

Critique: external comparison of conceptual nursing models

Research by Jacobson on development of a semantic differential for external comparison of conceptual nursing models was reported in 1984. The present article critiques the philosophical stance and the research methods presented in the Jacobson report. Methods of analysis and evaluation of conceptual nursing models are reviewed, and the influences of conceptual nursing models on the structure of the discipline are examined in light of the purposes of the Jacobson study. Issues related to the investigation and use of models in the development of nursing knowledge are discussed.

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BY USING SEMANTIC differential, Jacobson¹ has presented an external comparison of five conceptual nursing models. We believe that nursing is developing as a discipline and that the nursing perspective is being enunciated. The value of conceptual models to the profession is their content in relationship to nursing's perspective, rather than their relationship to each other. Therefore, Jacobson's rationale for external comparison of nursing models is invalid.

Jacobson stated that the purpose of this research was to test the use of the semantic differential technique for quantitative comparison of nursing models. The King,^{2,3} Orem,⁴ Rogers,⁵ Roy,⁶ and Wiedenbach⁷ models were evaluated by 78 master's degree students, using a tool developed for the study, the semantic differential for the external comparison of conceptual nursing

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models (SDCM). The subjects also completed a six-item biographical questionnaire. Analysis of the data included examination of the mean ratings of the scales and factor analysis. The results, as presented by Jacobson, indicated that "six factors ... accounted for 49% to 56% of the total variance of models and [that] all scales loaded on some factor for at least one model."^{1(p58)}

In this description of the study rationale, Jacobson indicated that a systematic, objective, and rapid method of model comparison is needed to understand model differences. The understanding derived by such a method would facilitate the selection of models for educational, clinical, and research purposes. However, in relation to the stated purposes of the comparison, the following questions must be asked.

- Is a systematic, objective, and rapid method for external comparison of nursing models necessary?
- Is quantification for the purpose of external comparison of conceptual nursing models syntactically appropriate?
- Was the research methodologically sound, including aspects of instrumentation, sampling, data collection, and analysis?

CONCEPTUAL NURSING MODELS

Definitions and purposes

To understand and discuss conceptual nursing models, definitions of model must first be considered. Bush stated: "In common language the term model refers to precise replication of the structure of an

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object ... [or] the term is used to describe an ideal version of something, usually an abstract ideal."^{8(p14)} Lancaster and Lancaster suggested that "a model is a device to facilitate the examination and analysis of concepts."^{9(p32)}

Models may be considered to exist along a continuum, with mental models, the most abstract, at one extreme and physical models, concrete replicas of real-life objects, at the opposite extreme.⁹ For the scientist, these models may be used to define, describe, or analyze components of interest; to specify and understand relationships and processes; or to present a situation symbolically so that it may be manipulated for various purposes.

Numerous definitions of the term "conceptual nursing model" exist; most definitions state that models are sets of concepts and/or statements logically related to provide a unified whole.¹⁰⁻¹² Conceptual models for nursing are at a level of high abstraction and are not observable in the real world.¹³ These abstractions "provide a certain frame of reference for the members of a discipline, telling them what to look at and to speculate about,"^{14(p3)} this being part of the substantive structure of the discipline.¹⁵

Analysis and evaluation

Fawcett^{13,14} developed a framework for analysis and evaluation of conceptual

models of nursing and clearly identified the distinction between analysis and evaluation of both models and theories. Analysis of conceptual models was defined as "nonjudgmental, detailed examination of the conceptual model including its philosophical base, content and scope."^{13(p12)} In contrast, evaluation was presented as a focus on internal validity, allowing judgmental conclusions about the model to be made. Evaluation is not "external comparisons among various conceptualizations."^{13(p12)}

The criteria Fawcett^{13,14} identified for analysis include considerations of the historical evolution of the model, the approach used to develop nursing knowledge, and the reflection of nursing's perspective, including the essential concepts, the relationships among the concepts, and the problems of concern to the discipline. The evaluative criteria include questions about the logical consistency of the model, social criteria derived from Johnson,⁶ and the usefulness of the model for theory development and nursing practice, education, and research.

Subjecting a model to external comparison implies a process of matching it with an external criterion. Considering the definitions, purposes, analyses, and evaluations of models, it is apparent that the importance of models lies in their content, not in external comparisons. Using external comparisons may therefore constitute an invalid if not a conceptually unjustified method of evaluating models, and the problems are compounded by the selection of the external criteria.

These criteria may be a set of defined and operationalized standards, or another nursing model may be explicitly or implic-

itly advanced as the basis for comparison. Both procedures were adopted by Jacobson¹ when a set of criteria was developed and presented as a profile. However, this profile emerged from a factor analysis of ratings of one particular model, thus ascribing a relative superiority to this model. The fact that models address different problems and are limited in scope reinforces the need for each to be individually analyzed and evaluated.

Jacobson's proposal for a systematic, objective, and rapid method of external comparison to facilitate the understanding of similarities and differences is incongruent with the purposes of nursing models presented in the literature. Although the analysis and evaluation of models require systematic thought, it is not necessarily an objective or rapid process, nor should it be.

The necessity for objectivity proposed by Jacobson is questionable, because nursing problems vary by situation and by individual nurse. A nurse must decide if a conceptual nursing model can be used for determination of specific nursing activities.¹³ Such an approach makes the use of a model a subjective process. Similarly, the need for rapidity can be questioned. The uses of models should reflect understanding of the content, rather than relationships among models. This understanding should evolve from lengthy and contemplative thought, not from a rapid assessment. If a comparison of models is deemed to be necessary, this comparison should develop from the understanding of the usefulness of the model to assist in determining choices in specific situations.

Algorithms (models) for analyzing and evaluating conceptual models are not nec-

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essarily inappropriate. They may greatly facilitate the critical study of conceptual models for nursing. However, if the approach is to make such a study into a process of comparison to external as opposed to internal criteria, the process itself becomes obsolete. Appropriate and helpful algorithms to the internal critique of models have been presented by Fitzpatrick and Whall¹² and Fawcett.¹⁴

Quantification

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quantification as the outcome of the comparison of conceptual nursing models. Quantification of phenomena as a necessity for nursing research has been questioned by Munhall,¹⁷ and the same questions may be asked about research relating to conceptual models. If models are useful in subjective situations, the need to develop methods for objective quantification must be questioned. When data are subjected to statistical analysis, the means and standard deviations may be obtained, but this does not account for the purposes for which the data might be useful.

This same reasoning can apply to conceptual nursing models. To say that Rogers's model is 5.61 and Weidenbach's model is 3.94 on an emotional-rational scale has no meaning. It is a contrived

numerical expression. The endeavor to quantify conceptual nursing models may be grounded in a desire to develop a nominal base for comparison. Measurement theory, however, poses two major requisites for quantification: (1) the establishment of a measurement scale and (2) the adoption of a measurement reference.

The manipulation of semantic differential scores reflects the adoption of a rudimentary scale of measurement. The lack of a measurement reference to interpret numerical values thus generated invalidates the measurement process. What *is* a 5.61? To what does it *refer*? What does it *mean*? One of the purposes of the study was to make models more accessible to practicing nurses, but a meaningless number will not be beneficial to those in practice. Its usefulness to those in education, and even in research, is also limited.

CRITIQUE OF METHOD

Instrument

Two instruments were developed for use in this study, the SDCM and a brief biographical questionnaire. Jacobson provided the rationale for choosing the semantic differential as the comparison technique: "Its view of meaning as a point in multidimensional semantic space was seen as particularly compatible with the abstract, holistic nature of nursing models."^{1(p59)} However, based on the previous questions posed about the validity of quantification of models and also based on weaknesses in the semantic differential technique itself, doubts are raised about the choice of this as the data collection method.

One of the stated purposes of the study was to determine if "the semantic differential technique . . . could detect plausible similarities and differences among models."^{1(p39)} Information about the semantic differential technique indicates that it can be used to rate anything that can be named, including concepts or objects.^{18,19} The rating of the concept, in this case the conceptual model, reflects the attitudes of the rater.²⁰ Therefore, similarities and differences among models detected by the SDCM would not necessarily be a reflection of true discrimination, but rather, a reflection of the attitudes of the raters of differences and similarities in the models.

Adjectives chosen for use on semantic differential scales are bipolar and attempt to identify a number of meanings associated with the concept being rated. One limitation of the technique identified by the developers is that this meaning is connotative, not denotative.²¹ A major problem with the use of semantic differential scales lies in the conceptual fluidity of the terms used, which in turn results mostly from the lack of definition and delineation of these terms. Protagonists of the semantic differential method¹⁸ have argued for the need to use clear, precise, and unambiguous words, but linguistic research has sufficiently attested to the differential meanings of words and the wide variability in their interpretation.

Scoring semantic differential instruments may thus reflect the eye and the mind of the beholder, instead of the attribute being scored. Therefore, despite the flexibility and adaptability of the semantic differential technique, it is questionable whether the purpose of the research can be met using this instrument.

Even if the semantic differential approach were appropriate, a psychometric concern pertaining to the scaling of the items should be raised. Jacobson assumes equality in weight of all items, thus ignoring the fact that graders may have considered some items as more descriptive, informative, and evaluative than others. Although a factor analysis was performed, no analysis of the derived factor weights and scores was done for purposes of item analysis.

Jacobson concluded that the "mean profiles of the models are a satisfying blend of similarities and differences."^{1(p67)} Based on the preceding discussion, the more apparent conclusion is that the mean ratings reflect the differences and similarities in the attitudes of the raters toward the models, not a blend of similarities and differences of the models.

Reliability and validity

To develop the semantic differential scales, adjectives were chosen from the literature on semantic differential and theory and from Jacobson's colleagues. Jacobson stated that these sources provided "some degree of reliability and content and construct validity."^{1(p60)} Jacobson also used the input of colleagues and graduate students as "aids to validity."^{1(p60)} The scales seem to have some degree of face validity, but a more systematic testing and a more thorough assessment, especially of content validity, would have strengthened the tool.

From a psychometric viewpoint, the reliability testing is problematic. First, reliability estimates were obtained only during the pilot testing and on an inadequately

From a psychometric viewpoint, the reliability is problematic. Reliability estimates were obtained only during pilot testing and on an inadequately small sample, and a test-retest procedure was used.

small sample of ten graduate students. The statistical power of an estimate obtained from such a sample is questionable.

Second, a test-retest procedure was used. Psychometrically, this method is valid only when independence in scoring is presumed. This implies that the instrument is low in reactivity and that, therefore, the first scoring does not influence the second. It is questionable, however, whether the evaluation of the nursing models can be considered a stable characteristic or, conversely, whether it is reasonable to presume that persons may alter their views with additional reflection and, in the case of this sample of graduate students, learn more about the same or a different model. In other words, does an intellectual attraction to a conceptual nursing model at a given point imply a commitment to it? Or may a reconsideration or reformulation occur as the result of intellectual activity and clinical practice?

The adoption of a conceptual nursing model is a continuous process of reflection and application, which concomitantly alters the understanding of and commitment to that model. A test-retest estimate of reliability as temporal stability is therefore of limited value.

The Jacobson instrument lent itself to the estimation of internal consistency as an index of its reliability. Internal consistency,

the extent to which items intercorrelate within a scale and its subscales, is generally considered more informative than temporal stability.²⁰⁻²² Moreover, it can be accurately estimated from a single administration. Cronbach's coefficient alpha²³ is generally considered the preferential estimator and should be given priority over other techniques such as split halves or alternative forms.²²

Not all the test-retest reliability coefficients obtained by Jacobson "broke the 0.70 barrier"; the range was 0.49 to 0.96. Reservation should be applied in the appraisal of some of the subscales. However, these coefficients may also be artifacts of the limited sample size.

Sample

For the data collection phase of the research, 78 graduate students completed the scales. It is not clear why the author chose graduate students as the sample; she states: "[Models] do not often involve clinicians, the ultimate users and transmitters of models in a practice discipline."^{1(p59)} Sampling convenience may be justified,²⁴ but this method should not be equated with what is often cynically referred to as "arm chair sampling." Convenience is a relative concept, even in scientific matters.

The following critique attests to the inappropriateness of Jacobson's sample. Although graduate students are readily available, they are only one group of users of conceptual nursing models. Usually, they are enrolled full time, thus having a reduced clinical practice. Furthermore, their exposure to and study of the conceptual nursing models is structured and directed, whereas practitioners rely on limited exposure, possibly coupled with self-

study. Therefore, graduate students are not representative of the practitioners whom Jacobson addressed, at least implicitly. The sampling bias therefore compromises the study's external validity.

In view of the multivariate factor analysis used for data reduction, the sample size of 78 was inadequate for this study. Five models were rated, and the semantic differential scales included 35 items. Each semantic differential scale was a variable. Using a guideline of at least ten subjects for each variable, a minimum sample of 350 subjects was necessary.²⁵ Since this was an exploratory study, a larger sample would have helped to determine the presence of recurrent trends in the data. "Reliability and stability (i.e., insensitivity to small changes in the data) in the results will increase asymptotically as sample size increases. . . . For the purposes of factor analysis sample sizes of several hundred are advisable."^{26(p3)}

Data analysis

The preliminary analysis included calculation of mean ratings and standard deviations from the semantic differential scales. A graphic representation of the profiles for three of the five models provided an intuitive interpretation of the data. After the preliminary analysis, factor analysis was done. Only limited information about the factor analytic procedures was presented, and there was no information about the preliminary factor analysis; eg, answers to questions about the homogeneity of variances, the independence and distribution of the sample, and whether the variables were orthogonal.

Six factors with eigenvalues of 1 or more were identified, using loadings of 0.50 or

greater. Loadings of 0.30 are generally acceptable²⁶ so Jacobson was more conservative and stringent in identifying variables to be included in the factors. The author named the factors but did not provide meanings. For example, the differences in the factors "sophistication-dynamism" and "sophistication-dynamism-scope" cannot be determined from the information provided. It would be helpful to have definitions for these terms.

The purpose of the analytic procedures is to confidently answer the initial (implicit

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and explicit) research question(s). Statistics are used to safeguard against making undue inferences (type I errors). Jacobson never arrived at an answer to her implied research question: Do the different conceptual models for nursing differ from each other, using the six-factor profile structures generated from the ratings on one of these models? Although a graphic representation of the profiles was presented, it applied to only three of the five models, and it only provided an opportunity for intuitive interpretation of the data.

Statistical procedures were developed with the specific aim of avoiding intuition in inferences. A true comparison of the profiles should have relied on the set of statistical procedures termed "profile analysis" (Harris²⁷), in which hierarchical serial

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tests are used to compare the profiles of different groups or models.

The first test investigates the null hypothesis that the profiles are parallel and therefore similar in shape. If the null hypothesis is retained, the null hypothesis of coincidence of profiles is tested (second test). If this hypothesis is in turn retained, it is inferred that the profiles are similar and moreover located at insignificant distances within the geometrical space. The retention of this hypothesis also permits the execution of the third test of the null hypothesis of flatness.

Profile analysis permits minute comparative investigations of profiles. Applied to the Jacobson data, profile analysis might have revealed similarities and differences as well as equalities and inequalities among the profiles.

Notwithstanding these alternatives, the factor analysis was unjustified, and, therefore, the resulting factor profiles are questionable. The limited sample size reduces the statistical power of the procedures, and the factor analysis was performed on ratings for one conceptual model, thereby imposing the internal structure of the ratings of this model as the basis for external comparison of several models.

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Jacobson's statement that models are rapidly proliferating and need to be systematically evaluated is true. But the need for a quantitative method of evaluation and comparison can be questioned, in view of the purposes that models serve in the discipline. An evaluation is done to gain an understanding of the content of the model so that a view of phenomena of interest to

nursing from the model's perspective can be obtained. The information and benefits derived from these views of phenomena provide a firm foundation for the development of nursing knowledge.

To be effective, there must be a comprehensive analysis of the content and a critical examination of the internal validity of the model. Comparison of models can only occur at this level. External comparison, using the methodology proposed by Jacobson, is inappropriate methodologically, psychometrically, and statistically.

Nursing models should incorporate a perspective of nursing. Each may direct new thinking about a selected phenomenon of interest, making it useful for individual nurses in particular situations. The discipline needs to be open to various conceptual models that lead to an understanding of selected phenomena. It is an understanding of the content of the models that is useful, not a rating that identifies a degree of quantification on a numerical scale, using adjectives such as "raw refined." The content of the models and the subsequent view of phenomena guide the research and theory development in the discipline, and this advances nursing knowledge.

Nursing has a history of critiquing method in relation to research that is reported, but it is necessary to look at the philosophical structure of the research as well. Jacobson provided the methodology as well as the philosophical thinking that led to the development of this study; a philosophical component is frequently not included in research reports. Critique of both method and philosophical stance is necessary for knowledge development in nursing. Attention is thus paid to the

syntactical and conceptual structure of the discipline.¹⁵

Jacobson recognized the need for testing models as a method of knowledge development. Effort needs to be directed toward the refinement of existing criteria and the development of new methods for analysis and evaluation of models. But more careful consideration needs to be

given to the decision to use quantification as a means of model comparison. However, the ultimate goal of making models useful and accessible to nurses engaged in practice, education, and research is important, and strategies in the development of nursing knowledge should be directed toward this end.

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