A New Assessment-Oriented Decision-Making Model for Instructional Computer Simulations in Nursing

Anna Powers-Taylor

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ABSTRACT

A NEW ASSESSMENT-ORIENTED DECISION-MAKING MODEL FOR INSTRUCTIONAL COMPUTER SIMULATIONS IN NURSING

Anna Powers-Taylor

This is a new formal model (quasi-algorithm) for use by nursing educators in producing instructional computer based simulations. What has been needed is a model which will better meet the assessment learning needs of nurses, in all aspects of the assessment sub-processes.

The author's model is grounded in a new and improved framework for teaching the nursing process. The most relevant decision-making literature was analyzed using the Black Box Theory.

The model presented here has attempted to combine all elements seen to be necessary from the literature, and incorporate them in such a way that the model can be readily used as the basis for designing computer simulations.

ACKNOWLEDGEMENTS

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DEDICATION

To my daughter,

Andrea Lynn

who is the true joy

of my life.

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I STATEMENT OF THE EDUCATIONAL PROBLEM

- Introduction

The Nursing Process is a term used in the daily work of nurses in any setting. A closer look at this process reveals that it involves data collection and analysis from which the initial assessment is made, progresses through planning and implementation of appropriate nursing interventions, and culminates in the evaluation of the client's response to those actions. This simple, straightforward and logical process is known as decision-making. However, to apply theoretical knowledge from nursing and related fields in unique clinical situations is one of the most difficult skills for nursing students to learn (Aspinall and Tanner, 1981).

Humans are problem-solving beings and by the time students enter a nursing program they possess established patterns of dealing with problems. On the other hand these same students may be using processes other than decision-making to deal with the issues that present themselves. Intuition, protocol, authority and precedent are examples of the models used to find a solution (Callin and Cilisha, 1983). Adults tend to define themselves mainly in terms of their experiences so that any discussion of decision-making must outline why their behaviour is difficult to change. Having to re-evaluate and possibly alter the way one perceives the world is difficult, particularly if the student believes her behaviour has been entirely appropriate.

What is needed is a way for students to observe their decision-making behaviour and consciously scrutinize their invisible thinking

patterns in a non-threatening environment. One answer is computer simulations. Students can be presented with actual clinical data and be asked to respond to the presented clients (Taylor, 1980). There is an opportunity for some of their previously held beliefs, attitudes, and knowledge to be given up. Defensive or protective behaviour will be avoided. Computer simulations allow students the opportunity to participate, observe, and evaluate their decision-making abilities. One to one follow-up with the nursing professor can act to verify these self-assessments and allow for any discussion necessary to clarify the performance and suggest appropriate learning activities.

A formal model (quasi-algorithm) is needed to enable nursing educators to design and to develop computer based instructional simulations of the nursing process which will prepare nurses in all aspects of the assessment sub-processes. Such simulations would provide the learner with activities where her decision-making would not be subject to direct scrutiny by her professor or responsible for fatal consequences for the client.

One of the critical elements in the decision-making process is learning to consider multiple alternatives at each step (Aspinall and Tanner, 1981). The number of plausible alternatives the individual considers in decision-making will distinguish the expert from the novice. Another major element is the storage and retrieval of information held in memory. It has been suggested by them that the

learner should organize the knowledge in nursing around several major categories of cues. Each category of cues is related to physiology and pathophysiology.

Other authors suggest frameworks based upon the needs of the client (Bower, 1972). Abraham Maslow has identified man's basic needs in order of hierarchy as follows:

1. Hunger, thirst, sex and survival
2. Safety, self-preservation, security
3. Belongingness and love
4. Social esteem and self respect
5. Self-actualization (Maslow, 1962)

Using this framework data are collected, analyzed and utilized to determine what needs the client presents. Information from observation, interview, and ongoing appraisal is arranged into categories for analysis. If, on analysis, the data indicate unmet needs or blocked goals, then a problem exists. By definition a problem is an interruption in the individual's ability to meet a need; it is a difficulty or a perplexity that requires resolution. This type of categorization allows for another manner for information storage and retrieval.

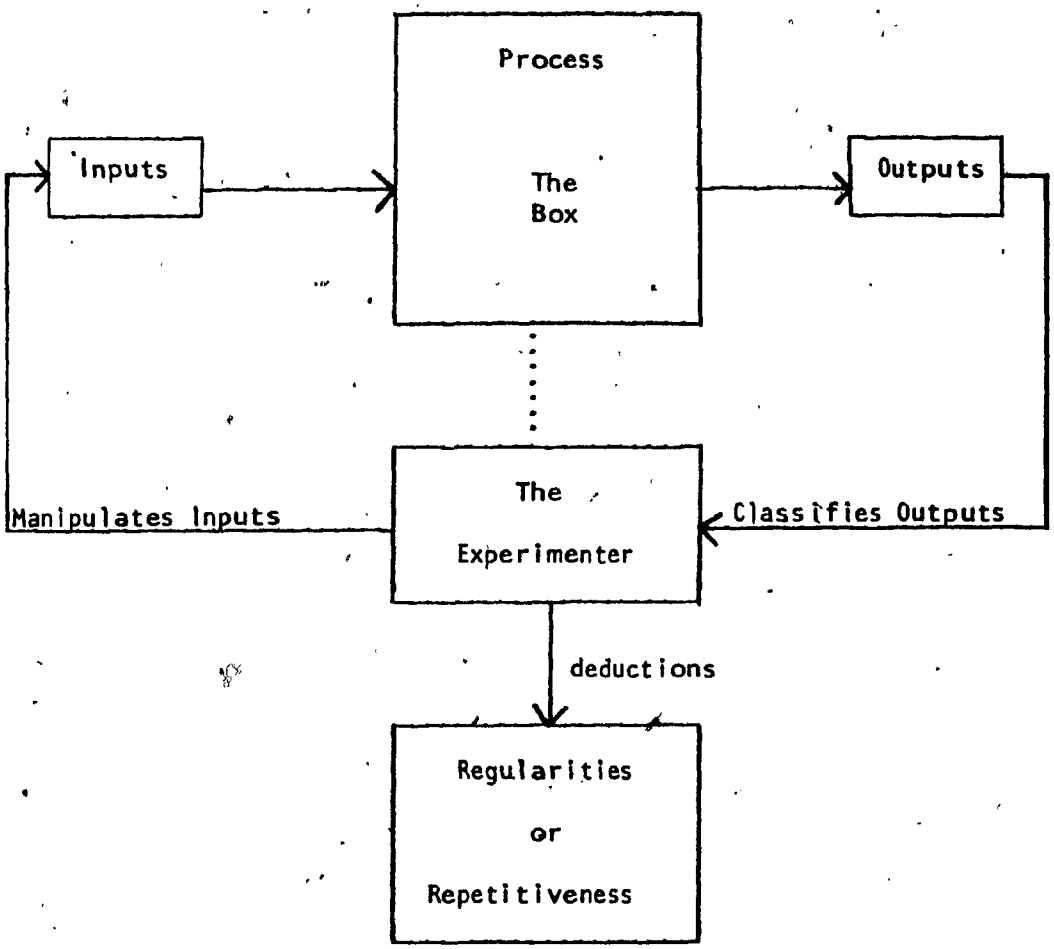
For the purposes of this work the decision-making process will be viewed as a Black Box which converts inputs into outputs (see Figure 1.). This Black Box component can be translated into the more

psychological: stimulus-organism - response paradigm or model (Beishon, 1976). In our daily lives we are confronted frequently with systems whose internal mechanisms are not fully open to inspection, and which must be treated by the methods appropriate to the Black Box. For example, the child who tries to open a door has to manipulate the handle (the input) so as to produce the desired movement at the latch (the output); and he has to learn how to control the one by the other without being able to see the internal mechanism that links them (Ashby, 1976). In the case of this thesis the internal mechanism is decision-making.

Models for decision-making from the current literature will be examined using this approach: Lancaster & Lancaster, 1982; Carpenito, 1983; Aspinall & Tanner, 1981; Bower, 1972; Callin & Ciliska, 1983; and Simon, 1976. Following this analysis and identification of essential elements for an optimal model of decision-making to be used in designing computer simulations in nursing, the model presented by the author will be discussed and evaluated. The relative advantages and disadvantages of using this model to develop simulations of actual clinical situations will also be addressed.

The literature in the field of educational psychology sheds light on the internal mechanism of decision-making. Robert Gagné suggests that there is a hierarchy of knowledge and that problem solving (decision-making) is at the highest level of complexity in intellectual skills. Stimulus-response connections, chains, verbal associations,

FIGURE 1. The Black Box Technique



Adapted from: Schoderbek et al, (1975) p. 79

discriminations, concepts and rules are required prerequisites. The learner combines simpler rules, which she recalls, into a more complex rule which is the solution to the problem. The learning guidance is provided by the learner herself and not by a professor or other external sources (Gagné & Briggs, 1974).

Cognitive strategies seem to be internally organized skills which govern the learner's own behaviour (Bruner, 1971). They include the processes of attending, learning, remembering and thinking. Cognitive strategies of thinking are involved when the learner defines and thinks out the solution to a unique problem. These strategies - how creatively, fluently, and critically the learner thinks - can be related to the theory of Piaget (1950) concerning intellectual development. Piaget suggests that the capabilities here referred to as cognitive strategies set limits to the kinds of problem solving individuals of various ages can successfully perform.

Some of the literature suggests that there are enormous differences among people with respect to their intellectual capacities (Tyler, 1965; Ausubel, 1968) and, therefore, the conditions of instruction can have only an indirect effect upon the acquisition and improvement of cognitive strategies. Cognitive strategies require more indirect control. External events must be organized so as to increase the probability of certain internal events and these in turn determine the learning of the cognitive strategy. Therefore, the design has to be in terms of favorable conditions and cannot be accomplished by

specifying the sufficient conditions. Essentially students need to be given opportunities to think in order to "learn to think" (Gagné & Briggs, 1974).

II REVIEW OF THE LITERATURE

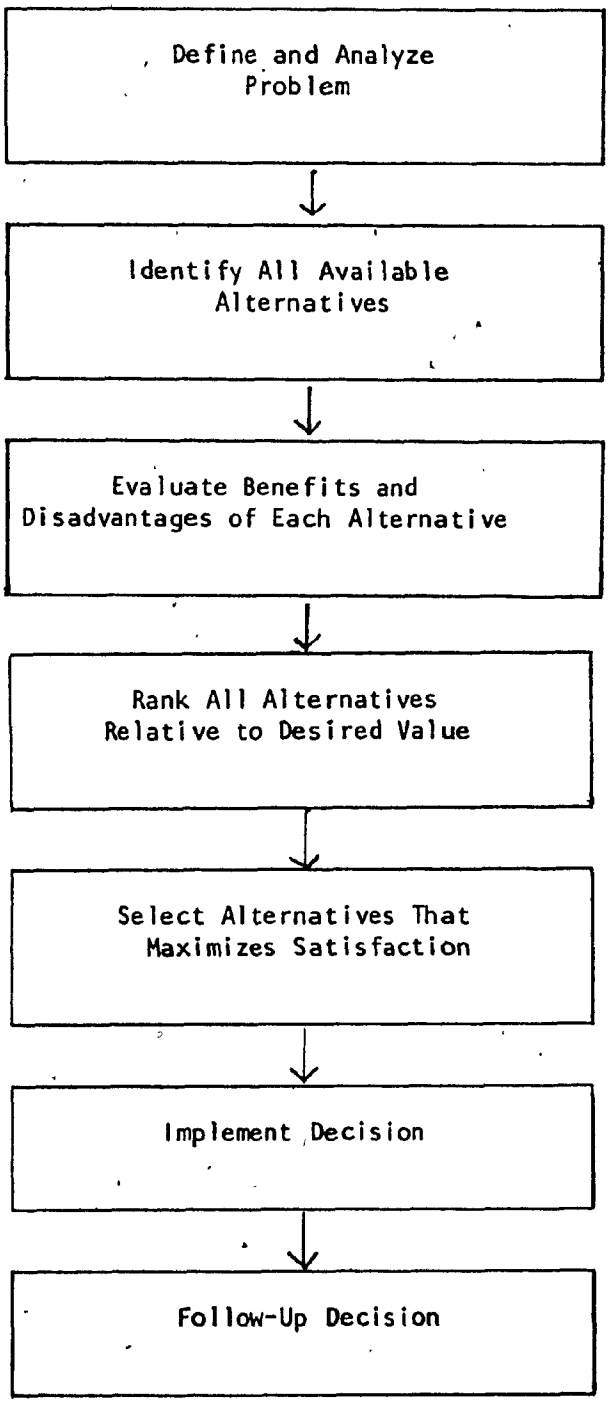
The author will discuss decision-making as described in the literature by generalists in the field such as Herbert Simon as well as by those who have published their views of decision-making related directly to the nursing process.

- Decision-Making Literature

Decision-making is a sequential process which culminates in the implementation and its follow-up thereby translating the decision taken into a course of action (Lancaster & Lancaster, 1982). The process of decision-making consists of several elements including the problem, the decision maker, the process, and the decision itself. Some people approach decision-making using the normative process. This model for decision-making was proposed by Adam Smith at least two hundred years ago. It involves two primary assumptions: firstly, that the objective of all decisions is to maximize satisfaction and secondly, that all possible choices and the consequences and potential outcome of each are known - the perfect knowledge assumption (Duncan, 1973). This model involves the sequences noted in Figure 2.

FIGURE 2.

The Perfect Knowledge Assumption Model



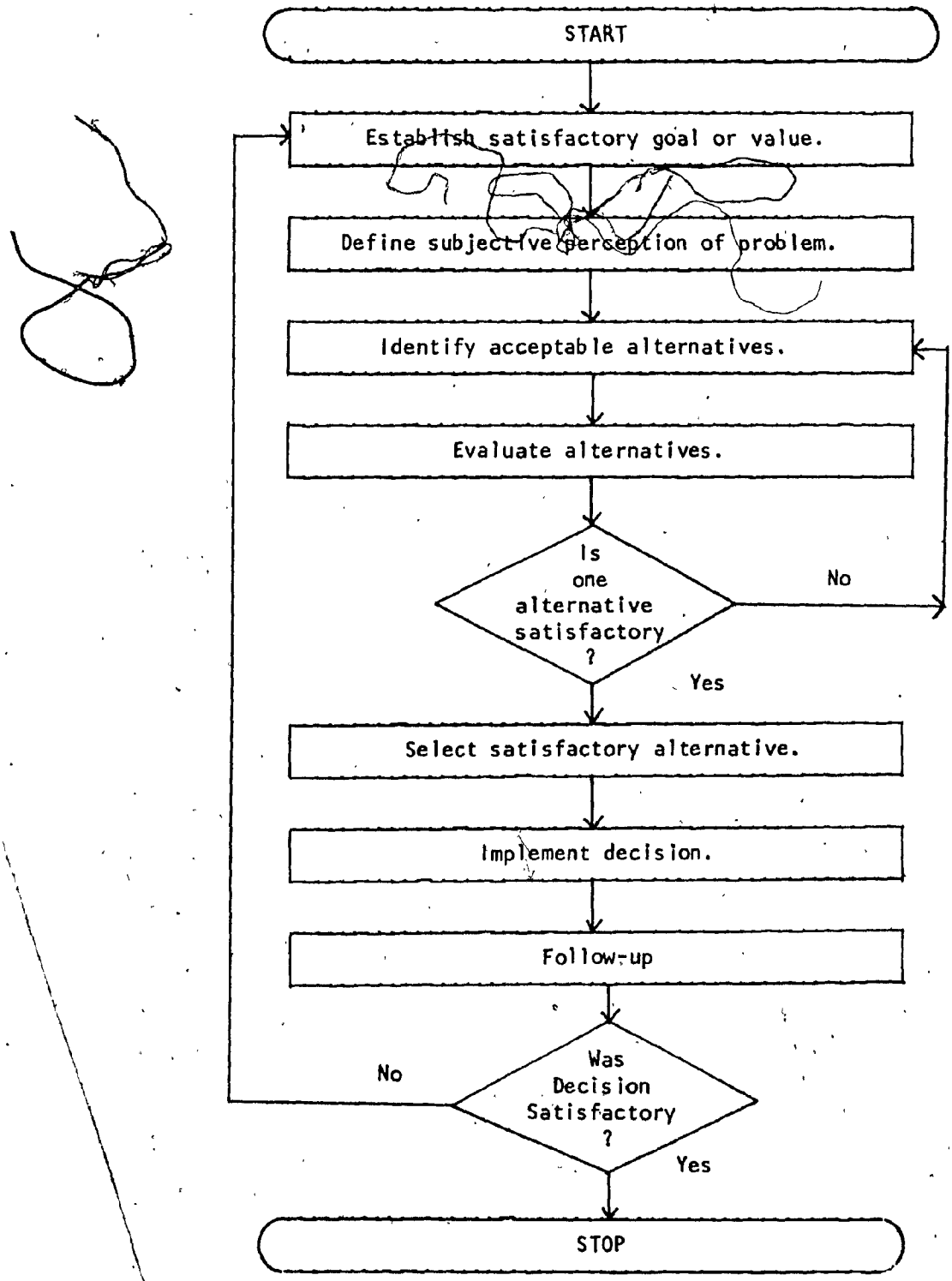
This approach to decision-making prescribes a specified objective and provides guidelines that greatly facilitate the application of analytical techniques in problem solving.

However, few people are aware of "all possible alternatives in a given situation and, therefore, its "perfect knowledge assumption" seems unrealistic.

Herbert Simon has developed a descriptive model for decision-making based on a set of alternative assumptions. They are: firstly, that decision makers are subjectively rational people who make decisions on the basis of incomplete information. They look for satisfactory rather than optimal solutions. Secondly, this model emphasis that problems are not always clearly and correctly defined and thirdly, that people do not always make the one best choice due to limitations of time, financial constraints, or human resources. This model involves the sequence of events shown in Figure 3.

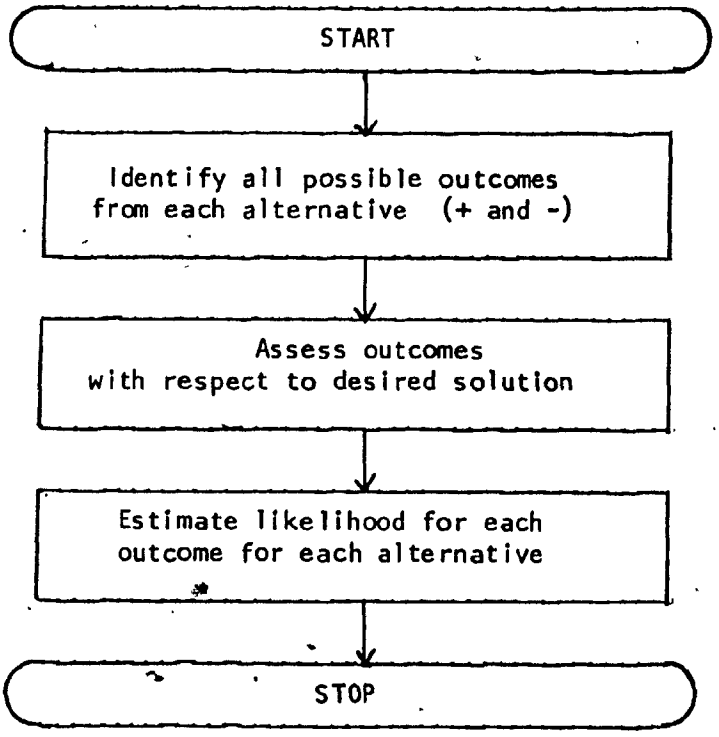
FIGURE 3.

The Simon Model



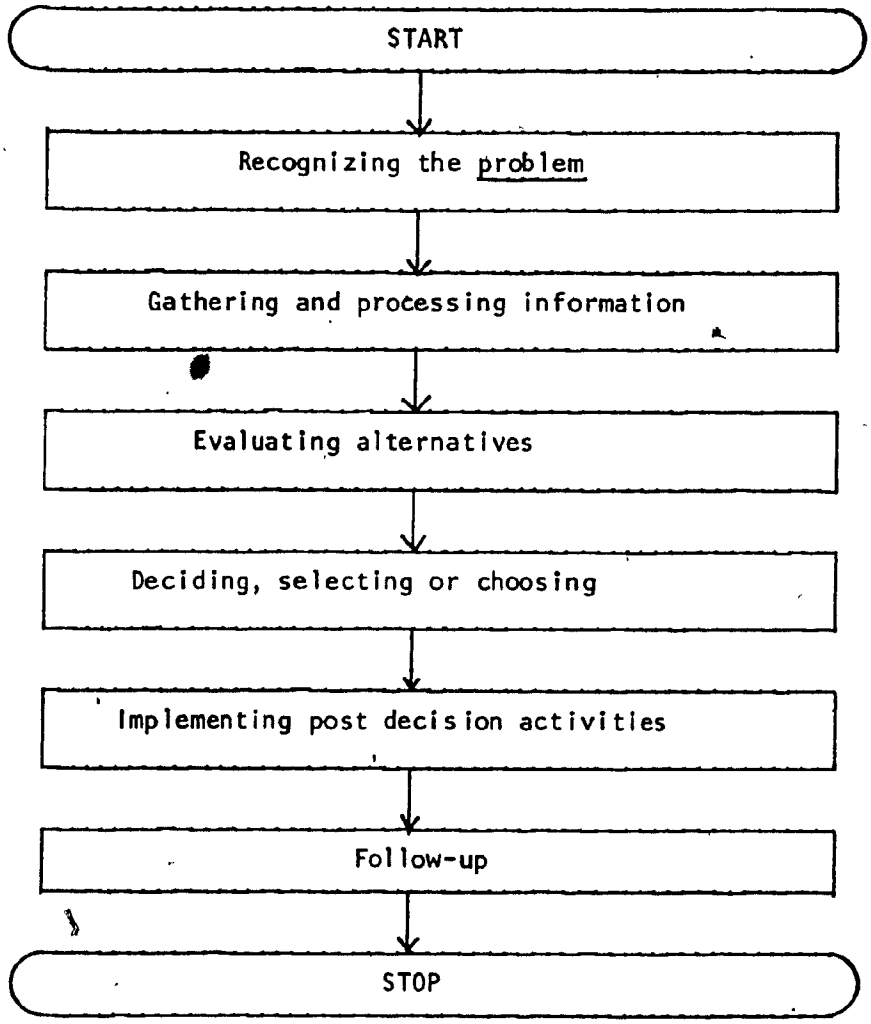
As is the case in the practice of nursing, the decision maker operates with a time pressure. Clients have needs that cannot wait indefinitely to be attended to. The practitioner needs to be aware of the best possible and worse possible outcomes as well as the alternatives that fall in the middle. Evaluating the amount of risk involved in each possible outcome leads to effective decision-making (Reitz, 1977). He recommends the sequence depicted in Figure 4.

FIGURE 4. Risk Evaluation



The quality of alternatives may be described as good, poor, bland, mixed, or uncertain (March & Simon, 1958). Lancaster describes the decision-making process as a systematic series of sequential steps. The steps include those identified in Figure 5.

FIGURE 5. Lancaster Model



The quality of the decision made may depend on the amount if time and energy that can be devoted to a given problem in that particular circumstance relative to the other demands and priorities that exist simultaneously.

Three suggested strategies for choosing priorities are:

(1) Deal with problems in the order in which they appear. (first encountered; first solved)

(2) Give first priority to the easiest problem to solve. (easy first; time-consuming problems later)

(3) Give crisis or emergency problems priority over all others (Reitz, 1977).

Once one's problems have been priorized and their degree of solvability assessed, the decision maker begins to gather and process information. This process involves both an internal and an external search for information

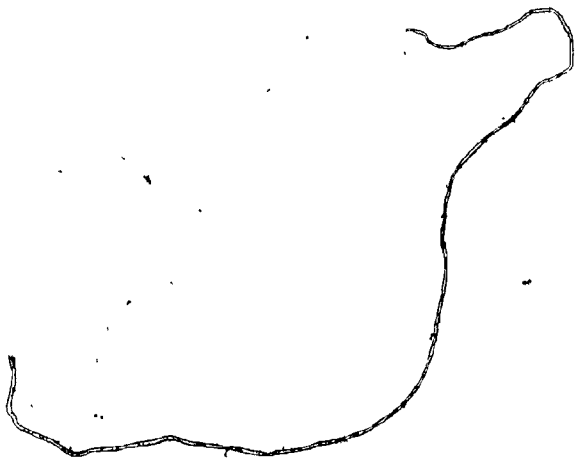
The internal search begins with an individual's memory examination (Lancaster & Lancaster, 1982). This involves calling forth such data as organizational policies, prior experience, training, education, or the experiences of others. This data must then be combined with additional information from the external environment. This external search begins with the identification of alternatives. These alterations are then evaluated with respect to the goal that is desirable.

Additional factors such as frustration, tension, and annoyance may also be associated with gathering data. A thorough search is also influenced by the type and amount of information stored in the decision maker's memory, the quality of this stored information, and the ability to recall it. A further determining factor is frequently the decision

maker's personal confidence in their decision-making abilities (Lancaster & Lancaster, 1982).

At this point, the decision maker must exercise judgement since many solutions are not clear-cut; not black or white but rather in the "gray" area. For example, if one alternative is good while the others are bland, mixed, poor, or uncertain, then the choice is clear. However, if there are no "good" alternatives then the selection becomes more difficult. The presence of a constantly changing environment is one factor that makes decision-making difficult.

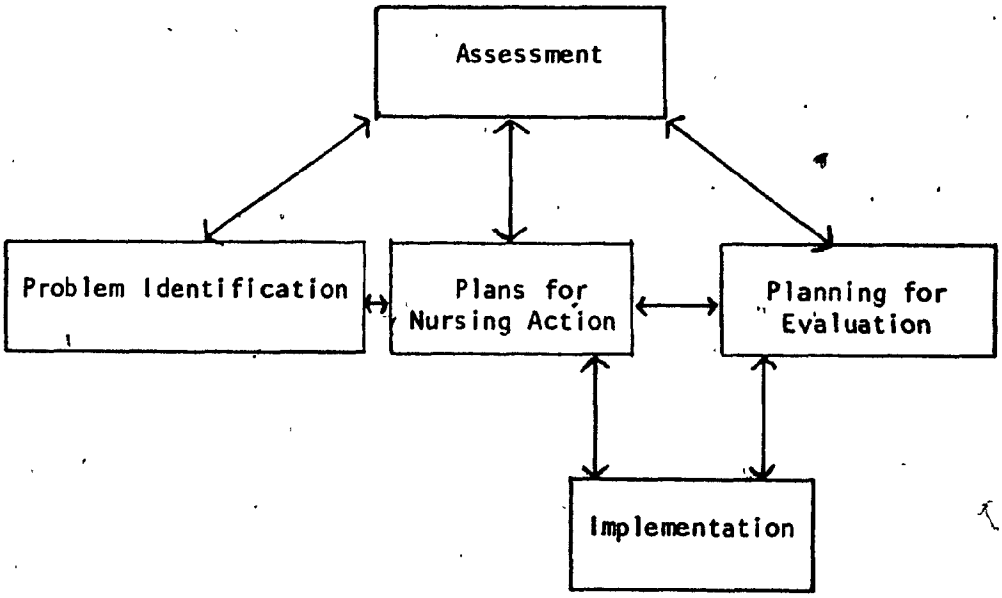
Once the decision is made it must be converted into action. It is worthless unless implemented. Follow-up on its impact is essential. The Lancaster model for decision-making, therefore, is a conscious systematic process, that can in turn be defined as a series of sequential steps.



Fay Bower (1972) describes the nursing process as a systematic step-by-step method of selecting an action or actions to reach a desired goal involving both cognitive and activity components. She states that this process of decision-making involves four phases: (1) assessment, (2) problem identification, (3) formulation of a plan, and (4) planning for evaluation.

Astute observation, purposeful listening, a broad knowledge of human behaviour, and an understanding of what needs to be known and where to obtain that information are all part of data collection.

FIGURE 6. Bower's Process for Planning Nursing Care



from: Bower (1972) p. 10

In any nursing situation there are facts that are immediately available to the nurse. Bower (1972) cites the following situations to better understand the process of planning nursing care:

Situation I

When making rounds on a medical unit, a nurse looks in on a middle-aged gentleman who is sitting in a chair eating his lunch. He is in hospital with a diagnosis of acute myocardial infarction. His wife is eating lunch with him as he convalesces. Suddenly the gentleman turns pale, gasps, and slumps forward (Bower, 1972).

The nurse knows:

- he is convalescing from a myocardial infarction
- he is middle aged
- he is eating his lunch
- he turns pale, gasps, and slumps forward.

She would infer:

(a) he is choking on something he is eating or

(b) he is having a heart attack.

Further data must be collected before action can be taken. Examination of the gentleman's airway for food is necessary. Other cues may be observed from his behaviour and his wife is available to give further information.

Bower (1972) suggests that the "nursing problem" in a given situation be stated in terms of the goal to be accomplished. For example, if the client's need for sleep is blocked by a severe cough, then the statement of the problem would be "how to relieve the client's cough to provide sleep." Other professional nurses prefer to identify client needs and state the problem as a statement of need. Still other nurses (Carpenito, 1983) suggest that problems be stated in terms

of a nursing diagnosis such as a "sleep pattern disturbance."

Bower suggests the following strategies for setting priorities:

1) life-threatening problems should be sorted from ones of lesser importance
2) short-term immediate problems should be distinguished from long-term problems
3) classify and sort conflicting goals to determine which goal should be met first, second etc...

Priority setting enables the nurse to organize and plan care that meets those needs and solves those problems that are most urgent, and to consider ways and means of handling the problems of lesser urgency (Bower, 1972).

In most instances the nurse cares for several clients at one time and, therefore, the following criteria are useful in setting priorities for groups:

1. Safety
   - (a) severity of health problems
   - (b) potential for recovery
   - (c) attainment of high-level wellness
2. Efficiency
   (time needed by client, nurse, or health team)
3. Cost
   (expense in money and energy to client, nurse, agency, society)
4. Receptivity to care

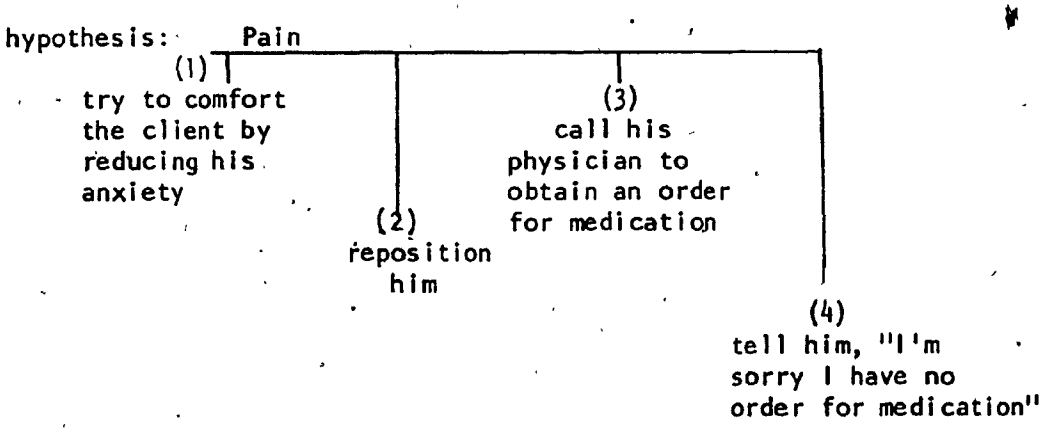
Children, pregnant women, and acutely ill clients, for example, are given preference since the prognosis for their return to society and to a productive life is greater than those who may have chronic degenerative illnesses.

The selection of the most appropriate alternative in decision-making is a complex behaviour.

Situation II

Bower (1972) cites the situation in a hospital where the nurse is faced with deciding what to do about a client's pain. The client experiencing pain is anxious and has no order for pain medication. The nurse has the following alternative choices:

FIGURE 7. The Client Experiencing Pain



The consequences for alternative three (3) and the likelihood of the consequences occurring are as follows (MacDonald, 1965):

FIGURE 8. Estimates of Occurrence

Alternative	Consequence	Probability
(3) Call the physician	Get an order	0.75
	Denied order	0.25
	Unable to reach physician	0.50

Here Bower attempts to estimate relative probabilities of outcomes and use these estimates for decision making. However, her derived probabilities are sometimes anomalous as in Figure 8 where the "get an order" and "denied order" probabilities do not add up to 0.50.

Bower does emphasize that these probabilities are tools for helping the nurse make decisions and not formulas for decision making. The nurse is in search of alternatives with the highest probability of occurrence, and therefore, that have consequences rated over 0.60. Probability is a mechanism regarding legality, morality, and policy are all involved in estimating the risk involved with decision making. The alternative nursing action must be evaluated in respect to its possible risk to the client, to the nurse, and to the agency.

Situation III

The patient in pain is a 66 year old man, first day post-operative after a right knee arthrotomy. The physician has an order on the patient's chart for morphine gr. ¼ for pain relief every 4 hours. The nurse checks and discovers that the patient's respirations are 10 per minute and that he was medicated with morphine 2 hours ago (Bower, 1972).

FIGURE 9. hypothesis

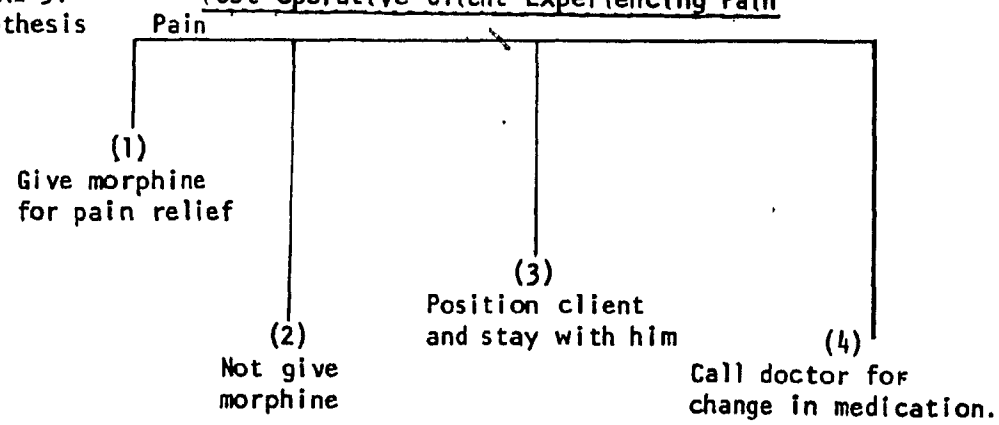


TABLE I Probability Estimates

Alternative	Consequence	Probability	Value	Risk
(1) Give morphine for pain relief	will relieve pain	0.95	desirable	none
	will decrease respirations	0.80	undesirable	high
	will not relieve pain	0.05	undesirable	low
(2) Not give morphine	no pain relief	1.00	undesirable	high
(3) Position patient and stay with him	may relieve pain	0.60	desirable	none
	may not relieve pain	0.40	undesirable	moderate
	may decrease anxiety and thus reduce pain perception	0.50	desirable	none
(4) Call doctor for change in medication	may reach doctor and get new medication	0.70	desirable	none
	may reach doctor and not get new medication	0.30	undesirable	moderate

After Bower (1972)

The probability that the medication will relieve pain if given now is high (0.95), but the risk to the patient is also high because of the depression effect morphine has on respirations, which are already reduced. To give this man morphine for pain is very risky, therefore the nurse should consider other possible actions and their consequences (Bower, 1972).

Analysis of this situation would rule out approach one (1) because it has a high-risk consequence and rules out approach two(2) because it has a high probability of occurrence with an undesirable value producing a high risk. The action most likely chosen would be approaches three (3) and four (4) in combination. Together they are safe and effective.

However, if this client had had a cardiac problem and were experiencing pain from a myocardial infarction and not from a first day postoperative arthrotomy, the action taken would be very different. Approach one (1) is the only choice, since it would produce the desired effect. The risk of not giving the pain medication is greater than the risk of doing so since pain intensifies shock, which is always present in some degree with myocardial infarction.

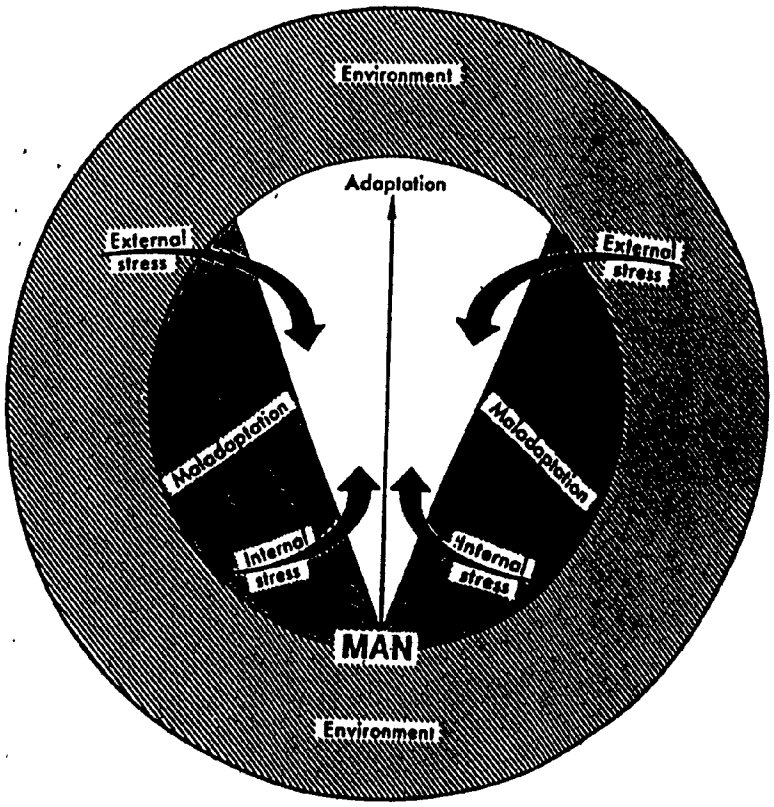
The fourth phase of Bower's decision-making process is the evaluation of the nursing action. Evaluation not only helps determine satisfactory accomplishment of a desired goal but the need for another approach.

Bower (1972) proposes a stress-response systems model as a means of organizing data to create a holistic approach to planning

nursing care. She makes the following assumptions:

1. Man is a system with purpose, process and content.
2. Man's purpose is self-actualized high-level wellness.
3. Man's processes are those that enable and promote the purpose of high-level wellness.
4. Man's content is all the factors that make up the processes.
5. Man is homeostatic in nature.

FIGURE 10. Stress-Related Model



from: Bower (1972) p. 38

This stress-response model determines the dynamics of the health situation. It identifies the health problem, the specific nursing problem, the cause of the problem and the individual's own coping behaviour. This model does not place all the "care" in the hands of the nurse. The client's strengths are determined and encouraged.

Situation IV

Data: Mrs. P. is a 23 year old woman. She is 3½ months pregnant. This is her first pregnancy and she is very happy and excited about the coming baby. She states she is "a little scared about the birth process and that she knows only what her friends have told her." She is eager to know all about pregnancy, labor and delivery, and infant care. She also states that she "hopes to be a good mother."

Assessment: Mrs. P, a 23 year old primipara, who states she is a little scared about the birth process, is eager to be a good mother and to learn about all the phases of pregnancy, childbirth, and infant care.

Stress: Pregnancy (changes in body image, changes in role, changes in physiological functioning of the body during pregnancy, process of labor and delivery).

Responses: Happiness about forthcoming birth. Eagerness to learn about pregnancy, birth process, and infant care. Fear about labor and delivery.

Unmet need: Knowledge about labor and delivery, infant care, and pregnancy.

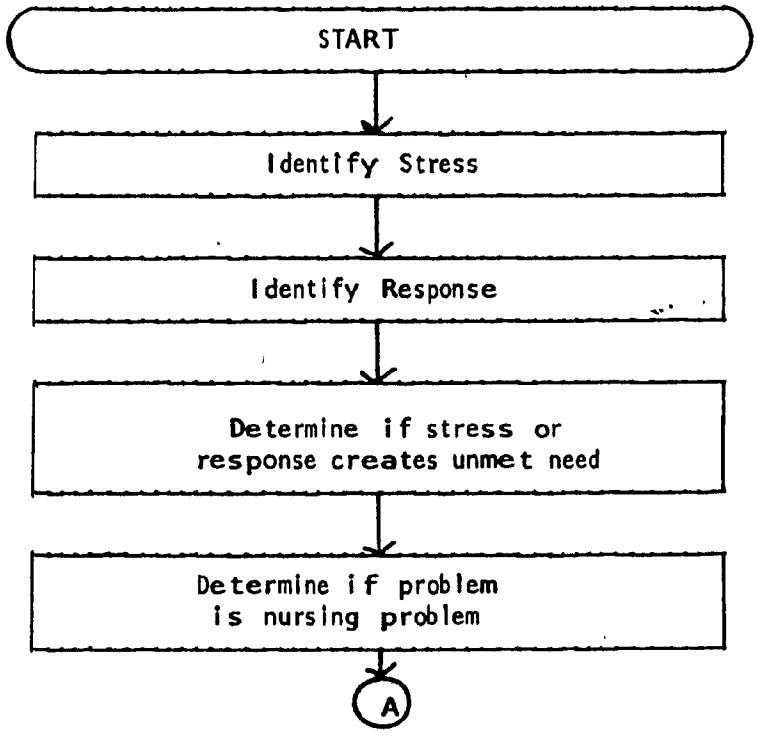
Problem(s): How to design teaching concerning pregnancy, labor and delivery, and infant care for Mrs. P, considering her desire to learn and her fear about the birth process? How to help Mrs. P make the transition from nonmother role to mother role?

Note that the problems are stated clearly, specifically, and are goal-oriented; they have a built-in objective. The goal or objective of the first problem is to teach Mrs. P. The goal of the second problem is to help Mrs. P make the transition to mother role. The nursing interventions will determine how the goals are met (Bower, 1972).

Problem identification involves the nurse's ability to assess a given situation accurately and as fully as possible. She must supplement the assessment with knowledge from the behavioural and natural sciences and place this information into a framework that helps organize, analyze, and identify the stress, the response, and the unmet need.

Throughout the process of identifying a nursing problem, the nurse collects additional information. Data from observations, conversations, medical records, consultations, treatment plans, laboratory findings, and other paramedical personnel contribute to this ongoing assessment. A schematic representation of the steps in identifying a nursing problem utilizing the stress-response model might be expressed as follows:

FIGURE 11. Steps in Identifying a Nursing Problem



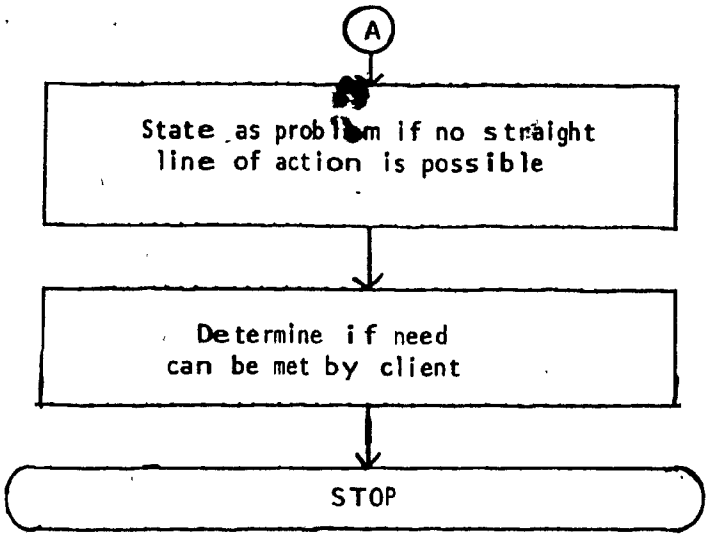
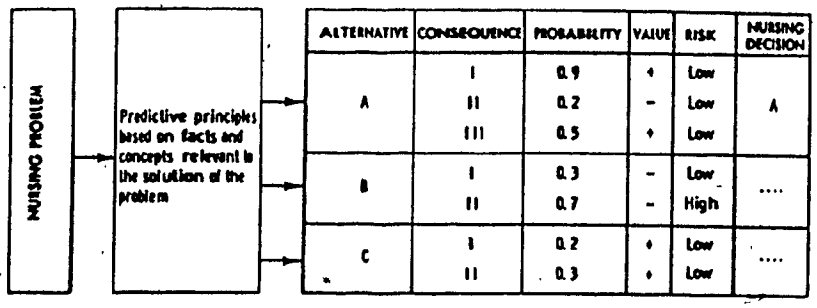


FIGURE 12. Process of selecting nursing actions and formulating evaluative criteria



Decision-making schema.

from: Bower (1972) p. 89

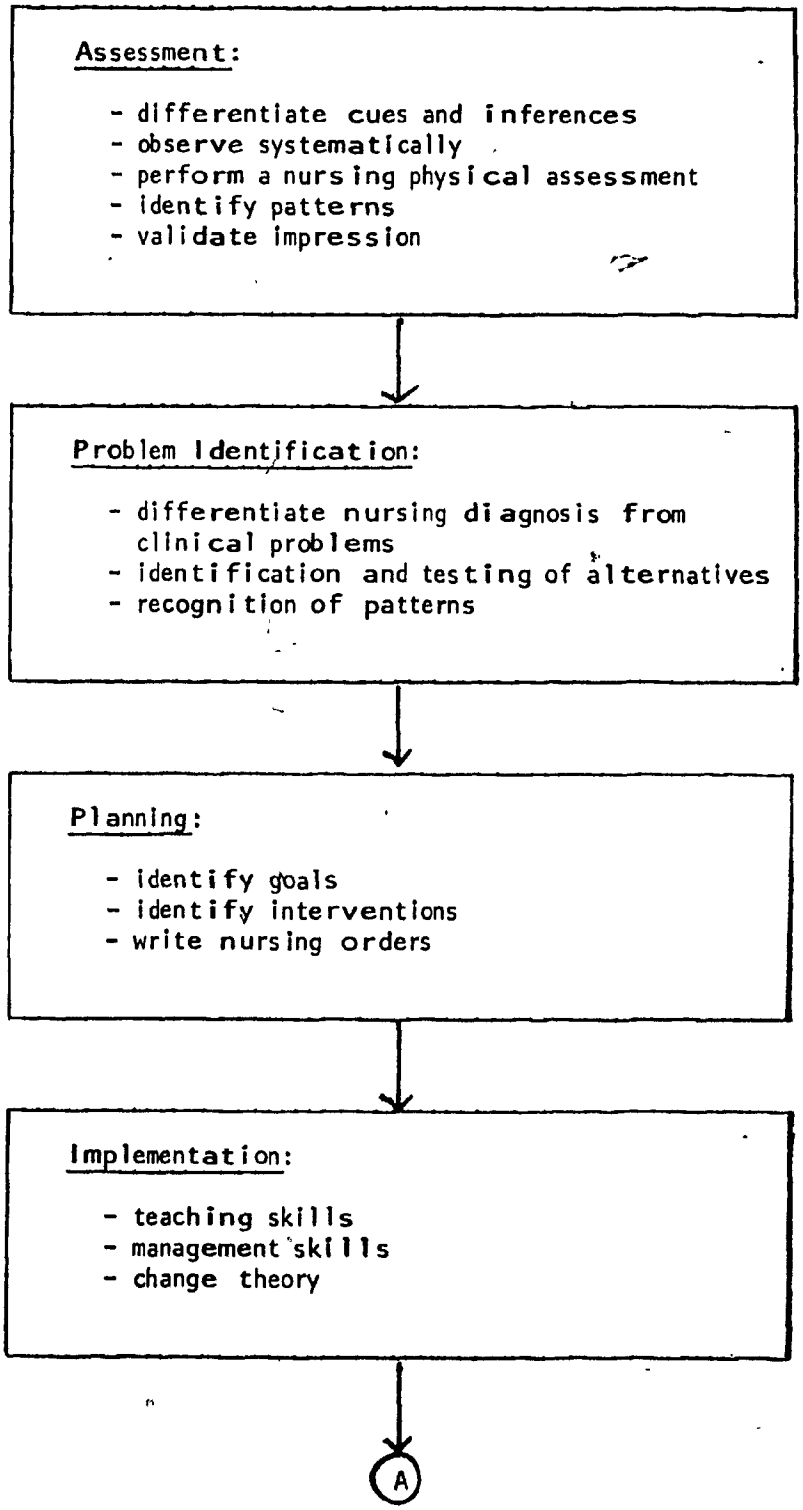
Use of the stress-response model is one approach to determine nursing problems from the assessment.

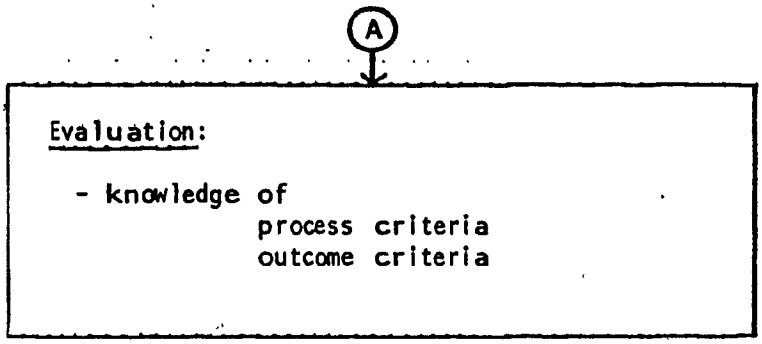
Lynda Carpenito (1983) is a proponant of using nursing diagnoses (See Appendix I) as a focus in problem identification. She suggests that:

a nursing diagnosis is a statement that describes a health state or an actual or potential altered interaction pattern of an individual, family, community, to life processes (physiological, psychological, socio-cultural, developmental, and spiritual) which legally, the nurse can identify and order nursing interventions to maintain the health state or to reduce, eliminate, or prevent client alterations.

Carpenito's (1983) model for decision-making involves the following sequence:

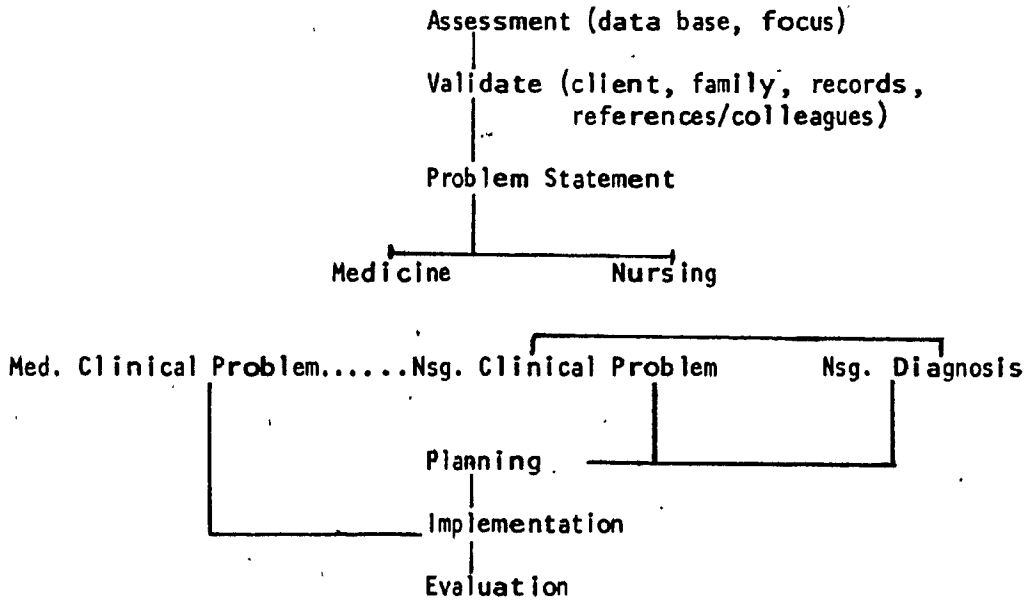
FIGURE 13. Carpenito's Model





She further breaks down the sequence leading to a Nursing Diagnosis as part of the problem identification within the decision-making process as follows:

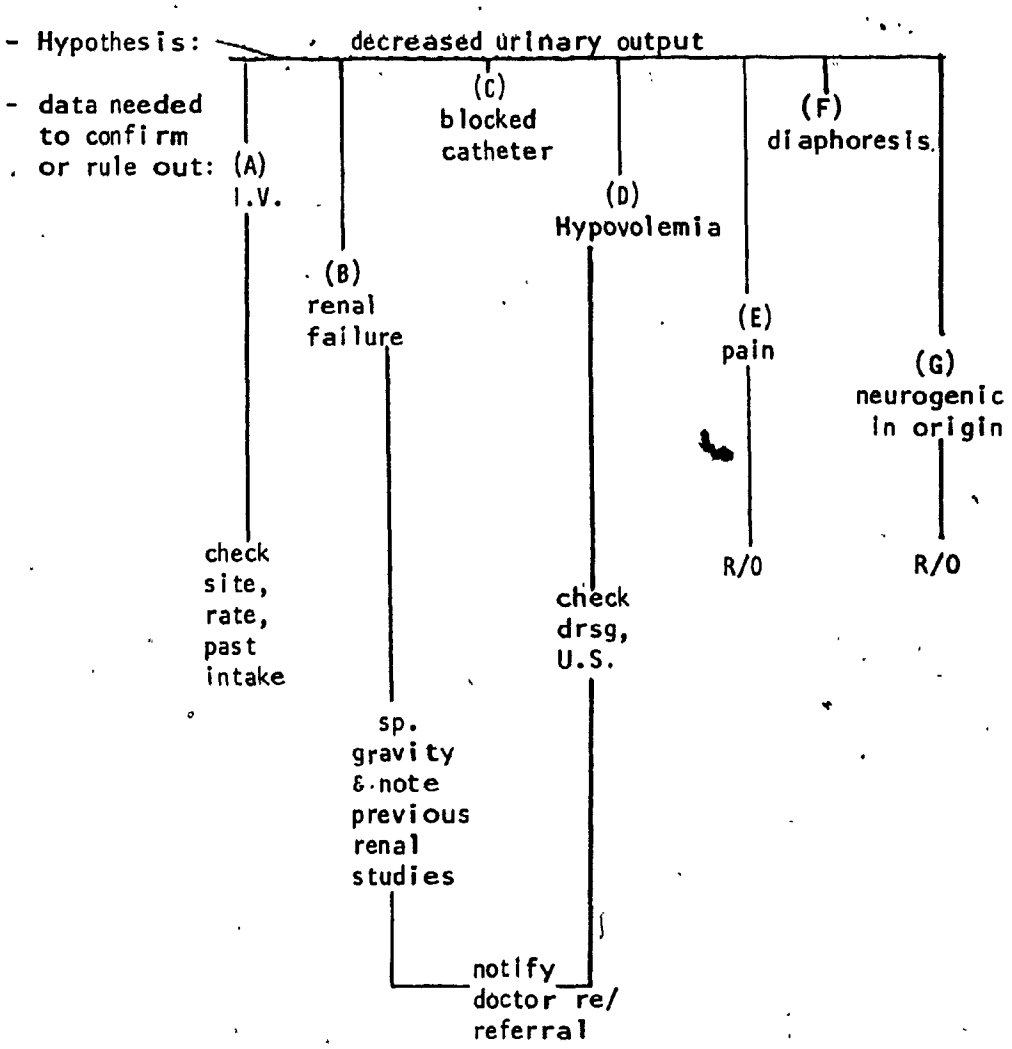
FIGURE 14. Establishing a Nursing Diagnosis



Situation:

- Cues, Inferences, Contributing factors:	48 year old man post-op - cholecystectomy (24 hrs.) foley catheter inserted I.V. therapy @ 1600 hrs. output = 22 cc. @ 1700 hrs. output = 18 cc.

FIGURE 15. Identification of Alternatives



- Rule-out easiest first ⟶ C,A,E,.....
- Alteration may be
  - actual
  - potential ⟶ high risk
  - possible

The Nursing Diagnosis is a two part statement consisting of the diagnostic label related to the etiological/contributing factor of the individual. For example: - Impairment in skin integrity related to pruritis secondary to liver dysfunction. This two-part diagnostic statement directs goals and interventions. If the etiological/ contributing factors are unknown, the statement can be written: fear related to unknown etiology. Appendix A lists Nursing Diagnoses commonly used in the United States.

Aspinall and Tanner (1981) describe the nursing process as a dynamic, continuously evolving, and deliberate sequence of steps directed toward the goal of the restoration, maintenance, or promotion of optimal levels of health for individuals, groups, and communities. This process is central to most nursing activities and yet there are many pitfalls in the intellectual strategies used in clinical problem-solving. Aspinall and Tanner (1981) suggest that data collection falls into two broad categories:

(1) a complete and thorough assessment in which the data that are to be collected have been determined in advance

(2) a more focused assessment that is based on subjective reports by the patient and/or signs recognized by the patient or nurse. The more complete assessment usually follows a prescribed format such as the "data base" prescribed for the problem-oriented record:

- patient's chief complaint
- patient profile

- related social data
- history of present illness
- past history
- review of systems
- physical examination
- base-line laboratory data
- nursing history

The focused assessment involves data collection from the patient as well as a variety of other sources such as signs and symptoms.

The philosophy and beliefs of the nurse herself about basic human rights have an influence on the kind of information she seeks as well as the way in which she communicates with the patient in obtaining it. The theoretical framework under which the nurse operates will also influence the kinds of data collected and the manner in which they are interpreted. The nurse using Roy's adaptation model will gather data related to the individual's behaviour in each of four modes of adaptation, for example (physiologic, self-concept, inter-dependence, and role function). Data related to the factors which influence the behaviour (stimuli) will also be collected and classified as focal, contextual and residual stimuli. Focal stimuli are those immediately confronting the person, while contextual stimuli are those present in the environment and residual stimuli are the beliefs, attitudes or traits which have an effect on the present situation.

The advantage of using a framework such as Roy's adaptation model clarifies areas of assessment and provides a structure for the interpretation of cues and the attainment of data relating to strengths and coping mechanisms of the individual in question.

While the nurse is not expected to make medical diagnoses, she must at least recognize the possible presence of a general category of conditions since this will guide her subsequent data gathering. For example, the nurse who recognizes that an elderly patient recovering from major abdominal surgery is particularly prone to atelectasis (medical diagnosis) will assess the patient for signs of its presence (eg. auscultating the lung fields for fine rales). Should the nurse not recognize this as a potential problem she may not gather the appropriate data and, therefore, miss making important modifications in planning care.

The Aspinall and Tanner model for decision making includes assessment and diagnosis, evaluation, planning and intervention, and evaluation once again. It is depicted in Figure 16.

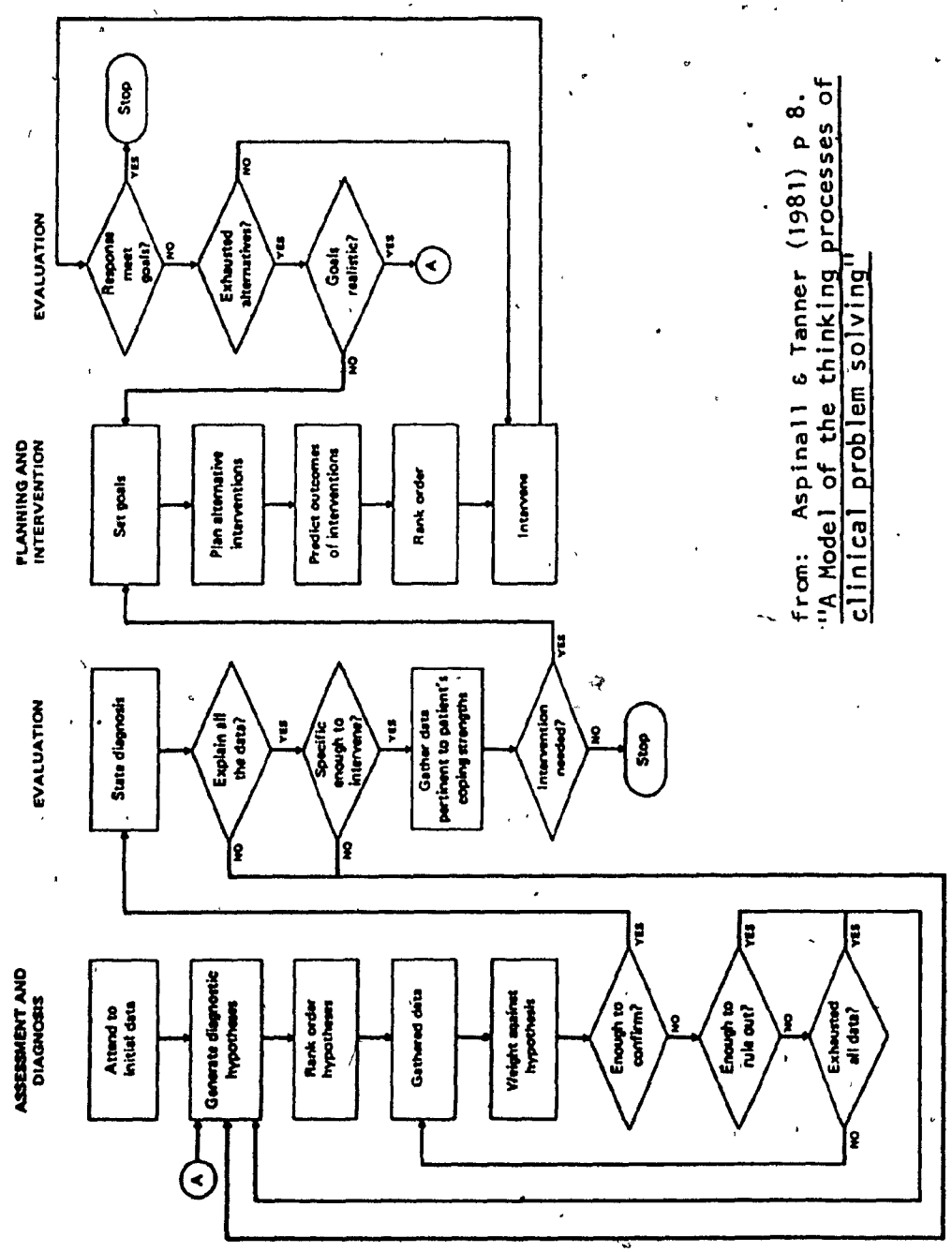


FIGURE 16.

from: Aspinall & Tanner (1981) p 8.
"A Model of the thinking processes of clinical problem solving"

The intellectual strategies of the nurse in clinical decision making consists of generating multiple alternatives and systematically testing those against additional information obtained from the patient and other sources. When sufficient data are obtained that strongly confirm one hypothesis, while disconfirming other possibilities, then a diagnosis is reached (Aspinall & Tanner, 1981). However, nurses may take many approaches and it seems appropriate to look at a sample case study and focus on how four different nurses might approach the problem presented. These approaches are indicated in Table II.

TABLE II Four Approaches to a Given Problem

NURSE A	NURSE B	NURSE C	NURSE D
Assessment: -skin warm & dry -pulse 72 & full -B.P. stable 128/60 -last insulin 8 hrs ago, NPH 40U. -last urine @ 11:30 A.M. sugar 2+, Acetone Neg -7:00 A.M. FBS 138 mg/100 ml.	Assessment: rhythm strip - normal sinus rhythm, no arrhythmias U.S. - pulse 72, B.P. 128/60 Resp. 18 and unlaboured T. 98.4 Urine output: 800 cc's since 7:00 hrs IV: patient @ 30 cc/hr. (lidocaine) Chest PA: Lungs clear	Assessment: -routine assessment -rhythm strip -chest PA -urinary output -package insert for lidocaine -recalls previous patient with lidocaine toxicity	Assessment: -skin warm and dry -patient states she ate lunch well -Pulse 72 and full -B.P. stable at 128/60 -Last S and A was 2+ and neg.
Action: Nurse A gives Mrs. L. 120 cc orange juice and draws blood for blood glucose	Action: Noting nothing abnormal in her routine assessment, Nurse A reorients Mrs. L. and charts her findings.	Action: reduce lidocaine to 1 mg/min. monitor PVC's over next hour; if less than 6, Dk it.	Action: Reorient, record findings, observe closely
Assessment: she then checks: - I.V. patient without lidocaine @ 30 cc/hr. -she examines for evidence of tremors			

NURSE A	NURSE B	NURSE C	NURSE D
Assessment: -she notes normal sinus rhythm with no dysrrythmias Action: -She decides to slow down the lidocaine to 1 mg/minute if Mrs. L. fails to respond to the orange juice. Assessment: She then checks: - urinary output stable (800 cc) past 8 hours - Peripheral circulation good. - Heart rate @ 72/min. -Decides skin colour good -No evidence of low cardiac output which might result in disorientation. Action: None indicated Assessment: She then checks: - pupils - equal, react to light - denies headache			

NURSE A	NURSE B	NURSE C	NURSE D
Assessment: -early admission data indicate no evidence of substantial head trauma sustained in fall prior to admission Action: Decides to monitor neuro signs. Assessment: She then checks: -degree of problems with vision -presence of "meaningful" stimuli (books, clock, radio, calendar) in room -frequency of visitors -delusional quality of Mrs. L's disorientation Action: Decides Mrs. L. needs to get her glasses from home, to relax visiting restrictions, obtain some diversional activities for her.			

Aspinall and Tanner point out that Nurse A has been thorough and systemic. She has noticed that all of the data gathered in the initial assessment are related to a complication of insulin administration (hypoglycemia). This would be the most urgent problem. However, the data do not clearly support this and subsequently the glucose is administered. She goes on to evaluate the possibility of confusion due to lidocaine toxicity. Reduced cerebral perfusion due to low cardiac output, reaction to head trauma and finally sensory deprivation are considered.

Nurse B on the other hand, seems to gather information in a prescribed manner. She did not seem to recognize the patient's disorientation.

Nurse C uses a heuristic (availability of instances) to assist in the rapid generation and/or narrowing down of hypotheses. The problem with this methodology is that the accurate diagnosis may not be considered, depending upon those clients previously cared for.

Nurse D rejects one hypothesis before enough information has been gathered to do so.

An optimal model for decision-making should, therefore, attempt to assess for:

(1) failure to associate initially available data with plausible diagnostic hypotheses

(2) failure to include the accurate diagnosis in the initial set of hypotheses considered

(3) overestimating the probability of one hypothesis because of greater ease of recall, recent experience, etc.

(4) failure to use disconfirming data

(5) overestimating the reliability in either confirming or or disconfirming hypotheses.

Callin and Ciliska (1983) suggest that nursing students' experiences that allow them to observe and evaluate their decision-making behaviour, while simultaneously verifying their self-assessments with another "person" are desirable. Their Triple Jump Exercise was designed to make the student's implicit approaches to decision-making more explicit.

Students are given problems derived from actual patient situations. The first part of the activity involves data collection, assessment and planning. The second part includes implementation and evaluation. This activity is especially helpful in working with students whose written work does not clearly demonstrate their ability to make decisions or those who are not vocal in tutorials. The student is provided with feedback - positive or negative in an acceptable manner. Decision-making becomes more visible and, therefore, more within the individual's control. This Triple Jump Exercise incorporates the cognitive processes associated with successful decision-making as identified by Woditsch (1978):

a) the ability to control the class of stimuli receiving conscious focus (selective attention)

b) the capacity to probe a complex situation until its components are identified (sustained analysis)

c) the capacity to identify and test resemblances between new and previously known situations (analogizing)

d) the willingness to assign priorities to factors in a situation before considering possible solutions (suspension of closure)

e) the ability to test a solution covertly before applying it overtly (autocensorship).

These processes along with three further cognitive behaviours associated with decision-making are involved in this design by Callin and Ciliska (1983):

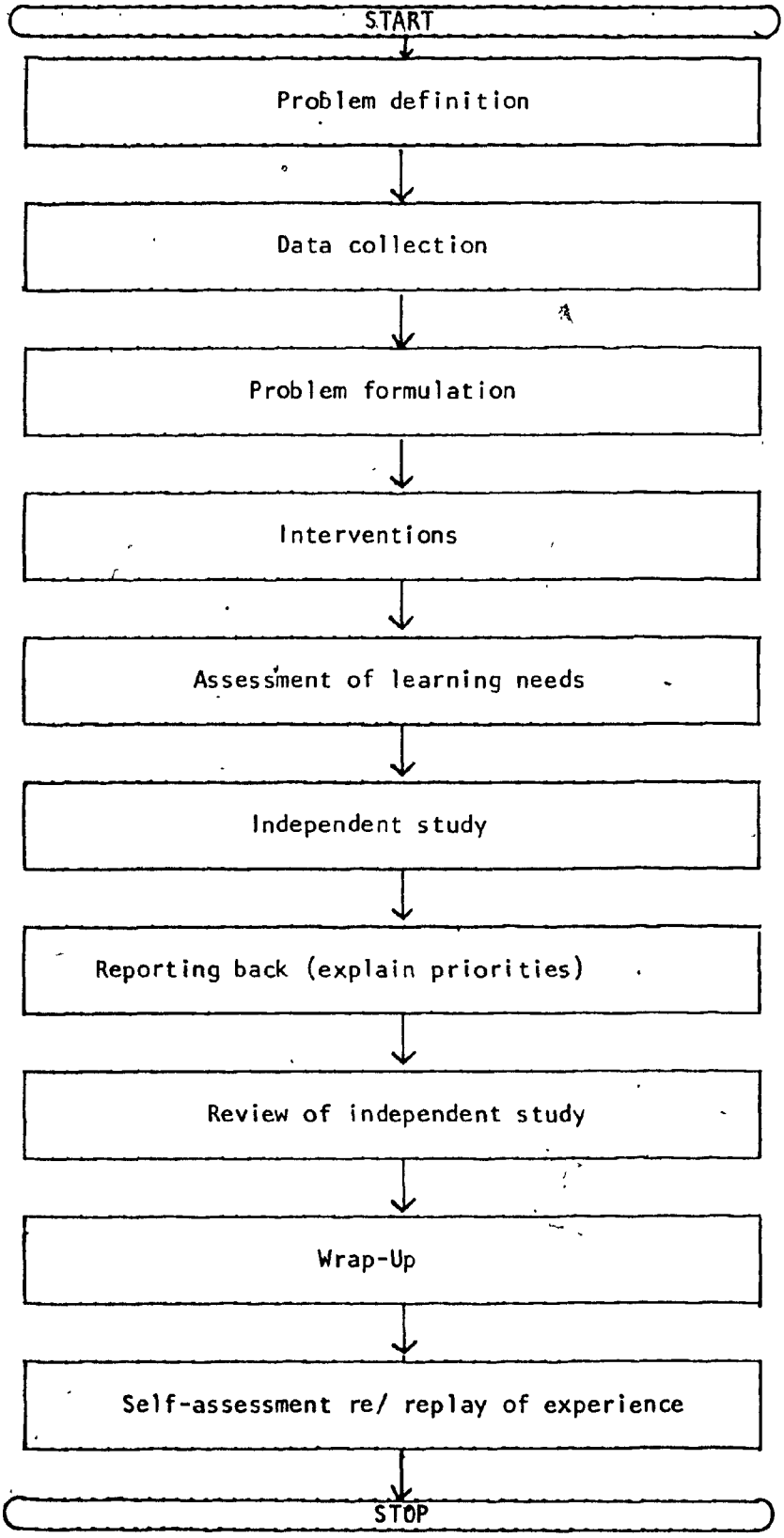
f) being constantly alert and receptive to new information, particularly to information which does not confirm the assessment and if acknowledged has the potential to change the problem formulation

g) having faith in oneself, valuing one's own perceptions and having the will to act on them

h) being able to live with ambiguity and uncertainty and understanding a conclusion is provisional until the appearance of further data makes a different conclusion more logical.

Their model includes the aspects shown in Figure 17.

FIGURE 17. Problem Solving With Triple Jump



This final phase of the exercise allows the student to reflect upon her performance and share her perceptions with her professor. The professor can also be a sounding board for the student.

The simulation of client situations is not novel since various paper and pencil simulations or games have been devised which allow the student to choose between certain courses of action and then see the consequences of her decisions (Rushby, 1979). However, the use of the computer to control the simulation reduces the administrative overhead and allows the situation to bemade more complex when this is educationally useful. The learner's impression of reality may be augmented if the simulation is run against the clock so that the student has to consider the time she takes to come to a decision and its relative effect on her client.

The use of computer based simulation for learning can overcome problems such as time, cost, or danger to clients (Rushby, 1979). These factors can in real-life situations come between the student and her understanding of the underlying theory or concepts.

The computer-based instructional simulation is designed to guide the student's investigation of the model along a route which will help her to build the desired concepts of its behaviour. The student should present herself to the simulation session without prior discussion with her peers who may have completed the package.

Simulation is the process of designing a model of real system and conducting the experiments with this model for the purpose either of understanding the behaviour of the system or of evaluating various

strategies for the operation of the system (Shannon, 1975). Model building provides a systematic, explicit, and efficient way for various experts and decision makers to focus their judgment and intuition. Models have been used widely as instructional aids. Psychologists, for example, have come to recognize the importance of the individual's learning certain skills under conditions in which she is not "over-motivated". A crisis situation is not the time and place to attempt to learn new skills. Models, therefore, are ideal for assisting the learner to cope with various simulated situations before they actually occur.

The potential advantages of using simulations are numerous. For example, the learner can grasp events which might require months or years to observe in the real world or which might take so little time as to be out of the realm of the observer.

The following table (Table III) presents the major simulation features suggestive of some design alternatives (Campbell, 1980).

TABLE III Simulation Design Alternatives

A. Application	Examples of Applications
1. Operating Procedures	Pilots in an aircraft
2. Diagnosis	Medical diagnosis, electronic troubleshooting
3. Analysis of Systems	Modeling a complex chemical plant
4. Social/Team	Group problem solving
5. Personality	Simulation of a paranoid patient
6. Resource Allocation	Determining how long to spend with each customer waiting in a queue

B. Time Dependency

1. Time Dependent: Events occur based on time
2. Time Independent: Events occur based only on user actions and internal states

C. External Representation

1. Replica of appearance of system being simulated
2. Functional representation of major components

D. Internal Representation

1. Table driven (if a given condition is met, the specified action is taken)
2. Modeled by equations

E. Intelligence

1. Expert model
2. Model of student
3. Tutor

F. Purpose

1. Description/prediction of system operation
2. Instruction

G. Relation to systems simulated

1. Generic to several systems
2. Specific to one system

H. Interactivity

1. User operated
2. Feedback from computer or another person

I. Recordkeeping

1. Replay
2. Major events/costs

J. Input Mode

1. Keyboard/keypad with function keys
2. Controls (e.g. joystick, throttle)
3. Light/sonic pen
4. Touch surface
5. Voice

K. Output mode

1. Dials, gauges, lights
2. Electrical test points
3. Computer-generated images
4. TV scan of mockup
5. Stored images (e.g. microfiche, videodisc, slides)
6. Recorded motion (e.g. videodisc)
7. Voice

from: Campbell (1980) p. 87.

The use of computer games is an excellent strategy for orientating students to the use of computers (Taylor, 1982). Students working in pairs easily overcome their anxiety about using computer terminals while they enjoy the hands-on experiences.

Students at the Mercy Hospital School of Nursing in Illinois have for some time now been enrolled in courses with the major portion of their instruction via PLATO (Programmed Logic for Automatic Teaching Operations), a computer-based education system (Bitzer and Boudreaux, 1980). Of all the systems that the author has had the opportunity of viewing, the programs developed through PLATO seem to be the most advanced.

Bitzer and Boudreaux designed learning activities in Maternity Nursing so as to assist the student to develop or reinforce critical thinking skills by the method of presentation or teaching logic (rules). The learner is presented with commonly encountered problems and the teaching rules are arranged so that she must think about what information she needs, think of and investigate possible solutions or sources of information, interpret and sort the data provided, select her response (solution), and test it. The information the learner needs to solve the problem is prestored in, or calculated by, the computer and is provided to the student in response to her inquiries. The computer in this case provides appropriate feedback to the learner's constructed response, thereby reinforcing a correct approach or, in the case of an incorrect response, forcing the student to a new approach while providing her with specific assistance for particular error habits.

The success of this type of learning activity has meant that other agencies have also adopted this methodology. At the present time in Canada, most nursing programs do not have computer-based educational systems with the capabilities developed on the PLATO network. This is a dedicated system and is costly to access. Most nursing programs do not have the operating budgets necessary to link into PLATO and thus reap the benefits of twenty years of progress in computer programs for nursing.

What is affordable is access to microprocessors such as the Apple III that can be purchased at a very reasonable capital cost. However, software development is still in its infancy for these systems. The technology is here but the challenge to nursing still remains. Subject area experts must become acquainted with the capabilities of computers and devote their energies to the development of programs that can, in fact, allow students to learn in one-third to one-half the time presently required in learning through classroom activities (Bitzer and Boudreaux, 1980).

Computer-based education allows the professor to be a facilitator who can assist the nursing student to use her time in the classroom and in the clinical setting to her optimal advantage. The constant availability of materials on computer allows students to learn at their own pace as well. Students who need less time to complete the material can then go on to independent study or to devote time to another course. Other students can have additional instructional time as they find necessary without feeling that they are "slowing down the class." The professor has more time to provide individual instruction and provide guidance where it is needed most. This role change, from "Dispenser of information" to "facilitator" will certainly take time for many of our present nursing faculty.

III HYPOTHESIS: A New Assessment-Oriented Decision-Making Model for Instructional Computer Simulations in Nursing

Nursing students in colleges (CEGEPS) throughout Quebec and across Canada have programs that are very heavy in terms of hours per week. Their week involves both time in the classroom as well as time spent in the nursing laboratory and/or in actual clinical situations. The ratio of professor to student in the clinical setting is typically 1:8. Nursing students in the later part of their programs usually care for a number of clients for a six to eight hout period on any given day. For the nursing professor, being a facilitator to eight nursing students who are in turn caring for several clients and this all taking place sometimes on "several" hospital units is quite a challenge. Having been a nursing professor for twelve years, the author believes that it is essential to look at alternative strategies for facilitating learning. The area of clinical decision-making is of particular importance. The design and use of computer simulations as pre-requisite activities to certain clinical experiences would optimize the use of clinical settings. Clinical supervision in nursing is a delicate balance between providing opportunities for students to care for clients, thus practicing what they have previously learned and facilitating further opportunities to gain new experiences, while on the other hand providing safe client care. Nursing students themselves have shown a keen interest in this instructional methodology (Taylor 1979-81) within their program.

Intellectual processes are not visible like the procedural aspects of their clinical performance and, therefore, computer simulations may be an optimal mechanism whereby these cognitive processes can be assessed. Computer assisted learning is based on the concept that knowledge can be created through the student's experiences and its emphasis is on the student's exploration of information on a particular topic (Rushby, 1979).

Students often express a lack of confidence in their clinical competencies and simulations can provide a non-threatening environment in which they can become more skilled at making independent decisions.

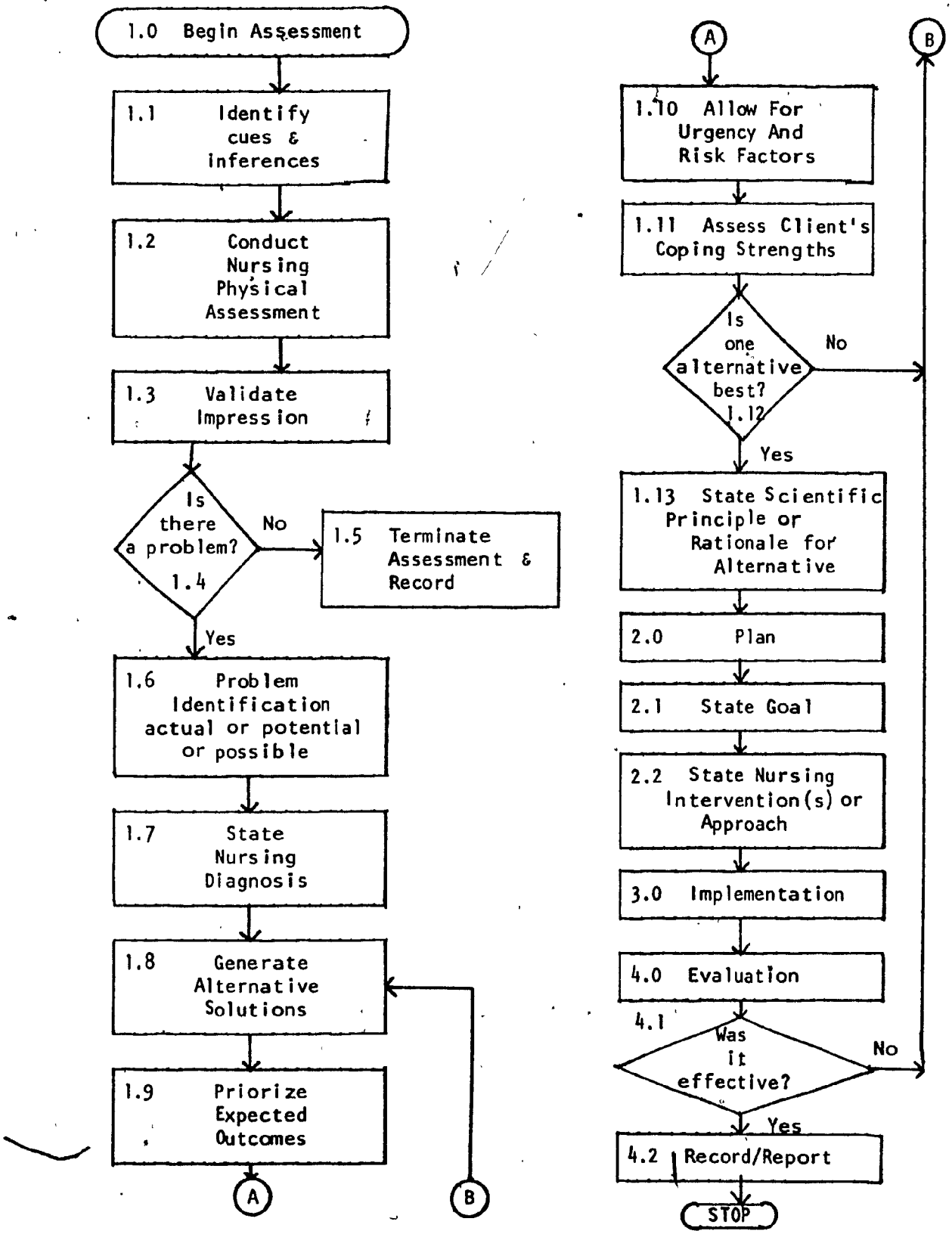
Computer simulations elicit the active involvement of students, break down information into clear elements and provide feedback to the learner. The nursing student assumes the role of the primary care provider and practices her intellectual skills in applying theory to representative clinical situations. This approach provides data for purposeful learner-tutor follow-up as well as improved decision making abilities.

After graduation these practitioners are expected to make decisions constantly. Nurses today are frequently faced with an increasing number of ever more complex decisions (Baumann and Bourbonnais, 1983). In critical care areas, for example, sophisticated technology, intensive diagnostic and lifesaving activities combine to demand a very highly refined decision-making ability from the entire critical care

staff. Many of the decisions made by the nurse in this sort of environment are complicated further by unstable client conditions. These situations require rapid decision-making and immediate action. In a matter of seconds, the nurse must identify problems such as the development of lethal cardiac arrythmias and take action to alleviate the impending crisis. These situations may be further complicated by environmental stresses such as noisy equipment, anxiety of family members, politics of administration, and the list goes on. Frequently, the nurse must filter out extraneous information and focus on the most relevant facts. However, the decision-maker may also lose the broader perspective if she is inexperienced and, therefore, unable to see the essential aspects (Cleland, 1967). The quality of the nurse's thinking deteriorates as the quantity of environmental stresses increase. Peripheral cues are often eliminated and then central cues may not be perceived.

The new model (quasi-algorithm) exhibited in Figure 18 is capable of serving as the basis for producing instructional computer based simulation which will better meet the assessment learning needs of nurses than can simulations based on other existing nursing process algorithms. It is the assertion of this thesis that the author's Assessment-Oriented Decision-Making Model for Nursing offers a better basis for designing instructional computer simulations; one that is grounded in a new and improved framework for teaching the nursing process. The author's model works as follows: the nurse, using a structure such as Maslow's hierarchy of needs or Roy's classification of stimuli

FIGURE 18. Assessment-Oriented Decision-Making Model for Nursing



systematically observes and interviews the clients. She obtains cues and inferences and performs a physical assessment which includes such aspects as vital signs, state of skin and appendages, motor ability, nutritional and elimination status and so on. Once the data is obtained, the nurse uses a variety of sources to validate her impressions: client, family, records, colleagues, references, etc... It should be evident at this point whether there is a presenting problem (actual, potential or possible). If so, this problem is identified and a nursing diagnosis is stated. (See Appendix A).

It is important here to differentiate nursing diagnosis from medical diagnosis. The medical diagnosis describes a disorder or injury and directs the doctor toward medical treatment. The nursing diagnosis is a statement of actual, potential, or possible health problems that directs the nurse to those problems she is prepared to treat. For example, appendicitis is a medical diagnosis whereas the related nursing diagnoses would be (1) an alteration in comfort; pain due to sporadic abdominal cramps and (2) an alteration in fluid and electrolyte balance - less than body requirements due to vomiting.

Once the nursing diagnosis is determined, alternative solutions must then be generated and their expected outcomes considered in terms of their likelihood of occurring. More experienced nurses should be able to generate more alternatives in her field or specialty than the novice. In all cases, matters of urgency and risk must be allowed for. For example, the client's airway must be maintained first! In addition,

the client's ability to cope in the presenting situation should also be assessed.

If one "best" alternative action is identified, the nurse must be aware of the scientific principle or rationale behind it and go on to state the goal. If, however, a desirable alternative has not been identified then the nurse must go back to the point of generating alternatives once again. Once the goal is stated, nursing interventions or approaches are delineated and implemented. Reassessment or evaluation of these actions should determine their effectiveness. If the action has been ineffective then the nurse should once again generate further alternative solutions.

IV EVALUATING THE HYPOTHETICAL MODEL

The authors reviewed in the literature have various views of decision-making and yet the commonalities are certainly evident. In all cases, the nurse must consciously assess her client's needs on the basis of a number of criteria. Nursing requires a precise method of determining when interventions are necessary (Lamonica, 1979). Abdellah (1960) and associates described an approach to planning care using their "twenty-one nursing problems" guide. Bonney and Rothberg (1963) also suggested a method of identifying needs of the chronically disabled for nursing services. However, neither of these approaches have been widely utilized in nursing practice. The model proposed by this thesis certainly concurs with the literature reviewed that the nurse must use direct observation and interviewing as her tools. The primary source of information is the client and yet further data can be obtained from his family, records and other members of the health team in order to validate one's impression. Judgments are made on both objective and subjective data. Indeed, patient assessment is the responsibility of the professional nurse. Her assessment continues as the client's behaviour or functional abilities change. For this reason, the student learning to nurse must have a framework for gathering information. Maslow's hierarchy of needs or Roy's adaptation model, as previously discussed, can certainly provide this. The number of frameworks for nursing practice is growing but the essence of all these theoretical approaches is to look at the total client - to assess his status socially, psychologically, emotionally and physiologically (vital signs, respiratory status, circulatory status, nutritional status, elimination status, reproductive status, state of activity, rest and sleep, state of comfort and safety etc...). The assessment skills of

the nurse certainly influence the types of decisions she will make in her practice. The author's model for decision-making emphasizes the assessment phase. This assessment is identified as having several facets which include the following:

- identify cues/inferences
- conduct nursing physical assessment
- validate impression
- determine if a problem exists
- identify problem as actual, potential, or possible
- state nursing diagnosis
- generate alternative solutions
- priorize expected outcomes
- allow for urgency and risk factors
- assess client's coping strengths
- determine if one alternative is best
- state scientific principle or rationale for alternative.

When these facets of assessment have been incorporated in the nurse's overall decision-making strategy, the quality of the decision itself should be more optimal. The model will attempt to overcome failure to associate initially available data with plausible diagnostic hypotheses. It, in fact, promotes the inclusion of the accurate diagnosis in the initial set of hypotheses considered. There is a further intent to the design of this model not to rely on recall and recent experiences to over-estimate the probability of one hypothesis. Data must be validated and, therefore, the reliability of the data used in confirming the

appropriate problem and its best alternative solution should be evident.

This assessment-oriented decision-making model was designed by the author who recognizes assessment as the foundation of current nursing practice. Assessment skills are indeed essential for all nurses. Quality nursing care results from deliberate decision-making and action through the use of the nursing process. The following Black Box analysis of decision-making related to assessment, planning, interventions, and evaluation outlines the elements that are similar and those that differ from one author to another (Table IV).

TABLE IV

BLACK BOX ANALYSIS OF DECISION-MAKING

	Assessment	Planning	Interventions	Evaluation
I Simon	- Establish satisfactory goal or value - Define subjective perception of problem - Identify acceptable alternatives - Evaluate alternatives	- Select Satisfactory alternative	- Implement decision	- Follow-up
II Lancaster	- Identify the problem - Gather and process information - Evaluate alternatives	- Select an alternative	- Implement solution	- Follow-up
III Bower	- Identify stress - Identify response - Determine if stress or response creates unmet need - Determine if problem is nursing problem - State as problem if no straight line of action is possible - Determine if need can be met by client - Select nursing actions	- Plan for nursing actions - Plan for evaluation	- Intervene	- Evaluate

	Assessment	Planning	Interventions	Evaluation
IV Carpenito	assess - differentiate cues and inferences - observe systematically - perform a nursing physical assessment - identify patterns - validate impression identify problem - differentiate nursing diagnosis from clinical problems - identify and test alternatives - recognize patterns	- identify goals - identify interventions - write nursing orders	- teaching skills - management skills - change theory	knowledge of - process criteria - outcome criteria
V Aspinall and Tanner	- determine data to be collected - do a thorough assessment re/ patient's chief complaint . patient profile . related social data . history of present illness	- set goals - plan alternative interventions - predict outcomes of interventions - rank order	- intervene	- determine whether response met goals

(continued)

	Assessment	Planning	Interventions	Evaluation
V Aspinall and Tanner	. past history . review of systems . physical examination . base-line laboratory data . nursing history - identify factors relating to the clients environment as well as beliefs and attitudes - interpret signs and symptoms to generate diagnostic hypotheses - gather data pertinent to client's coping strengths			
VI Callin and Ciliska	- give selective attention to stimuli - identify components through sustained analysis - relate to previously known situations - priorize factors before considering possible solutions			

(continued)

	Assessment	Planning	Interventions	Evaluation
VI Gallin and Ciliska	- test solutions covertly before applying one overtly - be alert and receptive to new information - value one's own perceptions and act upon them - tolerate ambiguity and consider conclusions provisional until further data leads to a more logical conclusion In order to: · define the problem collect the data formulate the problem	plan	intervene	evaluate
VII Taylor	1.0 Begin Assessment 1.1 Identify cues/inferences 1.2 Conduct Nursing Physical Assessment 1.3 Validate Impression 1.4 Is there a problem? 1.5 If no, Terminate Assessment/Record 1.6 If yes, Problem identification actual/potential/possible	2.0 Plan 2.1 State Goal 2.2 State Nursing intervention(s)/ approach	3.0 Implementation	4.0 Evaluation 4.1 Was it effective? If no, proceed to box 1.8 If yes, move to box 4.2 4.2 Record/Report STOP

(continued)

	Assessment	Planning	Interventions	Evaluation
VII Taylor	1.7 State Nursing Diagnosis 1.8 Generate Alternative Solutions 1.9 Priorize Expected Outcomes 1.10 Allow for Urgency and Risk Factors 1.11 Assess Client's Coping Strengths 1.12 Is one alternative best? If no, return to box 1.8. If yes, move to box 1.13. 1.13 State Scientific Principle or Rationale for Alternative			

Simon's descriptive model based on a set of alternative assumptions provides a reasonable framework for decision-making, however, the search for satisfactory solutions may not give the critical element necessary for nursing. Lancaster's model is a systematic series of sequential steps which gives us the basis for an algorithm and yet there does not seem to be the attention to assessment that is necessary in a model for instructional purposes. Bower's model offers a many useful components for nursing practice. Assessment is discussed as an essential element of greater magnitude than mentioned by the previous authors. However, there is some concern about Bower's attempts to estimate relative probabilities of outcomes and use of these estimates for decision-making. The concept of nursing diagnosis is not added by Bower and this element is considered desirable by many authors. Bower offers excellent situations to make clear the intent of her decision-making process. Although it is described as systematic and "step by step" the process of planning nursing care as illustrated in Figure 6 certainly does not meet the requirements of an algorithm for designing computer simulations.

Carpenito has a strong emphasis on nursing diagnosis and her assessment seems to include most of the elements included in this author's model. However, elements missing from Carpenito's model are: (1) the assessment of client's coping strengths, (2) allowance for urgency and risk factors, and (3) the nurse's requirement for supporting rationale.

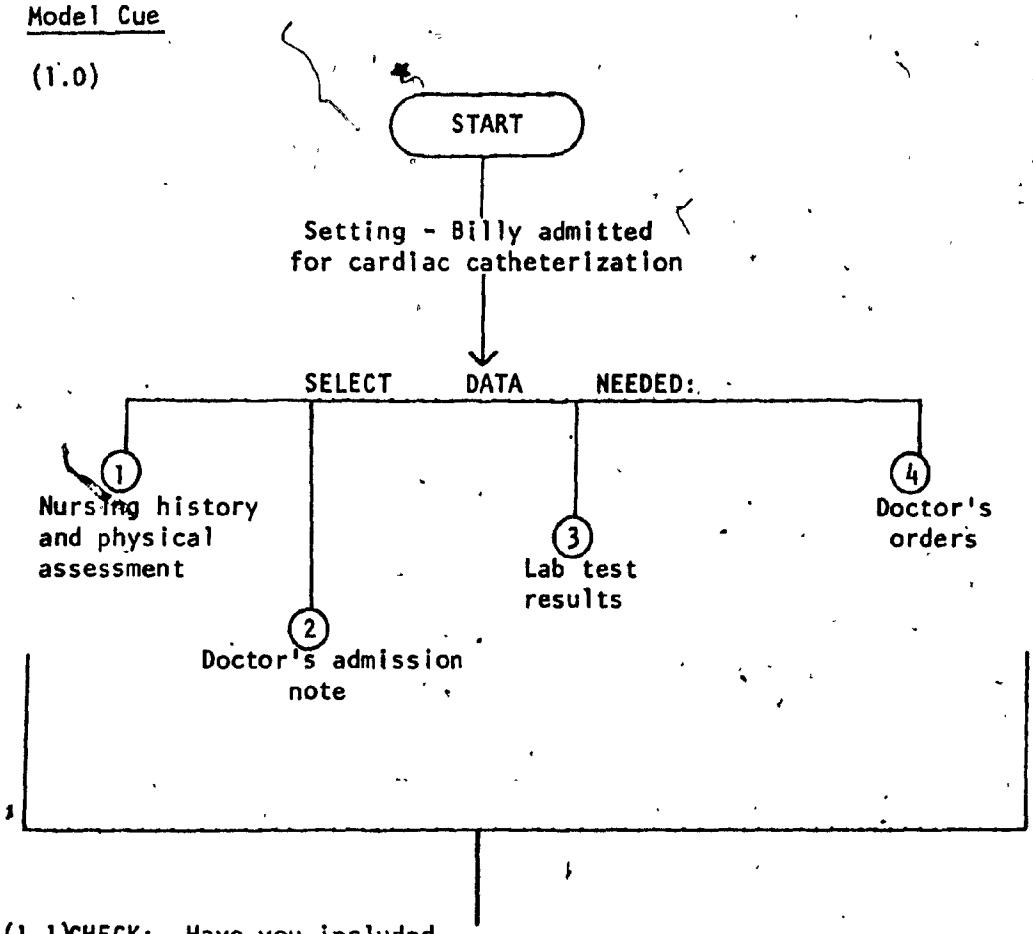
Aspinall and Tanner's model comes closest to that of this author's. They project decision-making as a dynamic, continuously evolving process with a deliberate sequence of steps. They further suggest that there are many pitfalls in the intellectual strategies used in actual clinical decision-making. The component missing in this model is nursing diagnosis and yet it makes reference to the necessity of being aware of various medical diagnoses and their consequences.

The author's model (quasi algorithm) has attempted to incorporate all elements seen to be necessary from the literature and incorporate it in such a way that it can readily be used as the basis for designing computer simulations.

Ideally, as the learner is able to manipulate this model in simulation, the decisions taken will have similar effects to those one would obtain in reality. The benefit of a "realistic" simulation is that the learner gets an overall impression of the process in question (Romiszowski, 1974). In addition, the student is provided with an experience that is close to the real-life situation and yet is non-threatening both for the learner and the recipient of her "care".

The following design attempts to use the New Assessment-Oriented Decision-Making Model in an instructional computer activity for nursing students:

Using the New Decision-Making Model (Taylor, 1983) to Develop a Computer Simulation Algorithm



(1.1) CHECK: Have you included ①②③ and ④?

If not, return to....

(1.3)

Your history and physical assessment indicated:

Billy was a full-tern baby delivered without complication. During an early check-up the physician noticed a heart murmur and referred Billy to a pediatrician for follow-up.

At 3 years of age Billy experienced an episode of cyanosis in connection with an upper respiratory infection. A similar incident occurred at 4 years of age. Billy is now 5 years old and during the past year his mother reports that he tires easily and has difficulty breathing on exertion. He seems to squat during strenuous play.

(1.1) You noticed mild clubbing and cyanosis of Billy's fingers.

KNOWLEDGE CHECK-POINT:

(1.13) Which of the following maternal factors has been implicated as a possible cause of congenital cardiac defects?

(1) Rubella during the first trimester of pregnancy

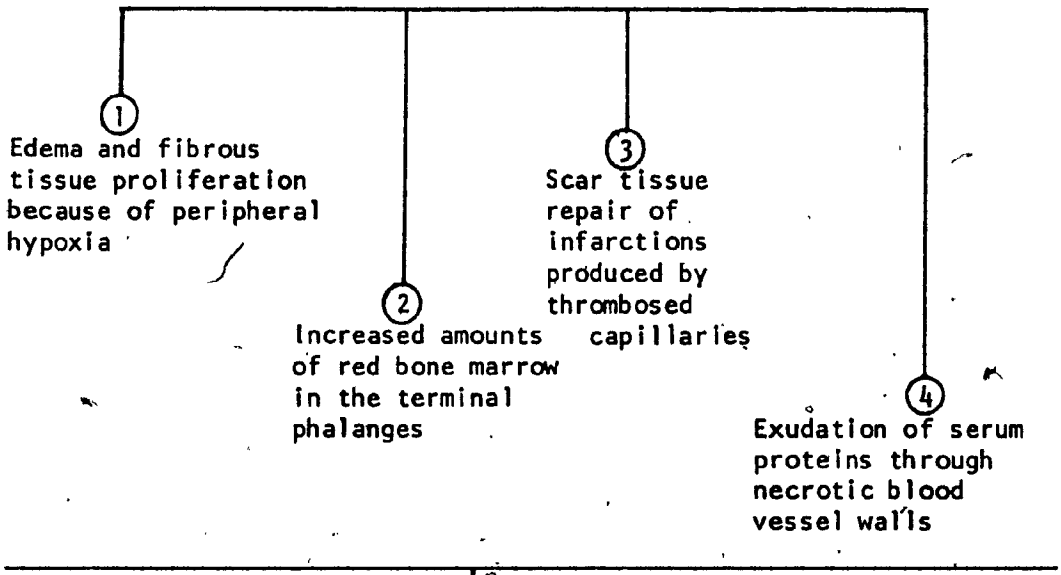
(2) hypertension associated with pre-eclampsia

(3) excessive and rapid weight gain during pregnancy

(4) metabolic acidosis due to diabetes mellitus

positively reinforce for answer (1)

The club-like appearance of Billy's fingers are due to:



positively reinforce for answer (1)

Billy's physical findings on admission included:

(1.2)

Rectal temperature 36.5°C

Pulse: 88, irregular

Respirations: 26/min.

Blood pressure: 90/60 in right arm

Weight: 42 lbs. (19 Kg.)

Brachial, carotid, femoral pulses full

Radial and dorsalis pedis pulses diminished

Decreased breath sounds and rales right lower lobe

(1.3) Results of laboratory tests revealed:

RBC - 6 mil/cu. mm.

Hgb - 18 grams/100 ml.

Hct - 60%

WBC - 6300/cu. mm.

Neutrophils - 63%

Lymphocytes - 22%

Monocytes - 5%

Eosinophils - 10%

Urine was normal

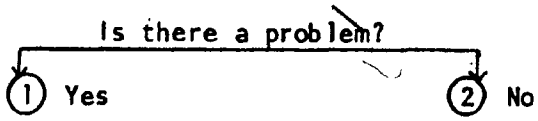
Chest X-ray revealed enlargement

Electrocardiogram indicated right ventricular hypertrophy

Doctor's orders included:

Penicillin G. 150,000 U. I.M. B.i.d.

(1.4)



Reinforce positively for (1)

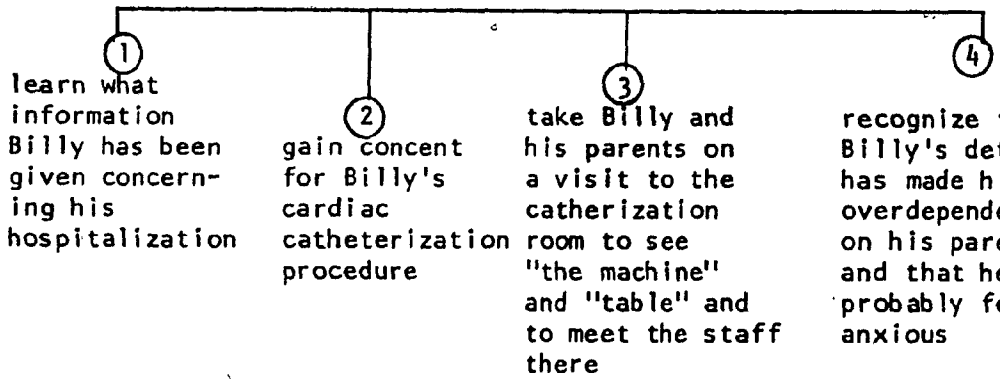
(1.7) State the appropriate nursing diagnosis:

Positively reinforce for either or both of:

1 Activity intolerance

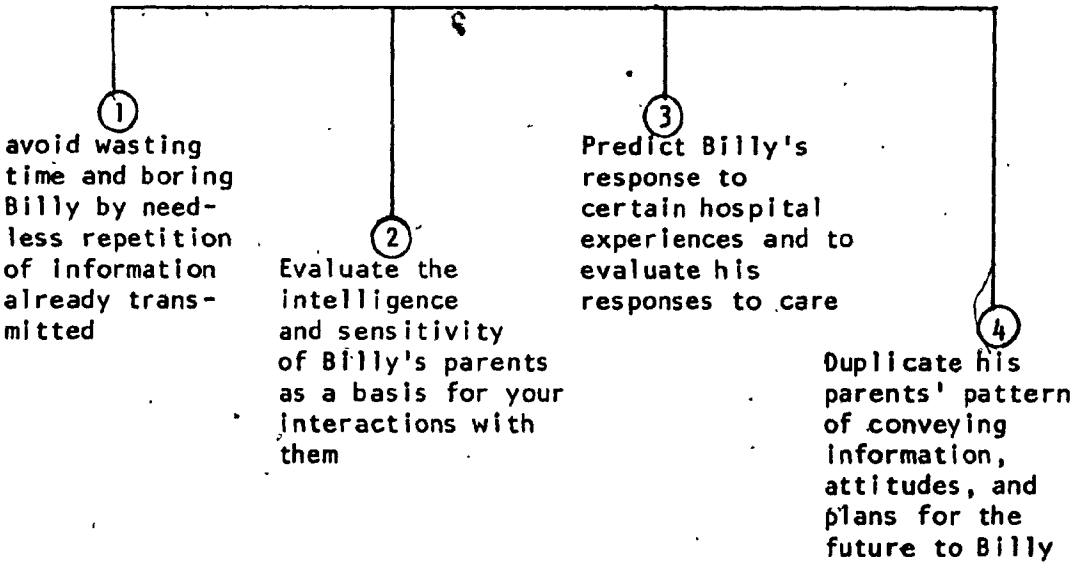
2 Alteration in Cardic Output

(1.8) Your alternatives are:



Reinforce positively for all of the above, ① + ② + ③ + ④.

(1.11) It is important for the nurse admitting Billy, to learn what information he has been given about his cardiac catheterization procedure and proposed surgery in order to:



Reinforce positively for response (3)

(1.9) Priorize expected outcomes for the following measures to reduce Billy's anxiety:

(1) give a clear, simple explanation of the procedure, using a play hospital; doctor, nurse and patient dolls; and some of the equipment used for the catheterization

(2) allow him to have free and guided play with dolls and selected equipment to display his understanding and any evidence of anxiety

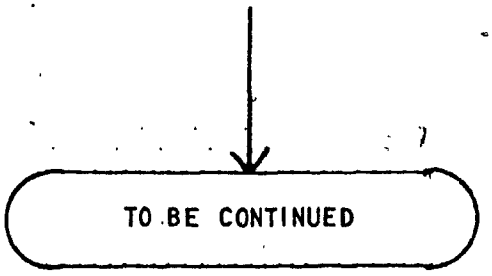
(3) take Billy and his parents on a visit to the catheterization room to see the equipment there and to meet the people who work there

(4) encourage Billy to talk with another patient who has undergone catheterization

Reinforce positively for (3), (1), (2)

Feedback:

A 5 year old child's thinking is concrete and tangible. Play is an excellent way to help Billy make associations between ideas.



This is a sample of the sort of simulation activity that can be designed for use with nursing students on computer. The author's model for decision-making becomes the basis for the selection of events through which the learner is guided. Responses are requested at various nodes as the algorithm is developed.

This type of simulation activity permits irrelevant factors to be carefully controlled or eliminated, so the learner can receive a higher density of experience with the simulation than is possible in the real world (Campbell, 1980). Just as pilots practicing landings using a simulator can repeatedly begin their practice at the final approach rather than repeatedly at take off in actual aircraft activities, so can the nursing student be directed to activities in any selected area of the nursing process that seems appropriate. The learner can take risks in simulation that the professor may not be able to allow in actual clinical situations.

V DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

From an analysis of the current literature on decision-making related to the practice of nursing it seems evident that there are several essential elements involved in decision-making: assessment, problem identification, planning, interventions and evaluation. Nursing students who care for clients must work through these elements so as to produce the "optimal" situation for clients in their care. The student must learn how to control the outputs through her use of the inputs without being able necessarily to "see" everything that links them. The nursing practitioner must keep in mind that the client's behaviour should be indicative of the promotion and maintenance of health; improvement in knowledge about identified health problems, performance of activities of daily living, attitude toward managing identified health problems, or management of identified health problems; or alleviation of effects of deterioration in physiological and psychosocial functioning. These outcomes are the effects of nursing practice.

It has been reported that PLATO students learned the same amount of material in from one-third to one-half the time required in the classroom (Zielstorff, 1982). This time-saving feature of the computerized nursing course has been demonstrated repeatedly. However, computer-based education is intended to supplement rather than supplant the teacher. It is an ideal instructional method for learning in general cognitive skills. The computer can provide individualized instruction, immediate feedback, and remedial training, as well as

complex internal branching which allows the method of presentation or the type of material to be altered on the basis of the student's past performance (Zielstorff, 1982). In addition, the constant availability of material allows students to learn at their own pace and allows for more effective use of both instructor and student time.

The author recommends that this new model for decision-making in nursing be used in experimentation with nursing students both through traditional classroom instruction as well as in designing instructional computer simulations. The author further recommends a study related to this work and the development of computer simulations in nursing.

This investigation would involve determining the most appropriate "learner guidance" that the nursing educator in the role of facilitator could provide those learning to nurse. A look at the work of Card, Moran, and Newell (1980) in attempting to explain computer simulations would be involved. Learner performance would be analyzed according to the cognitive operations which they use to complete each activity. Card, Moran, and Newell (1980) have used protocols coded as TYPE, LOOK-AT, and MENTAL. Predictions of the learner's choices of methods while executing the required task may assist in generalizing to other situations.

The final evaluation of the author's model would certainly involve its use in Nursing Education and whether other professionals find it useful in practice as well as in designing simulations.

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VII APPENDIX A

A. List of Nursing Diagnoses

Activity Intolerance

Airway Clearance, Ineffective

Anxiety

Bowel Elimination, Alteration in; Constipation

Bowel Elimination, Alteration in; Diarrhea

Bowel Elimination, Alteration in; Incontinence

Breathing Patterns, Ineffective

Cardiac Output, Alterations in; Decreased

Comfort, Alterations in; Pain

Communication, Impaired Verbal

Coping, Ineffective Individual

Coping, Ineffective Family

Diversional Activity Deficit

Family Processes, Alteration in

Fear

Fluid Volume Deficit

Fluid Volume Excess

Gas Exchange, Impaired

Grieving

Health Maintenance, Alteration in

Home Maintenance Management, Impaired

Injury, Potential for

Knowledge Deficit (specify)

Mobility, Impaired Physical

Non-compliance (specify)

Nutrition, Alteration in: Less than body requirements

Nutrition, Alteration in: More than body requirements

Nutrition, Alteration in: Potential for more than body requirements

Oral Mucous Membrane, Alteration in

Parenting, Alteration in

Powerlessness

Rape-Trauma Syndrome

Respiratory Function, Alteration in; immobility smoking

Self-care Deficit: Feeding

Bathing/hygiene

Dressing/grooming

toileting

Self-concept, Distrubance in

Sensory Perceptual Alteration: Visual

Auditory

Kinesthetic

Gustatory

Tactile

Olfactory

Sexual Dysfunction

Skin Integrity, Impairment of

Sleep Pattern Disturbance

Social Isolation

Spiritual Distress

Thought Processes, Alteration in

Tissue Perfusion, Alteration in: Cerebral

Cardiopulmonary

Renal

Gastrointestinal

Peripheral

Urinary Elimination, Alteration in Patterns of

Violence, Potential for