Nursing Diagnosis from the Perspective of Concept Attainment and Critical Thinking

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EXAMINING THE COGNITIVE PROCESSES UTILIZED IN NURSING DIAGNOSIS

NURSING DIAGNOSES are derived as the result of a cognitive process. They involve making a judgment based upon knowledge. Although knowledge is crucial to the diagnostic task, the knowledge must be stored in such a way as to make it effectively retrievable for use during the diagnostic process.[1] Two studies were conducted to determine specific variables which relate to the nurses' cognitive ability to process information during the nursing diagnostic process. The problems for study were: (1) What is the relationship between concept attainment and cue perception in deriving a nursing diagnosis?[2] and (2) What is the relationship between critical thinking and the ability to derive a nursing diagnosis?[3]

Background and Significance

The need to collect and process information has been noted throughout nursing

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history. Early recognition was given to the observational function of the nurse and to the complexity of data which the nurse must consider before making nursing judgments.[4] Nursing diagnosis is an integral part of the nursing process.[5] Inherent in nursing diagnosis is not only theoretical knowledge, but also a strategy that enables the nurse to evaluate the cues presented by the patient.[6]

Since the literature indicated that the skill with which the practitioner applies critical thinking to the diagnostic process will be a major factor in the quality of care that the client receives,[1] it was necessary to study critical thinking in relation to nursing diagnosis. It is postulated that patient care could be improved if nursing diagnosis was described, identified and taught to those who practice nursing.

Gordon used scores on the Graduate Record Examination and the Miller Analogies Test as a predictor of the nurse's ability to process information to derive a nursing diagnosis.[7] No reported studies were found which measured the ability to deal with concepts and to think critically and which correlated these abilities with the ability to utilize cues and to derive a nursing diagnosis.

Theoretical Framework

The basis of identifying nursing diagnoses lies in the accurate identification and perception of information in the patient's environment, as well as in the ability to assign valid meanings to each situation.[1] Bruner et al. described the cognitive operations that occur when information is selected, retained and transformed.[8] Information is processed by the learning and use of categories. Concept attainment is considered conjunctive or disjunctive. A conjunctive concept is defined by the joint presence of several attributes, while a disjunctive concept is defined by the presence of any one attribute or combination of attributes that are known to identify the concept.[8] Gordon states that nursing diagnoses are considered disjunctive concepts and, in addition, are highly probabilistic.[7] That is, arriving at one category label or diagnosis does not necessarily exclude other diagnostic categories. The ability of the nurse clinician to use appropriate information-processing strategies in concept attainment or categorization is basic to the nursing diagnostic task.

Definition of Terms

The terms used in both studies were defined theoretically and operationally. Theoretically defined, a cue is any observable feature of an event that is capable of some variation.[8] The operational definition of a cue as presented in the Case Studies is a sign, symptom or other information related to the patient. Cue grouping is theoretically defined as the arbitrary arrangement into sets of cues which have some common property.[9] Operationally defined, cue grouping is the process of cue arrangement utilized to derive a nursing diagnosis. The theoretical definition of concept is a complex mental image which is derived from an individual's perceptual experience.[10] Concept is operationally defined as the application of a category label to a set of cues, as measured by the Case Studies. Nursing diagnosis is theoretically defined as a form of probabilistic concept attainment in which an inferential

judgment is made about the state of the patient.[7] The operational definition of nursing diagnosis is the identification of the state of the patient based upon the utilization and grouping of cues, as measured by the Case Studies.

Critical thinking, theoretically defined, is an attitude of inquiry which involves the use of facts, principles, theories, abstractions, deductions, interpretations and evaluation of arguments. This ability also involves the cognitive skills of comprehension, application, analysis, synthesis and evaluation.[11] The operational definition of critical thinking is those cognitive skills measured by their performance on the Watson-Glaser Critical Thinking Appraisal. The theoretical definition of concept mastery is the ability to deal with abstract ideas. Operationally defined, concept mastery is the number and variety of concepts at an individual's command as evidenced by the performance on the Concept Mastery Test.

Instruments

Both studies used a Case Study to measure nurses' diagnostic abilities. For the Concept Mastery Study, the Case Study described a patient with the nursing diagnoses of emotional disturbance and impaired elimination.[2] For the Critical Thinking Study, the Case Study presented a patient's behavior that was indicative of an impairment in the ability to process thoughts, i.e., mental confusion.[3] The subjects were asked to indicate all possible nursing diagnoses for this behavior. Content validity for every cue in each Case Study was established by determining the rate of agreement with two of three medical or nursing textbooks. Content validity was further established by submitting each Case Study to a pilot sample. The construct validity was established by relating the theoretical framework of Bruner et al. to the construction of the Case Study.[8] The works of these authors demonstrate the process of cue utilization in categorizing or conceptualizing. The Case Studies contained cues which provided the basis for categorizing and deriving nursing diagnoses.

Reliability was not established for the two Case Studies. A review of the literature in nursing diagnosis revealed that in most instances where patient situations comprised one of the instruments, the reliability coefficient was not reported.[6,7,12-15] Dincher and Stidger elaborated on the difficulty in applying conventional methodology for establishing reliability for patient situations.[16] They concluded that conventional methods were not applicable to written patient case studies.

CONCEPT MASTERY TEST

The Concept Mastery Test (Form *T*) was selected in accordance with the theoretical framework, which states that categorization or the attainment of concepts is based upon proper cue selection and utilization. Cognitive functioning is determined largely by the number and variety

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of concepts at an individual's command and by the ability to see relationships between them. The Concept Mastery Test is a standardized test which measures the ability of the subjects to deal with abstract concepts.[17]

WATSON-GLASER CRITICAL THINKING APPRAISAL

The Watson-Glaser Critical Thinking Appraisal (Form *Ym*) is a standardized test which measures five aspects of critical thinking: (1) inference, (2) recognition of assumptions, (3) deductions, (4) interpretation, and (5) evaluation of arguments.[18] Construct validity of the instrument may be logically inferred as a method of measuring clinical reasoning. The ability to think critically is assumed as a basis for the cognitive processing of information.

Methodology

Data were collected in the same two-month period of 1978. The subjects included nursing students enrolled in a baccalaureate school of nursing who would complete their course of study within five months and graduate nursing students who were currently enrolled in a required clinical course. A purposive sampling technique was used. A Case Study and the Concept Mastery Test were administered to the subjects (N = 42) in the Concept Attainment Study. A Case Study and the Watson-Glaser Critical Thinking Appraisal were administered to the subjects (N = 48) in the Critical Thinking Study. In both studies the subjects were tested at their convenience in a quiet classroom.

Treatment of Data

The mean scores, standard deviation and normative scores on the Concept Mastery Test and the Watson-Glaser Critical Thinking Appraisal are reported in Table 1.

CONCEPT ATTAINMENT STUDY

The Spearman Rank Correlation Coefficient was calculated to determine the relationship between concept mastery and

TABLE 1
Mean Scores, Standard Deviation and Normative Scores for the Concept Mastery Test and the Watson-Glaser Critical Thinking Appraisal

Group	N	Mean Score	St. Dev.	Normative Score	St. Dev.
Concept Mastery Test					
Undergraduate	18	53.27	27.15	101.7	33
Graduate	24	66.89	21.88	119.2	33
Watson-Glaser Critical Thinking Appraisal					
Undergraduate	22	75	8.42	74.4	9.6
Graduate	26	78	6.02	*	*

*Not reported.

cue perception in nursing diagnosis. The significance level was set at $p < 0.05$. Significant correlations were found in the undergraduate subjects between the scores on the Concept Mastery Test and cue perception in the diagnoses of impaired elimination, $rho = 0.713$, $p < 0.001$ and emotional disturbance, $rho = 0.448$, $p < 0.05$. There was no significant correlation between cue perception in either diagnosis and the Concept Mastery Test among the graduate subjects.

The Mann-Whitney U test was applied to the data to determine whether there was a difference in cue perception and concept mastery between the graduate and undergraduate subjects. The graduates performed significantly better than the undergraduates on the Concept Mastery Test at the five percent level with $u = 117.5$. There was no significant difference in cue perception in either diagnosis between the two educational groups at the ten percent level with $u = 202.50, 186.50$. Chi square was applied to the data to determine the relationship between the education levels and the frequency of cue use. There were no significant relationships in the diagnosis of emotional disturbance. One significant relationship was noted in the diagnosis of "impaired elimination" with the undergraduates' use of the cue "paraplegia." Although it was not statistically significant, a strong relationship was noted with the graduates' use of the cue "clear chest," as presented in Table 2.

CRITICAL THINKING STUDY

The Mann-Whitney U test was applied to the data to determine a difference between the ability of the graduate students and the undergraduate students to think critically. There was no significant difference between the two groups' ability to engage in critical thinking, as measured by the Watson-Glaser Critical Thinking Appraisal ($u = 224$, $p < 0.2$).

An analysis of the Case Study revealed that the undergraduate subjects identified

TABLE 2
Significant X^2 Values of Cues Used in Nursing Diagnosis

Diagnosis	Cue	Educational Level	X^2	p
Diabetic imbalance	Infection	Graduate	3.80	0.051
Drug overdose	Decreased respiratory function	Graduate	4.84	0.028
Fluid and electrolyte imbalance	Behavior change	Graduate	4.94	0.026
Fluid and electrolyte imbalance	Anorexia	Graduate	7.16	0.007
Senility	Impaired memory	Graduate	7.24	0.007
Sensory deprivation	Hallucinations	Graduate	4.45	0.035
Impaired elimination	Paraplegia	Undergraduate	4.03	0.045
Impaired elimination	Clear chest	Graduate	2.88	0.090

an average of 50% of all possible nursing diagnoses, while the graduate subjects identified 62% of the diagnoses. The Mann-Whitney *U* test was applied to the data to determine any significant difference between the ability of the two groups to identify nursing diagnoses. A significant difference was found between the educational levels and the diagnostic ability. The graduate subjects identified significantly more diagnoses than the undergraduate subjects ($u = 158.50$, $p < 0.008$).

The Spearman Correlation Coefficient was calculated to assess the strength of the relationship between the ability to derive nursing diagnoses and the ability to think critically. There was no overall relationship between nursing diagnosis and critical thinking ($rho = -0.140$, $p < 0.535$). Chi square was calculated to determine the relationship between the educational levels and the cues utilized in deriving the nursing diagnoses. Table 2 displays the significant relationships that were noted.

The data obtained from both studies were analyzed for cue grouping. A total of ten cues each was documented from textbooks to identify the two nursing diagnoses in the Concept Attainment Study. A total of 59 cues had been documented to describe the nine possible nursing diagnoses in the Critical Thinking Study. Frequency distributions were constructed for each cue. None of the subjects in either study utilized all of the cues available for each diagnosis. It was concluded that the value of each cue, rather than the number of available cues, enabled each subject to derive the nursing diagnoses.

Using set theory as described by Feinstein, the researchers then arbitrarily identified three categories in which to group the cues: historical, physiological and behavioral.[9] By summing the frequencies of the cues in each group, it was possible to identify the discriminating cues for each diagnosis. Discriminating cues are described by Bruner et al. as those cues allowing the subjects to correctly categorize the information, i.e., to derive a nursing diagnosis.[8] Although the discriminating category varied according to the diagnostic label, it was clearly defined in every instance in which a nursing diagnosis was derived.

Conclusions

On the basis of the data obtained in these investigations, the following conclusions are warranted. The subjects' ability to deal with abstract concepts as measured by the Concept Mastery Test was considerably below the national average. However, the graduate subjects performed better than the undergraduate subjects. The subjects' ability to think critically as measured by the Watson-Glaser Critical Thinking Appraisal was consistent with the mean score of a national sample and there was no difference between the two educational groups tested.

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Among the undergraduate subjects, a strong relationship existed between cue

perception in nursing diagnosis and the scores on the Concept Mastery Test. No such relationship existed among the graduate subjects. There was a difference between the undergraduate and graduate subjects in their ability to derive nursing diagnoses, as determined in the Critical Thinking Study. However, there was no overall relationship between the ability to derive nursing diagnoses and to think critically. Cue grouping occurred in both investigations according to the frequency of cue use. The discriminating cues, which were those cues used with the highest frequency, were the basis for the nursing diagnoses that were derived.

Discussion of Findings

The Concept Mastery Test scores for the total sample were much lower than the established norms for similar groups. This test is validated for group administration to college juniors and seniors and to graduate students. Strong correlation coefficients have been noted with tests that measure verbal ability—e.g., the College Entrance Examination Board, the Weschler Adult Intelligence Scale, the Stanford Binet Intelligence Scale and the verbal section of the Graduate Record Examination. A review of the testing procedure failed to reveal a technical reason for the low scores.

The university where testing was conducted did not require the Graduate Record Examination as an admission criterion into the Graduate School. Since such a strong correlation exists between the verbal section of the Graduate Record Examination and the Concept Mastery Test, it is possible that this is not a representative graduate sample. However, nursing diagnoses are abstract concepts and the scores on the Concept Mastery Test may reflect what has been noted by Aspinall, i.e., the diagnostic ability of nurses is poor.[6] (Also, Aspinall, M. J. "Use of a Decision Tree by Nurses to Improve the Accuracy of Diagnosis." Unpublished paper presented to the Council of Nurse Researchers, American Nurses' Association, Las Vegas, Nevada, August 1977.)

While the Concept Mastery Test may be indicative of the diagnostic ability of nurses, it does not measure the cognitive processing of information, i.e., cue perception in the attainment of the diagnostic concept. A significant relationship existed between cue perception and the Concept Mastery Test among the undergraduate subjects. No such relationship existed among the graduate sample. The level of entry into information processing in deriving concepts varies. Thus, not all cues must be tested to derive a nursing diagnosis.

Different cue processing strategies may exist within the two educational groups. It is postulated that the difference in strategy has to do with the informational value of the cue to the individual rather than with the number of cues utilized. The preference of the undergraduate sample for the cue of "paraplegia" indicates that this cue had a higher information value to them in deriving the diagnosis than it did to the graduates. The graduates found that the cue of "clear chest"—which is a negative cue in this instance—had high informational value. This use of negatively confirming information indicates an en-

tirely different strategy. The variable of nursing experience is unaccounted for in this study. It may well affect not only the strategies employed but also the relationship between the scores on the Concept Mastery Test and cue perception.

The fact that there was no difference between the two educational groups' ability to think critically could be related to several factors. Educational level may not be a factor in developing critical thinking skills. The Watson-Glaser Critical Thinking Appraisal possibly is not designed to measure critical thinking skills that are developed at the graduate level, since those scores that are reported from a normative sample are related only to college seniors. If the Watson-Glaser Critical Thinking Appraisal does not measure the graduate subjects' ability to think critically, this certainly could be related to the inability to establish a relationship between nursing diagnosis and critical thinking.

Nurses may derive nursing diagnoses based on cognitive abilities other than those measured by testing critical thinking skills. This is substantiated by Gordon's findings in relation to information processing strategies.[7] It was hypothesized that subjects who had a higher inferential ability as measured by scores on the Graduate Record Examination and the Miller Analogies Test would use a more complicated method of information processing and would have greater accuracy and confidence in the concept attained.[7] However, the results indicated that the subjects' inferential ability as measured by those two standardized tests did not affect the strategy of information processing that was employed. Further research is indicated to investigate the cognitive abilities of the nurse as they relate to the nursing diagnostic task.

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In the Critical Thinking Study, the graduate subjects derived approximately 60% of the nursing diagnoses, while the undergraduate subjects attained only 50%. The graduate subjects' current positions as students in an educational setting, coupled with a more advanced education and clinical experience, can explain their more highly developed diagnostic ability. This finding is consistent with other studies which have demonstrated that advanced educational preparation accounted for a higher quality of patient care.[13,14]

The Case Study designed for the Critical Thinking Study was more complex than that designed for the Concept Attainment Study. An inverse relationship existed between the nurses' diagnostic ability and the number of nursing diagnoses to be identified, in that the nurses' diagnostic ability decreased as the number of patient diagnoses increased. This is consistent with previous research that has identified the poor diagnostic ability of the nurse.[6,20] Another source of difficulty in deriving the nursing diagnoses could be related to the Case Study itself, since standardized instrumentation which measures nursing diagnosis is nonexistent.

Nursing diagnosis has been identified as a disjunctive concept attainment task.[7] As noted by Bruner et al. disjunctive concepts are attained with more difficulty than conjunctive concepts.[8] The difficulty in disjunctive concept attainment lies in the fact that the cues are not necessarily related to each other but only define an ultimate criterion. Because the cues in this type of concept are not related to each other, the arrival at one diagnostic category does not exclude other possibilities. In this type of concept attainment no one cue can define the concept. The cues which inherently share no common characteristics are identified as discriminating and are grouped accordingly.

This cue grouping becomes the discriminating category which allows the subjects to correctly categorize the information and derive the nursing diagnoses. This was demonstrated in the Case Study designed for the Critical Thinking Study, which presented a mentally confused patient who had multiple, simultaneous and nonrelated nursing diagnoses. Perhaps the subjects' ability to derive only an average of 56% of the diagnoses was related to the multiple number of disjunctive concepts to be attained. An important factor in concept attainment is that of cognitive strain. When the nature of the concept attainment task imposes a high degree of strain upon the memory and the inferential capability, the strategy employed will be primarily aimed at reducing cognitive strain. Thus the chances of attaining the correct concept are affected in a negative manner.[8] Further research is indicated to identify methods of improving nurses' accuracy as the diagnostic task becomes more complex.

Implications for Nursing

These studies have demonstrated that the ability to derive nursing diagnoses depends upon identifying the discriminating cues for each diagnosis. Consequently, the discriminating cues for every nursing diagnosis, once identified, can be utilized in teaching the diagnostic task of the nurse and in formulating a nursing diagnostic taxonomy.

Nursing diagnoses are a result of nurses' ability to make an appropriate application of theoretical knowledge to the clinical setting, to interpret, to evaluate, to categorize and to make inferences based upon the utilization of cues. Nurse researchers and educators should focus more extensively on identifying and teaching the cognitive task of the nurse if nurses' diagnostic abilities are to improve.

REFERENCES

1. Little, D. E., and Carnevali, L. *Nursing Care Planning* (New York: J. B. Lippincott Co. 1976).
2. Gaul, A. "Concept Attainment and Cue Perception in Nursing Diagnosis." Master's Thesis, Texas Woman's University 1978.
3. Matthews, C. "The Relationship between Nursing

Diagnosis and Critical Thinking." Master's Thesis, Texas Woman's University 1978.
4. Nightingale, F. *Notes on Nursing: What It Is, and What It Is Not* (New York: G. P. Putnam's Sons 1922).
5. Carrieri, V. K., and Stizman, J. "Components of the Nursing Process." *Nurs Clin N Am* 6 (1971) p. 115-124.
6. Aspinall, M. J. "Nursing Diagnosis—The Weak Link." *Nurs Outlook* 24:7 (1976) p. 433-437.
7. Gordon, M. "Strategies in Probabilistic Concept Attainment: A Study in Nursing Diagnosis." Ph.D. dissertation, Boston College 1972.
8. Bruner, J. S., Goodnow, J. J. and Austin, G. A. *A Study of Thinking* (New York: John Wiley & Sons 1956).
9. Feinstein, A. R. *Clinical Judgment* (Huntington, New York: Robert E. Krieger Publishing Co. 1967).
10. Chinn, P. L., and Jacobs, M. K. *Theory Development in Nursing: Visual Accompaniments for Audiotapes* (Dallas: Nursing Science Library 1975).
11. Skinner, S. B. "Cognitive Development: A Prerequisite for Critical Thinking." *The Clearing House* 49:7 (1976) p. 292-299.
12. Grier, M. R. "Decision Making about Patient Care." *Nurs Res* 25:2 (1976) p. 105-110.
13. Verhonick, P. J. et al. "I Came, I Saw, I Responded: Nursing Observation and Action Survey." *Nurs Res* 17:1 (1968) p. 38-44.
14. Davis, B. G. "Clinical Expertise as a Function of Educational Preparation." *Nurs Res* 21:5 (1972) p. 530-534.
15. Hammond, Kenneth R. et al. "Clinical Inference in Nursing." *Nurs Res* 15:3 (1966) p. 236-243.
16. Dincher, J. R., and Stidger, S. L. "Evaluation of a Written Simulation Format for Clinical Nursing Judgment." *Nurs Res* 25:4 (1976) p. 280-284.
17. Terman, L. M. *Concept Mastery Test Manual, Form T* (New York: Psychological Corp. 1956).
18. Watson, G., and Glaser, E. *Watson-Glaser Critical Thinking Appraisal* (New York: Harcourt, Brace, and World 1964).