Designer's Corner

The Use of Metaphor Graphics to Depict Sleep Research Results

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The major barriers to research utilization in nursing are well documented (Polit & Hungler, 1998). One of these barriers is the complex nature of research. Many nurses are not familiar with the highly technical language of research and the types of graphics that researchers use to communicate research findings to one another. To facilitate the increased use of research, it is critical that mechanisms be developed to improve dissemination of research results to nurses in clinical practice.

Background

In an effort to find alternative approaches to displaying research results, "metaphor graphics" (Cole, 1988) was explored. Cole introduced metaphor graphics a decade ago as a novel way of graphically representing knowledge. He proposed that, as an alternative to traditional line graphs and pie-charts, data be summarized using visual metaphors — i.e., abstract signs and symbols — to show patterns and convey meaning. Viewing human beings as imperfect processors of information who tend to reason using pattern recognition and mental models, Cole hypothesized that visual metaphors would improve the uptake of scientific information.

Cole (1988) recommended that metaphor be used as an adjunct to commonly employed methods for communicating results of primary studies. Because the information to be conveyed is complex, he envisioned that its users would require instruction in interpreting metaphorical displays. His research suggested that clinicians could learn to "read" metaphorical displays of data more quickly than traditional graphics and would retain the information longer (Cole, 1990,

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1994; Cole & Stewart, 1993). Cole concluded that representing data metaphorically helps the data user to create mental models by facilitating pattern recognition and attachment of meaning. Overall, his research indicates that metaphor graphics are effective with complex as well as simple data sets, are useful for pattern detection as well as single-element reporting tasks, and can be used with novice as well as expert clinicians (Cole & Stewart, 1994).

The Current Challenge

Systematic reviews are emerging as important aids in the research utilization process. They aggregate, compare, and help integrate research results. However, the presentation of information from systematic reviews has its own challenges: How can clinically and administratively active nurses be helped to more readily grasp and retain scientific knowledge generated from systematic research reviews? Would the use of metaphor graphics increase dissemination, comprehension, and retention of research review results among clinicians?

Example

A recent review of research on sleep promotion in adults identified published studies of interventions to help adults initiate and maintain sleep (Sigma Theta Tau International, 1997). Information on the number of times each intervention had been studied, the effectiveness of the interventions, and the quality of the studies has been presented in both text form (Floyd, in press) and tabular form (Floyd, Falahee, & Fhobir, in press). It is expected that other researchers and advanced-practice nurses specializing in evidence-based practice will find these publications useful; however, presentation of the results of the review to students and nurses in our region of the United States suggested the need for alternative ways of reporting findings of systematic reviews to students and nurses focused on clinical practice.

The principles provided by Cole's work on metaphor graphics were used to display results from the systematic review of sleep-promotion research. These principles were used to create "meta-graphs" — graphical displays of systematic review results — for the sleep-promotion knowledge base. The patterns to be recognized by the viewer were the quantity and quality of research that underpins interventions. The meanings to be conveyed were the relative differences in research support among the interventions and the degree of improvement expected from each intervention. For example, viewers of the Sleep

Figure 1 *Meta-Graph Depicting Interventions for Facilitating Sleep Initiation*

Interventions	Design and Findings
Teach somatic relaxation	"▲" "▲" "□" "□" ◇ "◇" "O" "O"
Teach cognitive relaxation	"O" "O"
Teach sleep hygiene	"O"
Teach personal control of noise	◇
Use white noise	"◇" (n.s.)
Provide quiet environment	◇ "◇"
Recommend hot baths	◇ (n.s.) ◇ "◇" (n.s.)
Recommend lukewarm baths	"◇" (n.s.)
Encourage bedtime routine	"▲" "▲" "▲"
Limit frequency of naps	"▲" (n.s.) "▲" (n.s.)
Limit duration of naps	"▲"
Eliminate naps	"▲" □ (n.s.)

Initiation Meta-Graph (Figure 1) should be able to see the amount of research conducted on the effectiveness of each of 11 interventions, the strength of each study, and the effect of an intervention — when it has been found to be effective.

Explanation of Figure 1

The following abstract symbols were used to depict sleep research results: A row of boxes was used to represent the research domain for each intervention. Because of the number and nature of studies examining sleep-initiation interventions, 10 boxes were required. The first three boxes were used for correlational studies, the next two for one-group pretest-posttest (i.e., pre-experimental) designs, the next three for true experiments, and the last two for meta-analytic studies. Triangles represent correlational studies; squares, pre-experimental designs; pentagons, quasi-experimental designs (of which there were none for the sleep-initiation studies); hexagons, true experiments. The more sides the figure has, the more confident the clinician can be that the intervention, rather than some other factor, accounted for the effect on sleep initiation. Circles represent meta-analytic studies and suggest maximum confidence in causal inference, with their inferred number of sides as infinite.

Occasionally a study's design is such that the causal link is questionable. Such studies are shaded. All triangles are shaded because they represent correlational studies and the shading is meant to remind meta-graph users that correlation is not causation. Other geometric shapes are shaded only if internal validity is judged to be exceptionally low because of major design flaws. There were no examples of this among the studies on the Sleep Initiation Meta-Graph. On other meta-graphs, when internal validity was markedly lower than would be expected given the nature of the design, notes were included with the meta-chart identifying the specific threats to internal validity.

Quotation marks (" ") were placed around the geometric figures when self-report was the only method used to measure the amount of change in sleep initiation. The figures were left unadorned if objective measures were used. This allows the meta-graph user to consider whether improvement was measured in subjective ways only or whether objective measures of improvement were also used for a particular intervention.

The direction and strength of the finding is shown by signs placed above the geometric figures: a plus sign (+) for positive effects on sleep

initiation, a minus sign (–) for negative effects, and "n.s." for non-significant changes in sleep initiation. The number of pluses and minuses indicates effect size: small (+ or –), medium (++ or – –), or large (+++ or – –). Effect sizes are calculated from statistical information in each study, and Cohen's (1988) "Rules of Thumb" are used to identify effect sizes as small, medium, or large.

Table 1 lists themes and patterns identified by nurses who viewed the meta-graph shown in Figure 1.

Table 1 *Examples of Patterns and Meanings Identified by Users of the Sleep Initiation Meta-Graph*

- Somatic (muscle) relaxation is the most studied intervention.

- Relaxation approaches produce large, self-reported improvements.

- Only one intervention, "personal control over noise" (Topf, 1992), appeared to have a negative effect.

- Bedtime routines and variations in napping have the weakest research base.

- The majority of the studies measure sleep improvements using self-report measures.

Sleep-promotion meta-graphs are currently being field tested to evaluate their comparative effectiveness in displaying the results of research reviews. Much needs to be learned about the conditions under which metaphor graphics can replace or enhance traditional graphics, tables, and text; however, their informal use in classroom and in-service educational settings suggests they may increase interest, speed of comprehension, and retention of information on the research base underpinning sleep-promotion practices. If proven effective, meta-graphs may be a useful adjunct to traditional methods of disseminating review results to students and nurses in clinical practice.

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