using basic psychometric analyses. Applying the steps described in the following review should support the development of valid instruments improving the validity of study finding interpretations.

Methodological literature review

Articles that cover steps for defining and constructing instruments to measure concepts in health science education research are uncommon. However, there are many publications in pharmacy, nursing, and medicine more generally that describe similar sets of steps as they relate to the specific task of questionnaire development.[2–4] These articles provide useful information about procedures that should be used to write questionnaire items, select appropriate scales, and conduct various validity and reliability analyses. Unfortunately, there is a paucity of articles that provide detailed descriptions of how to define concepts based on steps of conceptualization that have been outlined and widely accepted in social science research.[5] A similar situation unfolds in the context of specific instrument development and validation studies where, while some researchers discuss general ideas conceptualizing and/or defining concepts, few, if any, base their process on accepted best practice as outlined in social science research theory.[6–8] This is an apparent gap in the broader health sciences education literature that the present review attempts to address.

Defining concepts for empirical inquiry

Defining concepts for the purpose of scientific inquiry is a process of moving from conceptualization to measurement (Fig. 1).[5] This process involves specifying *nominal* and *operational* definitions that combine to create alignment between what is intended to be studied (i.e., the underlying concept) and what is ultimately studied (i.e., the measurement).

Nominal definitions facilitate general understanding and are analogous to dictionary definitions. They provide a general guide and delimitation of what could be measured to represent the underlying concept.[5] They are typically provided in background and literature reviews as the building blocks of the theoretical framework underlying a study. In the absence of accepted nominal definitions or nominal definitions that suit the needs of a study, nominal definitions are derived through a process of conceptualization.

Conceptualization is a process of systematically mapping out what comes to mind when thinking about the concept in question. It involves an iterative process of listing the types of mental images or indicators that are associated with the concept of interest in order to delimit what the researcher intends for the concept to mean in the context of his/her research.[5] For example, consider the concept of *knowledge about the influenza vaccine* as described in the opening example. In order to begin the process of conceptualization, we begin by listing indicators that represent the concept in the context of the study. This list could include things like people who had "knowledge about how the influenza vaccine protects against getting the flu", "knowledge about how often the influenza vaccine needs to be administered to be effective," "knowledge about the concept of 'herd immunity' as it relates to influenza vaccine efficacy," "knowledge about whether the flu vaccine is for people who have already had the flu," and "knowledge about the flu vaccines relationship to conditions like autism" (first level of Fig. 2). This list is expanded by consulting experts and literature. As the list becomes larger, natural groupings start to emerge. Three categories of knowledge labeled "safety of the influenza vaccine," "influenza vaccine effectiveness," and "influenza vaccine indication" were able to be identified (second level of Fig. 2). These groupings

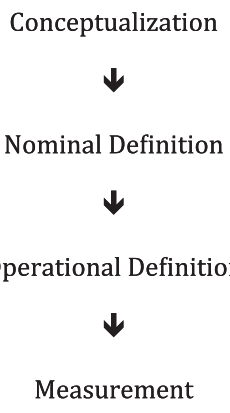

Fig. 1. Babbie's process for defining concepts for the purpose of measurement.