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Teaching Decision Making Skills to Student Nurses

James Shanteau
National Science Foundation

and

Margaret Grier, Joyce Johnson, and Eta Berner
University of Illinois Medical Center

Abstract

This chapter describes the results of a project to teach decision making skills to student nurses. A special course was designed around three deficiencies observed in nurses' decision making: inappropriate information utilization, biased risk assessment, and suboptimal alternative evaluation. Student nurses skills in each of these areas were assessed before and after taking the course. Substantial improvement was observed in nurses' use and acquisition of information; after taking the course, the students' behavior approached that of expert nurses. In contrast, here was little improvement in assessment of probabilities; before and after the course, nurses showed conservatism by underestimating high probabilities and overestimating low probabilities. An improvement was observed in the ability to choose appropriate nursing actions; most of the improvement apparently was due to learning about the concept of utility maximization. These findings demonstrate, first, that there is a demonstrable need for a course to develop decision making skills and, second, that such a course can be effective in improving some decision skills of student nurses. Additional efforts are needed, however, on ways to teach probability and risk concepts more effectively.

Introduction

Today's graduates lack problem-solving and decision-making skills (Ruggiero, 1988).

There are file cabinets full of failed efforts to train decision making (quote from a professional colleague).

The purpose of this chapter is to present research that addresses the questions raised in these two quotes. First, is there a need for specific courses to teach decision making? Second, can the decision making abilities of students be increased through such a course?

There have been numerous efforts to teach decision making skills through training. Unfortunately, most of these efforts have had little measurable impact (e.g., Lichtenstein & Fischhoff, 1980). There are several possible reasons for this, including (1) use of unskilled subjects, (2) lack of motivation to learn, (3) absence of relevant training materials, and (4) inadequate evaluation instruments.

The research described in this chapter is designed to investigate alternatives to traditional training approaches. In particular, the results of a course are described which involved (1) pre-professional students, (2) strong motivation to learn, (3) content-relevant training materials, and (4) specially designed evaluation measures.

Although the students in this study were college undergraduates, the present findings have considerable relevance for teaching adolescents. Not only were the students generally in their teens, the material in the course was quite basic. Thus, the approach used here could be directly applied to younger students.

Nurses' Decision Making

The purpose of this project was to investigate the effectiveness of teaching decision making skills to student nurses. A special course was designed for nursing faculty to teach students how to make better decisions and to solve problems more effectively.

Previous research shows nurses' decision skills leave something to be desired. Three specific deficiencies have been identified.

First, nurses do not making effective or efficient use of available information. Nurses have been found, for instance, to extract exceedingly large amounts of information when making judgments. Consider the following numbers reported by Hammond, Kelly, Schneider, and Vancini (1966) in nurses' esponse to pain for a specific case:

- 165 cues used in making a decision,
- 58 doctors' orders concerning pain, and
- 17 nursing actions that could be implemented.

Not only are such numbers well beyond the capabilities of the human information processing system (Simon, 1957), but this situation may interfere with patient care (Sisson, Schoomaker, & Ross, 1976).

Second, deficiencies in nursing decisions have been reported in analyses of risk and uncertainty. Grier and Grier (1978) found that nurses were under-medicating patients in pain, in part, because they overestimated the chances of drug addiction. Similarly, Bailey, McDonald, and Claus (1973) observed that despite the accepted goals of nurses to maximize patient care, they were more concerned about minimizing perceived risks. Such tendencies to overestimate risks may be coming more exaggerated as the em-

phasis on malpractice and medical liability increases.

Third, shortcomings have been reported for nurses' abilities to evaluate alternatives and to choose appropriate actions. Gordon (1973) reported that nurses use habitual strategies regardless of the situational demands (also see Grier, 1976). The inflexible application of heuristic judgment strategies has been found to lead to suboptimal decisions in a variety of non-nursing studies (Kahneman, Slovic, & Tversky, 1982).

Relevant Decision Research

Based on the preceding analysis, three deficiencies in nursing decision making were identified: use of excessive amounts of medical information, misestimation of risks in making nursing diagnoses, and selection of suboptimal alternative courses of action. In this section, relevant literature from judgment and decision making will be reviewed.

Information utilization. A critical component of expert judgment is the ability to appropriately define and use information that varies in relevance. Ideally, decision makers should select and use only that information which is most relevant. There is considerable evidence, however, that irrelevant or partly relevant information can adversely influence many types of judgments.

Shanteau and Gaeth (1983; also see Gaeth & Shanteau, 1984) found over 250 published papers that investigated the effects of irrelevant factors on behavior. The fields of study range from problem solving and perception to social psychology and learning. Effects of irrelevance have been observed for children, adults, and the elderly. Moreover, evidence has been obtained from both laboratory and applied settings.

To find out if these effects could be reduced by training, Gaeth and Shanteau (1984) compared two procedures for helping experienced soil judges. The training was designed to help judges ignore specific factors known to be irrelevant, but that nonetheless influence soil classifications, e.g., excessive moisture. One training procedure involved a lecture format (similar to typical classroom approaches). The other involved interactive experience with hands-on practice (similar to a laboratory experience). The lecture approach was found to produce some reduction in the influence of irrelevant information. However, a greater impact came from interactive training, with measurable improvement one year later. Moreover, training to ignore one specific factor generalized to other irrelevant factors (e.g., small pebbles and rocks). In addition, the training also improved the accuracy of the judgments.

Risk assessment. The difficulties that people have in dealing with probabilities and uncertainty have been documented for over 30 years. In the 1960' s, there were numerous studies by Edwards and his colleagues on Bayesian probability-revision tasks. This research (summarized in Edwards, 1968) revealed that people generally gave estimates that were conservative or less extreme than predicted by Bayes theorem.

In the 1970' s, Kahneman and Tversky (1972; 1973; Tversky & Kahneman, 1973; 1974) initiated a series of studies on heuristics (mental rules of thumb) and biases in probability judgment. Heuristics such as availability and representativeness led to biases or errors of judgment in naive subjects. Although these authors argue that heuristics also apply to experienced decision makers (e.g., Tversky & Kahneman, 1971), there is evidence that experts do better than nonexperts in some settings (Ashton, 1983; Schwartz & Griffin, 1986; Shanteau, 1989).

Recent research has focused on the assessments of risk and uncertainty. One common finding is that people' s probability judgments are poorly calibrated – the responses are not consistent with outcome frequencies (Lichtenstein, Fischhoff, & Phillips, 1982). Other studies have shown that basic probability concepts, such as conjunction, are judged inappropriately (Tversky & Kahneman, 1983).

Such fundamental misunderstandings of probability have led to the development of college courses on risk and uncertainty. Some of the texts available for such courses include Baron (1988), Dawes (1988), Halpern (1989), and Huber (1980). There are also high school books on thinking under uncertainty (Beyth-Marom, Dekel, Gombo, & Shaked, 1985).

Alternative evaluation. Many of the earliest studies of decision making concerned choices between risky options. In his pioneering research, Edwards (1954) looked at with the effects of subjective probability on gambling preferences. Similarly, early research by Coombs (e.g., Coombs & Pruitt, 1960) examined the influence of outcome distributions on choices between bets. The results of these studies consistently revealed that subjects did not maximize expected utility in making their decisions.

Other deviations from rational choice theory have been observed. Probably the most widely studied has been the preference reversal phenomenon where subjects' choices are inconsistent with their ratings. First described by Lindman (1971) and Slovic and Lichtenstein (1971), preference reversals have been of considerable interest to economists. Despite numerous efforts to eliminate the effect by training or financial inducements, the phenomenon has proven to quite persistent (e.g., Grether & Plott, 1979).

Although utility maximization would appear to be a fundamental and easily understood concept, there is little literature on how to convey this concept to subjects. One approach has been to point out the consequences of making intransitive or inconsistent choices. Adherence to preference reversals, for instance, can lead subjects to be a "money pump" – by choosing illogically, they would lose money on every transaction. Such training, however, produces marginal improvements that generally fail to generalize (Einhorn, 1980). It is an open question, therefore, whether efforts to improve alternative selection can be successfully taught.

Teaching Program

In the present course on nursing problem solving, emphasis was placed on the three decision making deficiencies described above: inappropriate information utilization, biased risk assessment, and suboptimal alternative evaluation.[1] In this section, the strategies used to teach each of these is outlined. It is worth noting that many of the techniques in the course were adapted from procedures observed in the training of expert agricultural judges (Shanteau & Phelps, 1977).

The course began with background information about judgment and decision making, e.g., problem definition and alternative selection. General concepts were explained, such as "do not select dominated (inferior) alternatives" and "determine what information is relevant for making choices." Then, specific decision strategies were provided. In evaluating available information, for instance, students were told to determine the relevance of each piece of information for the decision problem and to use only the most diagnostic. In addition, the dangers of seeking too much information were explained by showing that information over-

load can result from exceeding cognitive capabilities.

The course shifted to more specific topics such as how to make decisions under uncertainty. Initially, general concepts and definitions from probability and statistics were taught. Then, various techniques for using probabilistic information were described. Specific rules such as Bayes theorem were explained as well as other concepts from formal decision analysis, e.g., how to interpret and use conditional probabilities. These rules were taught both at the formal mathematical level and at a conceptual/intuitive level using relevant nursing examples.

Both general principles and specific rules-of-thumb were provided to make choices. In learning how to choose between alternative courses of action, for example, the concept of utility maximization was explained in depth. Then, several specific strategies for making choices were offered, e.g., the students learned about the basic principles of multiattribute utility analysis. In addition, the nurses were told how to work through an alternative by outcome table (see the example in Table 4).

Three other general aspects of the course are worth emphasizing. First, the basic concepts were offered initially in standard classroom lectures by regular nursing faculty. This was supplemented by hands-on explanations by practicum instructors in a hospital setting. These two-sided approach parallels the lecture/laboratory technique for teaching science and language courses.

Second, the concepts were described using specific nursing illustrations whenever possible. Also, the students were encouraged to contribute examples from their own nursing experiences. By using familiar contexts, it was hoped that problems in understanding and generalizing decision making concepts to new situations could be avoided.

Finally, having a positive attitude toward decision making and problem solving was emphasized. An effort was made to give students positive experiences and to increase their self-confidence in decision making and problem solving. Analyses have revealed that confidence plays an important role in expert decision making (Shanteau, 1987).

Method

Subjects. One hundred and fifteen third-year nursing students and seven nursing faculty participated in a year-long research project in the College of Nursing at the University of Illinois Medical Center. The instruments developed (see below) were administered to both students and faculty.

The second and third authors were responsible for developing evaluation materials and teaching the course to nursing students. Other nursing faculty, who supervise the practicum experience for third-year students, reinforced the course concepts in actual nursing situations. These nurses served as the "expert" group.

Design. As shown in Table 1, there were three phases in the project; the sample sizes for each condition also appear in the table. The first phase was a pre-training assessment of nursing decision making skills before the course. The second phase involved taking the newly developed class on decision making and problem solving. The final phase was administration of a post-training assessment after the course.

The course was taught to two groups of students: Group One completed just the post-training assessment, while Group Two completed both the pre-training and the post-training assessments. Comparison of these

groups allows examination of effects from prior instrument administration. In addition, there were two groups of control subjects who did not take the course: Control One subjects completed just the pre-training assessment.[2] Control Two subjects completed both the pre-training and the post-training assessments. No substantial differences emerged between the two control groups.

For the nursing faculty, several workshops on decision making were offered. These workshops preceded the teaching of decision making skills to the students. The material presented in the workshops was based on the first author' s experience in teaching a course on Problem Solving and Decision Making to undergraduate students. This material was supplemented with nursing examples provided by the second and third authors. It should be noted that several of the nursing faculty had been involved in preparing the initial course proposal. Consequently, they were already familiar with many of the decision making and problem solving concepts taught in the course.

Assessment Materials. A special instrument was constructed to assess the decision making and problem solving abilities of nursing students. Parallel versions of the instrument were developed for the pre-training and post-training conditions; there were no apparent differences in the difficulty of the two versions. Only the three sections of the instrument relevant for the present paper will be described here.

To evaluate the amount of information used by nurses when making a decision, several medical scenarios were constructed. One of the scenarios appears in Table 2. Each piece of information is followed by a number. After reading the scenario, nurses were asked to determine whether the content for each numbered item was "essential," "contributory," or "noncontributory" for making a decision. The answers for student nursing were compared to those of nursing faculty.

To determine the nurses' ability to evaluate probabilities, a hypothetical diagnostic problem, along with the associated conditional probabilities, was presented. One of the question sets appears in Table 3. After examining the probability values, nurses were asked to give a probability distribution for various medical conditions. The answers were compared to values computed from Bayes theorem and probability theory.

To evaluate the ability of nurses to select between alternative courses of action, a two-part procedure was developed; one of the forms is shown in Table 4. In the first part, students read a description of a nursing problem and made an initial (pre-assessment) choice of action. The nurses then completed an alternative-by-outcome tradeoff table and made a final (post-assessment) choice of action.[3]

For each problem, the correct answer was determined by an independent group of senior nursing faculty. Students' answers were coded as correct or incorrect based on the outcome. The process by which the answers were given was not considered, so that it is possible that some students may have simply guessed correctly. However, there is no reason to expect that guessing rates would vary before and after training.

The expert group of nurses completed the same instrument as the student nurses. These nursing faculty were not involved in either the development or the validation of the assessment materials. Thus, they were unaware of the content of the test instrument until the time of its administration.[4]

Results

The results are separated into three sections: information utilization, risk assessment, and

alternative evaluation. In each section, the pre-training and the post-training results are described and compared. The results are averaged over parallel assessment forms.

Information Utilization. The nurses were asked to look at two cases (similar to Table 2) and evaluate the relevance of each piece of information. The results appear in Figure 1. Without the course, the Control One students nurses rated 60% of the items as "essential" and less than 10% of items as "noncontributory." In contrast, the faculty nurses (the "experts") rated 44% of the items as "essential" and 56% of items as either "contributory" and "noncontributory." Using 95% confidence intervals, the patterns for students and faculty are significantly different.[5] Thus, naive nurses rated more information as essential than expert nurses and less as non-essential.

The effect of the course can be seen in Figure 2. Before training, the results for Group Two revealed that student nurses view a majority of information (67%) as "essential;" the pattern of results is similar to the Control One results in Figure 1. Following training, the results for Group Two show a reduction in the "essential" items to 50%; this reduction approached, but did not reach significance. However, the similarity of the post-training results to the experts in Figure 1 is noteworthy. Therefore, the students following training appear to have become more discriminating in evaluating information and thus behaved more like the expert nurses.[6]

Risk Assessment. After examining a conditional probability table (see Table 3), nurses were asked to give a probability distribution for various medical conditions. Relative to Bayes theorem, the student pre-training results (for Group Two) revealed a tendency to underestimate the most likely condition (number 1 in Figure 3) and to overestimate the two less likely conditions (numbers 2 and 3). The results for the expert nurses are similar, with the same tendency to underestimate the more likely condition and to overestimate the less likely conditions.

Following the course, the probability distribution estimates were unchanged, with no significant differences. The post-training data values in Figure 3 show a pattern similar to both the pre-training results and to the expert results. It would appear, therefore, that teaching the nurses about risk and probability combination rules had no impact on the nurses' ability to estimate probabilities.

As a follow-up to these analyses, the probability values given to complementary cases were examined, i.e., the chance of an event occurring plus the chance that it won' t occur. It was found that the response values violated the basic definition of probability. Instead of summing to 1.0, the estimates for complementary cases summed to as much as 1.4. Comparable results were found for the experts. Thus, there appear to be fundamental difficulties in understanding probabilities that were not influenced by the course.

Alternative Evaluation. Nurses examined a "Choice of Action" scenario (similar to Table 4) and made two sets of responses, before and after filling out an alternative-by-out-come tradeoff table. The pre-training results in Figure 4 show that the student nurses chose the correct alternative less than half the time (48%). The results were unchanged after filling out the tradeoff table (48%).

The results after training reveal a significant improvement in the students' performance compared to pre-training. Specifically, the pre-table assessment results are 20% higher than before training (68%), and the post-table assessment results are over 30% higher (79%); both are significant greater as revealed by 95% confidence intervals. The

difference (11%) before and after filling out the tradeoff table was not significant. The course, therefore, was effective in helping nurses select better courses of actions, with most of the improvement coming prior to completing a tradeoff table.

Discussion

There are four major observations about this research. The first reflects the pre-training results and the need for improvement in decision making skills. The second concerns the effectiveness of the course in improving the nurses' judgments. The third involves the decision skills that can and cannot be taught effectively. Finally, the initial questions about the need for and the effectiveness of courses in decision making are addressed.

Decision Making Deficiencies. The need to improve the decision making skills of student nurses is clear. The present pre-training results show that nurses identified too much information as essential, did not use probabilities appropriately, and selected the best course of action less than half the time.

Although such deficiencies have been noted in previous studies, it is notable that there were observed here in a nursing context. Prior research on decision biases has been criticized for using general knowledge questions instead of items familiar to subjects (Shanteau, 1978; Wallsten, 1983). In the present analyses, all materials pertained to nursing problems relevant to the students.

Similar evidence of biased decision making has been reported in other areas of medicine. In a series of studies of physicians, Elstein, Shulman, and Sprafka (1978) found that doctors interpret incoming information as supporting present hypotheses, even though the information is in fact noncontributory. In a summary of the medical decision making literature, Schwartz and Griffin (1986) reported that the same sorts of common biases observed in naive subjects can often be observed for physicians.

Not all studies of medical decision making, however, have obtained evidence of inappropriate decision making (e.g., see Christensen-Szalanski, Beck, Christensen-Szalanski, & Koepsell, 1983). It appears that there may be some medical settings in which more accurate decisions are made and other settings which lead to less accurate outcomes. Identifying the characteristics of each type of situation is an issue that deserves greater research (Shanteau, 1987).

Teaching Effectiveness. A comparison of the pre- and post-training results reveals that at least some types of nursing decisions can be improved by the course on decision making. Although the improvement was not equal across the three topic areas, the overall trend was for nurses to make better decisions after the class than before. This improvement is quite encouraging.

It should be pointed out that the course did not teach nursing topics, per se. Instead, the course focused on how to apply already existing nursing knowledge more effectively. Thus, the course dealt with the process of nursing decisions as opposed to the content. This is an important distinction because it suggests that efforts to teach decision process can succeed – once there is a knowledge base in place.

Another aspect of the present course deserves comment. The teaching did not stop in the class. The concepts were reinforced by practicum experience that the nursing students had in hospital settings. It is not possible to say which aspect of teaching – classroom or practicum – had the greater impact. However, research by Gaeth (1984; also, see Shanteau & Gaeth, 1983) comparing the two

methods suggests that lecture-based training is necessary, but not sufficient to alter decision behavior. Apparently, it takes the hands-on experience of a practicum to cement the learning process. If so, that may explain why the lecture format used in most training studies has failed.

Skill Specificity. The improvements in nurses' decision skills after taking the course was not consistent across the three areas examined. Although the acquisition of information and choice of actions improved following training, use of probabilistic information did not. This suggests nursing students have difficulty understanding and applying formal concepts from decision theory (e.g., Bayes theorem). In contrast, less formal concepts (i.e., "use only relevant information" and "maximize utility") may be more easily grasped. The implications of this observation will be considered for each training area.

Information utilization. Following the principle of "GI-GO" (garbage in-garbage out), a decision cannot be any better than the information on which it is based. Although there may be situations in which medical professionals gather too little or the wrong types of information (Elstein, Shulman, & Sprafka, 1978), the primary concern here is with gathering too much information. The presence of excessive information, if it is nondiagnostic, can only diminish decision quality (Shanteau, 1975; Troutman & Shanteau, 1977).

The evidence from a variety of sources is clear – medical students generally attempt to use excessive amounts of information (Hammond, et al, 1966). So much is viewed as essential that information overload is an inevitable consequence. In contrast to students, medical professionals appear to be more discriminating in their use of information. Both here and in Hammond, Frederick, Robillard, and Victor (1989), medical experts saw less information as essential.

Of course, training students to use less information won't necessarily improve decision making. The key is to differentiate between the essential and the nonessential. That requires medical knowledge and experience. Nonetheless, teaching about the importance of ignoring irrelevant information can improve the quality of even experienced decision makers (Gaeth & Shanteau, 1984).

Probability assessment. There is an extensive literature on the inaccuracies of probability judgment. In over 25 years of research on probability assessment, the results have consistently pointed to suboptimal behavior. The present findings, for instance, mirror the reports of conservatism in probability revision tasks (Edwards, 1968); the likelihood estimates are less extreme than that predicted from Bayes theorem.

Beyond conservatism, the present results show that there are more fundamental problems in nurses' use of probabilities. Finding that complementary probabilities sum to more than 1.0 suggests a deep-seated misunderstanding of basic probability concepts. It is notable that these misunderstandings were shared by faculty nurses. Given that the students' teachers did not understand probabilities, it should not be surprising that the students failed to improve after the course (also, see Fischhoff, 1982).

However, the failure of students to learn should not be blamed entirely on the nursing faculty. The first author has had over 10 years of experience in teaching decision making courses to undergraduates. Consistently, the most difficult area for students to grasp has been probability (Shanteau, 1984). Indeed, his course is now structured so that probability concepts are delayed as long as

possible. Only after teaching other more easily grasped concepts, such as utility maximization, are principles of risky decision making introduced. This contrasts with the approach taken by writers of most undergraduate texts (e.g., Dawes, 1988; Yates, 1990). The relative success of these two approaches has yet to be evaluated.

Despite the present difficulties, there are domains in which probabilities are estimated accurately. Not only do weather forecasters make well-calibrated probability estimates (Murphy & Winkler, 1977), their accuracy appears to have been improving over time (Lichtenstein, Fischhoff, & Phillips, 1982). Although this suggests that probability concepts can be learned, it is not clear how to translate from the specifics of weather forecasting to the general teaching situation.

Alternative evaluation. The selection of the best option is fundamental to decision analysis. Before the course, students selected the best alternative less than half the time. In contrast, there was a substantial improvement following the course. However, most of the improvement came before filling out an alternative-by-outcome tradeoff table. This suggests that the concept of utility maximization, as opposed to a formal tradeoff assessment, is central to teaching students how to make better choices.

A variety of decision aids and decision support systems have been developed to help decision makers. Many of these incorporate some variation of a multi-attribute utility analysis (e.g., Gardiner & Edwards, 1975). Although there has been some debate about which system is superior, the present results imply that much of the improvement comes before the use of any particular aid. It is apparently the overall approach that is important, not the specific technique. Determining whether this result generalizes beyond nursing will require additional research.

It is clear that nursing students can learn to make better choices. At best, the student nurses were choosing correctly about 80% of the time. As good as that is, there is still room for improvement. It is not possible to say, however, whether that improvement will come from increased decision making skill or from greater nursing knowledge.

Concluding Comments

To sum up, we return to the two initial questions: Is there a need for teaching of decision making skills? And, can decision making be taught effectively? From the present research, the answer to both questions is definitely "yes."

The need for courses on decision making has been demonstrated both by scientific studies and by concerns raised by business leaders and politicians. Although education can be effective in teaching technical knowledge, the ability of students to apply that knowledge is frequently questioned (e.g., Swoboda, 1989). It is noteworthy that the President' s 1989 Education Summit concluded with calls for an increased emphasis on thinking ability (Hoffman & Broder, 1989).

The present research shows that a course on decision making and problem solving can be effective. The decision making skills of nursing students were significantly better following the course. The improvements in information utilization and alternative evaluation are notable. At the same time, the failure to improve risk assessments is troubling. This failure presents an important challenge for future research.

For teaching adolescents, the fact the course was designed for nursing students is significant in three ways. First, the students were motivated to learn. Second, course concepts

were taught using nursing examples. Third, evaluation materials reflected actual nursing problems. These are all components that can be incorporated in courses at any level.

Although some have suggested that teaching thinking skills may be "the fad of the 80' s" (Ewen, 1988), the present success argues for an opposing view. As shown here, such courses can improve at least some decision making skills (also, see Nisbett, Krantz, Jepson, & Fong, 1982. There is still much work to be done, however, before we know how to teach all the skills necessary for better decision making.

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James Shanteau is Director of the Decision, Risk, and Management Science Program at the Nation Science Foundation; he is on leave from Kansas State University. Margaret Grier is now Associate Dean, College of Nursing at the University of Kentucky. Joyce Johnson is an Associate Professor of Nursing at the University of Illinois College of Nursing. Eta Berner is now a statistical consultant at the University of Connecticut.

Footnotes

[1] The special course included various topics on thinking, problem solving, and decision making. However, only the three decision making issues of information utilization, risk assessment, and alternative evaluation are discussed here.

[2] The pre-training assessment for the Control One group was conducted at the beginning of the school year. According, that group provides an uncontaminated measure of the initial performance level. In contrast, the other groups were evaluated at later times in the year when there could have been spin-off effects (on pre-training assessment) from other students taking the course.

[3] It has been suggested by a reviewer that the pre-training groups may have been hindered in their decision making ability by having to work through an unfamiliar table. It was for that reason that subjects were ask to choose nursing actions before and after working through the alternative-by-outcome tradeoff table.

[4] Keeping the "expert" nursing group uninformed about the instruments avoids the possibility that their performance was influenced by prior knowledge. Moreover, this reduces the possibility that they may have "taught the test" to students.

[5] Statistical tests were performed by comparing confidence intervals around means. Differences in 95% confidence intervals are equivalent to significant t-tests at the .05 level.

[6] Interestingly, the post-training only Group One results showed an even greater reduction in "essential" items (50%) following the course. Their results became even closer to the experts than Group Two. It is not clear why the course had more of an impact for this group.

Table 1

Research Design

Group	N =	Pre-Training	Training	Post-Training
Control One	11	Yes	No	No
Control Two	37, 25	Yes	No	Yes
Group One	41	No	Yes	Yes
Group Two	24, 26	Yes	Yes	Yes

Figure Captions

Figure 1. Classification of items in scenarios by Control One student nurses (pre-training) and faculty nurses.

Figure 2. Classification of items in scenarios by Group One and Group Two student nurses (pre-training and post-training).

Figure 3. Deviations of probability estimates from Bayesian values for Group Two student nurses and faculty nurses.

Figure 4. Percent correct choices before and after training for Group Two student nurses, before and after making tradeoff assessments.