Models for Nursing

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IN RECENT YEARS nurse scientists, as well as other persons concerned with science, have emphasized that knowledge in the field of nursing must be set in order and systematized. General systems science has made a significant contribution in revealing the potential dangers of failure to consider all pertinent factors surrounding a process or event—the most significant being that of drawing false conclusions. The use of "models" has been adopted as a system for observing, ordering, clarifying and analyzing events.

The process of model construction is one by which existing knowledge may be ordered or reordered, or relationships between known objects or events conceptualized and understood; it is a valuable means by which either abstract or unobservable phenomena can be portrayed, taught and observed.

0161-9268/79/0012-0013$2.00

THE CONCEPT OF "MODELS"

In order to understand the particular ways in which science uses the term *model,* it is necessary to bring to conscious awareness its broader range of meaning and application. The term has acquired a decided halo effect, and, as Kaplan has aptly acknowledged, models are considered to be "good things" having great status and value in the scientific endeavor.[1] As a result, the term is often applied loosely, without awareness of the ways in which its unconsidered use confuses the reader.

In common language, the term model refers to a precise replication of the structure of an object—as, for example, a model train or model ship. In other instances, the term is used to describe an ideal version of something, usually an abstract ideal. Examples of such usage are "model child" or "model city" or "model hospital unit." Here, for instance, a model hospital unit may or may not exist; or it may be constructed according to the abstract ideals conceptualized in advance, in order to demonstrate the feasibility or possibility that such an ideal might exist. The critical feature in each of these common usages is isomorphism; that is, the model is constructed in such a way as to be structurally "true" to the object for which it is a model.

Brodbeck emphasizes the importance of isomorphism in scientific models, stressing that it must be maintained in two distinct ways.[2] First, the reality represented must determine the form of the model. Second, the relations between the parts of that reality must be maintained in the model.

The Study of Structural Relationships

Models in both general and scientific usage provide a means of exhibiting, examining, observing and teaching the structural relationships of a selected reality in a way that is not possible in reality. For example, a planetarium provides a model of the universe as viewed from the planet Earth, and the structural entities in the planetarium may be caused to move in a way that is analogous to the reality we observe in the heavens. However, in certain critical ways the model of the heavens does not correspond to reality. The forces that move the heavenly bodies are contrived, and the speed with which the movement occurs may be altered according to the purposes of the person working with the model. Further, the model heavenly bodies themselves do not replicate the organic substances or energy complexes which exist in reality. Thus, while the model has great value in teaching, observing and studying various movements of the heavens, it does not explain or predict these movements, nor does it demonstrate certain functional or causative phenomena which are recognized or speculated to exist.

Fuller has stated that "how we think is epistemology, and epistemology is modelable; which is to say that knowledge organizes itself geometrically, i.e., with models."[3(p487)] Models therefore provide an important means of communicating what a scientist has in mind when speaking of an abstract entity, or a structure or process

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that cannot be directly observed. For example, a structural model of an atom or a molecule may be presented to students or colleagues to visually represent a scientist's conceptualization of an entity not yet observed directly. The traits of the atom are deduced from certain events that have been demonstrated in the laboratory, and the scientist constructs a model to depict its inferred structural properties.

Similarly, a model might be used to depict a behavioral process or structure that exists in reality, but that can only be observed through the indirect behaviors of those engaged in the process or structure. Thus an organizational structure model pictures otherwise intangible ways in which the persons in the organization relate to one another.

An example may be found in Claus and Bailey's model of power and influence which depicts elements that are conceptualized as being essential to the abstract, but real, phenomenon of power.[4] Because of the obvious difficulties of representing them pictorially, abstractions—such as "authority"—are expressed in words and abstract relationships by arrows. In a model, the word "authority" in a box does not represent real authority in the same sense that a sail on a model boat represents an actual sail on a real ship. However, the building of a model is always a logical activity, in which a group of perceptions of reality is symbolically or otherwise represented.[5]

Cognitive Styles

Kaplan presents six cognitive styles used by scientists to accomplish their scientific goals.[1] They are: (1) literary, (2) academic, (3) eristic, (4) symbolic, (5) postulational and (6) formal.

The literary cognitive style is generally used in sciences concerned with human behavior, and emphasizes the perspective of the people who are being studied rather than the scientist's own explanatory scheme. The discipline of anthropology often uses this style. The academic cognitive style—used by sociologists such as Parsons—is much more abstract and uses a technical vocabulary to express ideas. The events studied tend to be highly ideational rather than observational, and are interpreted from a theoretical or speculative standpoint. The eristic style focuses on proof of specific propositions, and makes much use of experimental and statistical data. Behavioral psychologists such as Pavlov have worked in this mode.

The symbolic style conceptualizes its subject matter mathematically. The probabilistic study of learning theory has utilized this style, for example. The postulational style is related to the symbolic style, but differs from it as logic differs from mathematics; i.e., the focus is on the validity of proof, rather than on the content of the propositions. Validated postulates, or axioms, serve as the basis for deriving theorems, which are verified in the empirical reality of the subject matter being studied. The study of kinship systems is conducted in this manner.

The formal cognitive style is based on the postulational style, but differs from it in that the mathematical terms are not defined in relation to any empirical content. The relationships between the mathematical symbols themselves are deemed to be consistent regardless of the subject matter to which they are applied. Euclid's geometry is one such system: the "points" to which it refers can be interpreted as ordered pairs of real numbers or its "lines" as linear functions of real numbers. This style is relatively rare in behavioral sciences.

Kaplan states that the term *model* and the scientific process to which it applies are most accurately used in conjunction with the formal, postulational and perhaps the symbolic style.[1] In such applications the term model comes closest to its classic scientific meaning: a theory established in one field but transferable to another. The laws connecting concepts in the first field can be shown to connect corresponding concepts in the newer field—that is, the laws are isomorphic, obviously symmetrical and can be demonstrated to remain the same regardless of the subject matter. With such a "transfer," an established theory becomes a "model" for understanding, explaining and predicting the relationships of the newer field to which it is applied. An example is applying a theory of epidemiology of disease to the transmission of social information.[1]

Common Features

Though concepts and styles of modeling vary, all models have certain features in common. A model represents some aspect of reality, concrete or abstract, by means of a likeness which may be structural, pictorial, diagrammatic or mathematical. A model focuses attention on the structure of a model itself rather than on properties of its subject matter. Where structural or functional relationships are depicted or implied, the *nature* of such relationships is not inherently a part of the model.

Functions or structural relationships may be defined in quantifiable terms, but not in causative, or explanatory, terms applied to the nature of the subject matter. In other words, the richness of the underlying phenomena and their relationships are not explained by the model. A model does not undertake to determine *why* a certain structure or relationship occurs. What a model accomplishes is the precise structural expression of a scientist's thinking. A model orders, clarifies and systematizes selected components of the phenomena it serves to depict.

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THE RELATIONSHIP BETWEEN MODELS AND THEORIES

In order to fully appreciate the nature, function and value of models, it is necessary to examine their relationship to theory. Often the terms *model* and *theory* are used interchangeably; this is confusing and blurs the precision which science seeks to attain.

Kaplan believes that the practice of regarding all theories as models had its beginning in language and meaning at a time when a true proposition had the same structure as the fact it validated.[1] Today the building of models is only one technique the scientist uses and is not to be considered *the* important work of the scientist.

Nevertheless, scientific models, by virtue of exhibiting a structure, do simplify a complex system or properties of a system, selecting certain components deemed necessary for the conceptualization of the object of study and consciously omitting certain other related phenomena. For example, a planetarium, which may be conceptualized as a model of the heavens, does not include an accounting of the real physical forces which cause the heavens to rotate as they do. A model may exhibit, in simplified form, the structure of reality, but the feature of relative simplicity is not what causes it to be a model.

Appropriately Relating Models to Theories

How then are models appropriately related to theories? While a model primarily expresses structure, a theory provides substance in addition to structure. Kerlinger defines theory as follows:

> A theory is a set of interrelated construct (concept) definitions, and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena.[6(p9)]

The logical units of a theory are several. A set of concepts is needed which will permit a description of a situation. A set of operations is needed to develop the concepts. Relationships between and among the concepts must be shown. Propositions or deductions must be set forth. In order to verify the concepts and the hypotheses that are stated or implied by the theory, empirical indicators are needed. As conceptualized by Weber, theory construction requires that the interdependence of concrete phenomena be shown, and the causes of the conditions (variables) and their significance be presented.[7]

Three Types of Relationships

Three types of relationships between models and theories may be identified. First, models may be constructed *for* theories. A physical model (e.g., a model of an atom or a molecule) may be used to display certain structural and functional relationships that are inherent in a specific theory. Similarly, a diagrammatic model may portray certain features of a theory of group dynamics.

In these instances, the model is offered to represent aspects of the theory that cannot be easily or completely communicated in descriptive language alone. Such a model is "tied to" a particular theory and serves to examine or explain certain of its structural features. The model's meaning is limited to the terms of the theory which it represents, and is viewed from a perspective offered by that theory alone.

A second type of relationship exists when theories are used to explain certain features of an independently constructed model—that is, one that is not tied to a particular theory. Thus, in the planetarium example, theories of physical phenomena may be used to identify the causes of celestial movements displayed in the model and the unusual or out-of-the-ordinary events that occur, and to predict future occurrences in the universe. Different theories, sometimes not compatible with one another, may be offered and studied for their validity and reliability in explaining and predicting the movements of the universe. The model serves a useful purpose in that it presents a manipulatable exhibit of the reality being studied, and stimulates development of possible scientific explanations.

The Claus and Bailey power and influence model examplifies this type of model-theory relationship.[4] Their model has been constructed to exhibit a structural relationship between various behavioral phenomena. The authors have made certain observations and drawn on the validations of other scientists in order to offer the model as an acceptable isomorph of the relationships perceived to exist in reality. However, the degree of isomorphism between this model and the reality it represents is not as easily validated as that which can be demonstrated between planetarium and universe. Various theories are used to explain the nature of the relationships, and to offer alternate explanations of "why" these relationships exist.

The third type of relationship is a formal model of a theory (see previous discussion of the formal cognitive style).[1] Such a model, usually mathematical in nature, exhibits certain "true" relationships that are independent of subject matter. The model can thus be applied to any number of different phenomena, and the relationships inherent in it will be demonstrated to be constant. The model exists independent of subject matter, though its theoretical expression may vary considerably according to the nature of the subject under consideration. In each theory derived from the model, however, the relationships of the model remain consistent.

UTILIZATION OF MODELS FOR NURSING

Research

Models can be used in two different ways in relation to the process of nursing research. First, the research process itself may be conceptualized by means of a model such as the one described by Chinn and Jacobs in "A Model for Theory Development in Nursing" (ANS 1:1). Such a model brings to conscious awareness each structural component of the research process as conceptualized by the authors, and exhibits certain features of relationship among and between these components. The model may help to define and guide specific research tasks; it also makes it possible to maintain a focus on the overriding goals or intended outcomes of the research effort.

In another sense, the researcher may use a model to facilitate thinking about concepts and relationships between them. The model selected depends on the nature of the research. It may have any of the three types of relationships to theory described above, although the formal model-theory relationship is probably nonexistent in nursing at present. The researcher may use an existing model or may construct one specifically for the research at hand.

The model simplifies, and by so doing it assists in ordering, clarifying and analyzing concepts and thinking processes. It brings together crucial elements of knowledge economically—providing structure while minimizing the fullness of the substance. Caution is needed, however, to avoid oversimplifying the phenomena under study. To view phenomena conceptually by means of a particular model is to put on mental "blinders." These may prevent the recognition of certain critical variables excluded from the model or may enhance inaccurate preconceived notions about possible reality.

Batey says of the guiding or "mapping" function within the conceptual phase of research:

> ...the substance for the map is the background knowledge that delineates the present knowledge state about the problem. The mapping process yields the theoretical statement through which the investigator attempts to construct as accurate an image of the phenomenon of study as existing knowledge and her logical interrelation of that knowledge will permit.[8(p326)]

The model may thus be seen as providing the structure or map which enables theory to take form in relation to the research under way.

Education

Educational models can generally be used in three ways: in guiding the student-teacher interaction, in planning the curriculum and in selecting materials for instruction. In nursing education, as in nursing research and nursing practice, a model serves to unify, to give direction and to simplify. By using a model, the nurse educator can identify focuses and rationalize them within an appropriate frame of reference.

Nursing education uses two major types of models: general models for the teaching-learning process and models developed specifically for nursing. In the first category are models of learning processes, motivation, human interaction and human development. Examples of nursing-specific models used in nursing curricula are: Rogers' model of unitary man, Neuman's total person approach to patient problems, the Roy Adaptation model and the Johnson Behavioral System model. Some models are designed for very specific purposes, while others have wider applications.

Practice

Nurse practitioners have special concerns relating to the day-to-day problems and situations they deal with. Where changes are needed in these areas of concern, there must be objectives for change—and in order to achieve objectives or outcomes of care, the practitioner must have some thoughts on direction and evaluation. It is here that a model or models may be of assistance. Chin states that the practitioner has a style of thinking

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about situations which utilizes concepts to sort out events, and that behind the conceptualization lie assumptions. By building or utilizing a model the practitioner "becomes at once the observer, analyzer and modifier of the system of concepts he is using."[9(p297-312)]

A comparison of various conceptual models for nursing practice reveals likenesses—which is logical, since nursing generally attends to human behavior and its environment. Major models used in nursing practice are the system model, the developmental model and the interactionist model. System models have been generated by Johnson, Roy, Neuman and Rogers. This type, the system, is a universal. Interdependencies and interactions are inherent. There are structure, organization and stability in a system, which is itself a model. Development models have been tried from the theoretical works of Freud, Erikson, Maslow, Sullivan and Rogers. The central theme of this type of model is growth and change to meet certain stated goals, and movement takes place from one level or stage to the next. Selected factors are responsible for this movement and, it is believed, natural or environmental forces which practitioners work to predict and control.

King, Orem, Orlando and Wiedenbach have created interactionist models which have their basis in the Gestalt principle of the whole being greater than the sum of its parts. Wholeness is the major construct, and integrity of the person is the goal of nursing. The categories of terms which form the essence of this type of model are social systems, interpersonal relationships, interactive process, perceptions and health.

MODELS STIMULATE SCIENTIFIC PROCESS

Building and using models is a logical activity in which a group of perceptions is represented—symbolically or otherwise—so as to clarify them and communicate them more effectively. Models provide analogues to reality and stimulate the scientific process by identifying new possibilities for explanation, prediction and control of phenomena. As with the use of other types of analogies, the limitations of the likeness must be recognized and understood. The selection of a model or models to be used depends on the discipline, the particular purposes of the research at hand and the personal preference of the nurse-artist-scientist. Whatever model is chosen, it should represent reality as precisely as posssible.

For nurses, the model or models constructed or chosen must represent the ordered reality of nursing's focus—persons, their environment, their health and nursing itself. As nurse practitioners collaborate with nurse scholars in viewing outcomes of nursing care, through the use of clearly represented models, nursing's actions will become precisely and consistently specified.

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