Decision Bases for Assisting Graduate Nursing Students in the Writing of a Thesis

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GRADUATE NURSING STUDENTS learn and use investigative approaches and research methodology to extend, expand, and reinterpret nursing knowledge. Their research knowledge, skill, and ability culminate in the conducting of theses. Theses are conducted as independent research under the direction of graduate faculty thesis advisers and additional committee members. The advisers assume major responsibility for guiding graduate students through the research process. This article addresses the key steps that must be taken for students to write their theses.

WHAT ARE THE QUESTIONS FOR RESEARCH IN NURSING?

Nursing assumptions

Two important assumptions concern nursing as a practice and nursing as a profession. First, the practice of nursing implies responsibility and accountability

0161-9268/81/0033-0085$2.00

for one's own actions and activities. While nursing involves carrying out treatment protocols, it is not simply following rigid rules of procedure without analysis.

The second assumption is that nursing as a profession exists to bring about changes in the real world, given a general societal charge, reinforced by formal regulation and enabling legislation.[1] Therefore graduate students should direct their research toward meaningful clinical problems to improve nursing practices.

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The questions

Graduate students should consider four kinds of questions in their search for research topics[1]: These are presented in the following discussion.

What is this?

The question "What is this?" occurs when nurses realize that the literature does not adequately describe the patterns of behavior surrounding a particular phenomenon, situation, or process. One example of this type of question is: "What is hope in the terminally ill patient?"

The process involved in accurately and analytically describing *what is,* is important to nursing for two reasons. First, few of the "facts" of nursing have been grounded in empirical studies. The study which asks "What is this?" provides a foundation on which to base nursing practice. Second, a study designed to describe the actions, interactions, and reactions surrounding a particular phenomenon, situation, or process often begins to show patterns of human behaviors. Predictions surrounding the occurrence of behaviors and the circumstances of behaviors can be made from these patterns. This type of study can therefore provide knowledge on which to build prescriptive theory, which ultimately directs practice.

What is happening here?

The question "What is happening here?" is used when concepts or variables have already been described or defined, but there is a need to examine new relationships between variables or measure variables in new circumstances. For example, a graduate student may study the relationship between assertiveness and self-esteem in a particular patient population.

Questions which examine variables and the relationship between variables are examples of how knowledge in nursing is expanded and extended. Research which asks these questions is predicated on previous studies and writings in the literature in which the factors and variables to be examined have been adequately analyzed, described, and defined.

What will happen if . . . ?

The question "What will happen if . . . ?" is used to seek a relationship between known factors or variables. Based on previous empirical evidence, this question addresses predictive outcomes through manipulating variables. Predictions are made which require hypothesis-

testing studies. For example, the question "Do nurse-conducted group discussions contribute to spouse adjustment following an acute myocardial infarction?" becomes the hypothesis "Nurse-conducted group discussions with spouses of myocardial infarction patients will decrease spouses' perceived stress."

How can I make . . . happen?

The question "How can I make ... happen?" explores how to achieve a projected goal or desired situation. This question explains the conditions in which a particular activity produces a specified goal.[2] Attention focuses on how to make a desired outcome happen, again requiring hypothesis testing. For example, a nurse interested in the relationship between family attitude toward mental illness and successful discharge would want to investigate the explicit dimensions of family therapy necessary to achieve successful discharge of mental patients with a particular diagnosis. Prescriptive-type questions are the most complicated to ask and to answer but need to be raised because they are the ones which can provide direction for nursing practice.

HOW CAN NURSING RESEARCH QUESTIONS BE STUDIED?

Formulating the research question

The following points can be addressed to help formulate the research question. First, does the research question significantly contribute to nursing practice or nursing theory? Second, is the problem researchable? Third, is the problem to be investigated feasible in terms of time, availability of subjects, equipment, and money? There are times when the importance of securing an interesting and meaningful topic is ignored in the concern for using appropriate and sophisticated research procedures. Yet without a good, workable, significant topic, the most carefully and skillfully designed research project will be of no value.[3]

Once a general topic is selected (remembering the kinds of research questions to be considered) the specific problem to be investigated should be defined as precisely as possible.

One of the most common difficulties for researchers is the development of a manageable, researchable problem statement. A clearly stated problem statement will provide direction for the subsequent research design and the data necessary to answer the research question. In some cases it may be a matter of preference whether the research is conducted to answer a research question or whether the research question is put into a hypothesis format. When little has been written or studied about a subject, a hypothesis statement is not necessary and, in fact, may be inappropriate.

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Types of information

After the research question or hypothesis is determined, the next steps in the

research process are to determine the types of information necessary to answer the research questions and then decide the best methods of obtaining the information.

Incidents, events, and histories

Information on incidents, events, and histories may include observations by the investigator, reports by the subjects, or both. Information may be a log of events during a given period or in a particular setting, a description of actions or a report on conversations. Both the behaviors observed and the explanations reported by the participants can be regarded as part of the incident or phenomenon under study, as long as they are considered perceptions and not observational data. Research questions or hypotheses dealing with behaviors and attitudes of people in crisis or the social process involved with the dying patient are examples which would require this type of information.

Distributions and frequencies

Information on distribution and frequencies can be gained through questionnaires and various research tools aimed at measuring a particular concept, characteristic, behavior, or belief. Distributions and frequencies are also used in epidemiological studies (eg, incidence of teenage pregnancies in the black population of New York City). This type of information can include both observations by the investigator (frequency of diarrhea in patients with uncontrolled rate of tube feedings) and reports from subjects (how many postmastectomy patients experienced feelings of depression following surgery).

Generally known norms and rules

Information on generally known norms and rules usually consists of reports from subjects. Examples of this type of information include a list of health practices, who enforces them, informants' accounts of how rules of child discipline apply, what sexual activities are accepted or rejected by various groups, and how laws regarding health are made and enforced.

Methods for obtaining information

Once the type of information needed to answer the research question has been determined, the method for obtaining the information should be evaluated. In deciding on the best method for obtaining information, adequacy of method, time available for collecting information, cost, and general efficiency need to be considered.

In some discussions of research, the term *method* refers to the research design as well as the method for obtaining information. In this article the term method refers only to the method for obtaining information. By focusing on the type of information needed and the best method for obtaining it, the question of quantitative versus qualitative data becomes: What methods are best suited for what kinds of information?

Subject interviewing and testing

The subject interviewing and testing method has been one of the most popular methods in nursing research. Populations of subjects are interviewed using open-ended questions or a variety of structured questionnaires to measure the degree to which a concept, characteristic, behavior,

or belief is present. For example, the level of anxiety in preoperative patients, the level of empathy in nurses, and the cognitive changes after patient education programs represent this method of obtaining information. The questionnaire method may involve the completion of a questionnaire without an interview (mailed questionnaires) or face-to-face contact with the investigator. The strength of this method is the relative ease of administration. The difficulty is in the development of research instruments with adequate validity and reliability. Because of the ease of assigning a numerical value to some structured questionnaires, they have been used repeatedly without adequate attention to whether they really measure what they are intended to measure.

Enumerations and samples

The enumerations and samples method includes surveys and direct, repeated, countable observations as well as the use of data from records and charts. Examples of this method are the amount of pain medication received by cardiac bypass surgery patients or the number of hospital admissions of a particular patient population. Record reviews can be used to evaluate patterns of preventive health behavior in particular populations of people or demographic characteristics of people with specific health problems. For example, studies in epidemiology use large volumes of data from health department and other official records.

Participant-observation

The researcher using the participant-observation method is both a participant and an observer. This method is often referred to as the "investigator as instrument" because the validity and reliability of the information gained depend entirely on the researcher. The participant-observation method is used extensively in anthropology and sociology. The use of participant-observation has been used more frequently in nursing research because of the education of nurses in these two disciplines. The strength of this method derives from the detailed data that cannot be recorded except by direct observation or interviewing of people at events or in particular situations. The difficulty in this method is the extensive time involved to collect data. This method was used in research surrounding the social process involved with dying patients[4] and in examining the identity of the juvenile diabetic.[5]

Table 1 summarizes the information needed to answer research questions and the methods of obtaining information.

HOW CAN RESEARCH DESIGNS BE IMPLEMENTED TO STUDY NURSING RESEARCH QUESTIONS?

"A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure."[6(p90)] One of the most critical components in nursing research is the selection of an appropriate design. Without a proper design, it is impossible to determine under what circumstances a particular phenomenon exists, if a relationship exists between variables, how different groups compare on

Table 1. Methods of obtaining information and types of information

Types of information	Methods of obtaining information: Subject interviewing & testing	Enumerations and samples	Participant-observation
Incidents, events and histories	Adequate with precautions, efficient	Not adequate by itself, not efficient	Prototype and best form
Distributions and frequencies	Often inadequate, if adequate it is inefficient	Prototype and best form	Usually inadequate and inefficient
Norms and rules	Most efficient and hence best form	Adequate but inefficient	Adequate, but inefficient, except for unverbalized norms

From Zelditch M Jr: Some methodological problems of field studies, in Filstead WJ (ed): *Qualitative Methodology*. Chicago, Markham Publishing Co, 1970, pp 217-231.

specific variables, or if a specific experimental treatment (independent variable) is responsible for any measured effect on the variable. Only with a good design can relationships be inferred from statistically significant results. Research designs differ depending on the purpose of the research. Examples of appropriate and inappropriate designs will be given for various research questions.

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Exploratory studies

Many exploratory studies are designed to formulate problems for more precise investigation or to develop hypotheses. However, an exploratory study may have other functions: increasing familiarity with a phenomenon or with the setting to be investigated in a subsequent, more highly structured study; clarifying concepts; establishing concepts for further research; gathering information about practical possibilities for carrying out research in practice settings; and providing a census of problems regarded as urgent by people working in a given field of nursing. Designs of this type are usually used to answer the questions "What is it?" and "What is happening here?"

An exploratory study whose major purpose is formulating a problem for more precise investigation or for developing hypotheses might ask the question "What is grief?" An appropriate design for this question requires direct observation of overt behaviors of grief by the investigator and expressions from subjects on their feelings related to grief. The research questions and the type of information needed to answer the research question give direction to a design comparing the perspec-

tives of three groups:

1. Loss of body part
2. Divorce
3. Loss of family member

The design suggests that the phenomenon of grief can be explored from the perspective of various groups in grief-producing situations. From the design the data can provide answers suggesting patterns of manifestations of grief (both physical and psychological), the variations of grief, and similarities and differences in grief situations.

Descriptive studies

The descriptive study, in contrast to the exploratory study, presupposes prior knowledge of the problem or variables to be investigated. Students must be able to define clearly what it is they want to measure and must find adequate methods for measuring it. In addition, they must be able to specify who is to be included in the population sample. A clear formulation of what and who is to be measured is necessary as well as techniques for valid and reliable measurements. Both correlation and comparative designs are examples of descriptive studies.

Correlational design. A correlational design is used to study the extent to which two variables are related in one group of subjects. If a positive relationship occurs, one variable increases as the other one increases. In a negative relationship, as one variable increases the other decreases (design for research question "What is happening here?"). A cause-effect relationship cannot be claimed with a correlational study.

An example of a study using a correlational design might be an examination of the relationship between presurgical pulmonary function and postsurgical pulmonary complications. A finding of a positive correlation demonstrates a relationship but does not show cause.

This type of correlational design can then be expanded to an experimental design by having a control group and an experimental group who receive exercise and training to improve pulmonary function. The two groups would then be compared postsurgically on pulmonary complications. In this way a researcher will have gone from the question "What is happening here?" to "What will happen if . . . ?"

Comparative design. The major point of a comparative design is that two or more groups of subjects are compared on the same variable. The groups may be distinguished by many characteristics such as age, educational level, and work setting. However, even if a statistically significant difference is found between the groups on the measured variable, no causal statement can be made based on this design. It can, however, lead to more controlled research and perhaps an experimental design so that causal statements can be made. An example of a comparative study might be the rate of return to work of postmyocardial infarction patients, one group enrolled in a structured exercise program, one group not enrolled in any formal program.

Experimental studies

Because the goal of nursing research is to eventually be able to establish cause-effect relationships, it is important to be familiar with descriptions of both inappro-

priate and appropriate experimental designs commonly found in nursing research. Thus students will not only be able to better judge the quality of research studies encountered but will also be able to select an appropriate design for their own thesis.

Preexperimental designs

Preexperimental designs, which provide a treatment for a group without using a comparison group, are inappropriate for nursing research. An example of an inappropriate design is the clinic nurse who found many cardiac patients were not staying on their salt-restricted diet. Therefore the nurse ordered a movie on preparing foods for people on salt-restricted diets. The movie was shown to several groups of clinic patients. Many patients expressed pleasure at viewing the movie, and the nurse believed something had been accomplished to reduce salt intake in patients' foods. However, had patients really reduced their salt intake as a result of the movie?

The single group posttest design. The single group posttest design involves following the films with an appropriate measuring device. Therefore, following each showing of the film, the nurse evaluated each patient's knowledge of those foods high in sodium and those low in sodium and the recommended method of preparing foods for a low-salt diet. The nurse found that the majority of patients were well informed on the foods to avoid in a low-salt diet and the recommended methods of preparing foods for this diet. However, their knowledge before the film was unknown. Even more important, the nurse did not know if the information changed the patients' compliance with the diet regimen.

The addition of a pretest prior to the lectures strengthens the single group posttest design. For example, if the patients had been pretested, the clinic nurse would have known whether they were more informed on their low-salt diet after the program than previously.

Experimental designs

The pretest-posttest control group design. Conducting the pretest-posttest control group design may involve less effort than the single group pretest-posttest design. In this design, "R" stands for the random assignment of subjects to one of the groups, "T" stands for the group who received the experimental treatment, and "C" stands for the control group. "M_1" is the pretest and "M_2" is the posttest.

$$R \begin{cases} M_1 \rightarrow T \rightarrow M_2 \\ M_2 \rightarrow C \rightarrow M_2 \end{cases}$$

The posttest control group design. The posttest control group design is simpler to perform than the pretest-posttest control group design. The posttest control group design is considered superior because there need be no concern about the pretest becoming part of the treatment effect. In addition, there need be no concern about limiting the generalizability of results to only a pretested population.

$$R \begin{cases} T\,(\text{treatment}) \rightarrow M \\ C\,(\text{control}) \rightarrow M \end{cases}$$

The Solomon four-group design. The problems associated with the use of a pretest are resolved in this more complex Solomon four-group design. In the Solomon four-group design, subjects are randomly assigned to one of four groups. Two groups receive the treatment, but only one of these is given a pretest. The other two groups serve as controls, and one of these receives a pretest. While this design has higher prestige, analysis of the results is statistically more complicated.

$$R \begin{cases} M_1 \longrightarrow T \longrightarrow M_2 \\ \qquad\quad T \longrightarrow M_2 \\ M_1 \longrightarrow C \longrightarrow M_2 \\ \qquad\quad C \longrightarrow M_2 \end{cases}$$

Some of the components within the different experimental designs have been presented. Table 2 may help the student select the preferred experimental design.

Quasi-experimental design

Nurses often find themselves part of inflexible conditions. For example, they might not have the opportunity to randomly assign subjects to experimental and control programs or they may be told that all available persons must receive the experimental program.

If graduate students find themselves in a similar situation, there are several designs to consider, although they may be questionable because they do not offer as much control as the two experimental designs. However, they are considerably better than the preexperimental designs.

Split group pretest-posttest design. The split group pretest-posttest design may be used when there is no option of dividing the sample into treatment and control groups. Demands such as "everyone must be exposed to the program" or "the programs can be conducted only once" may require modification using this design.

Table 2. Considerations in choosing between two recommended experimental designs

Questions	Preferred design to use	
	Pretest-posttest control group design	Posttest control group design
Is there some question about the random assignment requirement? If so, use . . .	X	
Is the measuring device conspicuous or reactive? If so, use . . .		X
Are people being programmed individually rather than in groups (e.g., individual counseling vs. group)? If so, use . . .		X
Are less than 60 people involved? If so, use . . .	X	
Is the primary interest whether the program works, rather than generalizing the results to other settings? If so, use . . .	X	

$$R \begin{cases} M_1 \rightarrow (T) \\ \qquad T \rightarrow M_2 \end{cases}$$

In this design the sample is divided into two groups. One group is pretested and then the entire sample receives the program or treatment. Following the treatment the group that did not receive the pretest is posttested. Differences are then determined between the pretest and posttest scores to evaluate the result of the treatment.

Weaknesses of this design include the fact that extraneous events occurring while the program is being conducted (eg, remarks made by a member of the audience) might contribute to the changed group attitudes. Moreover, in nursing research dealing with changes in patients' physical conditions, this design may not be workable. Although the split group pretest-posttest design is not as strong as those recommended earlier, it is much more adequate than the preexperimental designs and highly recommended for exploratory or pilot research.

HOW CAN NURSING RESEARCH DATA BE ANALYZED TO ANSWER RESEARCH QUESTIONS?

Data analysis, or statistics, is only part of the research process. The type of statistics used depends on the research questions or hypotheses, the research design and sampling procedure, and the type of measures used. Thus data analysis, like the other parts of the research process, is planned before the study begins.

Statistics serve two functions. First, statistics allow the researcher to organize, describe, and summarize data. Measures of central tendency (mean, median, mode) and dispersion (variance, standard deviation, range) are used, along with frequency distributions, scatter diagrams, and percentages.

Second, statistics allow inferences to be made. Sometimes inferences may be made about the population of subjects from which the sample is drawn (ie, patients who suffer an acute myocardial infarction rate tension in their lives). Other times, inferences may be made only about the sample (ie, group A is significantly different from group B). This second function of statistics is often called statistical testing because it involves testing to see if the data are "statistically significant." The specific statistical test used is largely determined by the nature of the data, with special procedures used with nominal, ordinal, and interval data and the research design.

Kinds of data

The data gathered to describe a variable will fall into one of three possible levels or classifications:

1. **Nominal Data** (or Categorical). Nominal data consist of different categories for a variable. Each subject's response is placed into one of the categories. The number of responses are then added and reported as frequency counts for each category of the variable. For example, sex is a nominal variable with male and female as its two categories. (Nonparametric statistics used.)

2. **Ordinal Data.** Ordinal data consist of categories of a variable which are ranked according to a predetermined standard by each subject. For example, five goals in recovery process might be ranked according to importance by postsurgical patients. (Nonparametric or parametric statistics used.)
3. **Interval Data.** Interval data consist of a measure of how much of a variable the subject has. It is usually a score. Scores on an anxiety test completed by preoperative patients would be interval data. Interval data and ratio data, which are considered together as one, are the highest level of measurement. They allow more sophisticated statistical analysis procedures. Whenever possible, graduate students should try to gather interval level data. (Nonparametric or parametric statistics used.)

The exact type of statistical test to use to analyze data is determined by the level of measurement of the data, sample size, and the research design. The research design depends on the research question and hypothesis.

Test statistics

Table 3 is divided into two major categories of statistical tests: those statistics that are commonly used to compare independent groups and those that are used with paired groups. Pairing includes:

1. *Self-pairing.* This is when an individual is compared with himself or herself, such as with a pretest and a posttest.
2. *Natural-pairing.* This is when two individuals are identical, such as identical twins, and can be compared on some trait behavior.
3. *Artificial-pairing.* This is when individuals in one group are carefully matched on specific characteristics (eg, age, sex, disease condition) with an individual in a second group. In this way the two groups are considered identical and can be compared.

The following table is developed from the information presented earlier. Table 4 can serve as a quick reference of research designs and analysis procedures.

SUMMARY

There are limitations in the extent and type of research conducted by graduate students; however, there is a need for greater development and expansion of experimental research. Ongoing survey and correlational research is needed that will employ accurate design and use appropriate methodology to render results in nursing practice as accurate as possible. There is also a need for replication of studies as well as extension of research which builds on past findings, and graduate students should be aware of these facts.

Finally, graduate students and other nurses engaging in research should be committed to improving patient care through research. Nurses must learn to seek knowledgeable researchers who offer consultation and be open to peer review early in the proposal stages. If this is done and emphasis is placed on the development of researchable problems important to nursing, then research can promote nursing theory and improve nursing practice.

Table 3. Test statistics and assumptions

Test statistics for two independent groups	Assumptions*
t-test for independent samples (parametric)	Two independent groups with subjects assigned at random (if possible); scale of measurement is interval level; assumption of normality and homogeneity of variance is valid.
Mann-Whitney U test (nonparametric)	Two independent groups with subjects assigned at random (if possible); scale of measurement is ordinal; assumption of normality cannot be maintained.
ANOVA (parametric)	Two or more independent groups; scale of measurement interval level; assumptions of normality are valid. Tests relationship between a dependent variable and two or more independent variables.
ANCOVA (parametric)	Two or more independent groups; scale of measurement interval level; assumptions of normality valid. Tests existence of an interaction between one or more treatment factors with statistical control of another variable.
χ^2 (nonparametric)	Two independent groups; scale of measurement nominal level; assumptions of normality cannot be met. Tests association or "goodness of fit" between two types of classifications or two methods of classification.
Test statistics for pairing	**Assumptions**
Paired *t*-test (parametric)	Paired sample; scale of measurement interval level; assumptions of normality are valid.
Wilcoxon's matched-pairs signed-rank test (nonparametric)	Paired sample; scale of measurement is ordinal level in which differences in scores are also ordinal; assumption of normality cannot be maintained.
Sign test (nonparametric)	Paired sample; scale of measurement is ordinal, in which paired scores indicate only the direction of a difference; assumption of normality cannot be maintained.
Test statistics for comparing ranking	**Assumptions**
Pearson product moment correlation coefficient (r) (parametric)	Paired sample; scale of measurement interval level; assumption of normality and homogeneity of variance is valid.
Spearman Rho (nonparametric)	Paired sample; scale of measurement ordinal level; assumption of normality cannot be maintained.

*Some researchers do not require interval level data for the use of parametric statistics and use these statistical tests with ordinal level data.

Table 4. Research designs and suggested analysis procedures

Design	Interval data	Ordinal data	Nominal data
Unassessed treatment	No analysis possible.	No analysis possible.	No analysis possible.
Single group posttest	Generally, no analysis is possible (except for "eyeballing" sample in comparison to larger group norms). Rarely, if comparison to the population is valid, a z test is used.	Generally, no analysis is possible; rarely, if comparison to the population is valid, one-sample runs test is used.	Generally, no analysis is possible.
Single group pretest-posttest	*t*-test for correlated measures.	Wilcoxon matched-pairs signed-ranks test or the sign test.	None used in nursing.
Pretest-posttest control group	1. Repeat measures analysis of variable (most proper). 2. Analysis of covariance using the pretest as a covariate (proper). 3. Gain score analysis of variance (least proper).	Analysis is unclear because there is no procedure which will make use of all measures. Analysis could use M_1 scores to assure sameness and base results on M_2 scores using procedures for the posttest control group design.	Analysis is unclear because there is no procedure which will make use of all measures. Analysis could use M_1 scores to assure sameness and base results on M_2 scores using procedures for the posttest control group design.
Posttest control group	Analysis of variance or *t*-test for independent measures (if sample is small).	Mann-Whitney U test; median test.	χ^2 for 2 independent samples.
Split group pretest-posttest	Same as posttest control group design.	Same as posttest control group design.	Same as posttest control group design.
Nonequivalent control group	Same as pretest-posttest control group design.	Same as pretest-posttest control group design.	Same as pretest-posttest control group design.

Adapted from Blalock HM: *Social Statistics.* New York, McGraw-Hill, 1972; Campbell DT, Stanley JC: *Experimental and Quasi-Experimental Designs for Research.* Chicago, Rand McNally College Publishing Co, 1963; Popham, WJ, Sirotnik KA: *Educational Statistics: Use and Interpretation.* New York, Harper & Row, 1967.

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