BLOOD PRESSURE MEASUREMENT:
COGNITIVE RETENTION AND FACTORS AFFECTING COMPLIANCE

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Departmental Honors in Nursing

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Introduction

The goal of nurse educators is to promote meaningful learning (permanent behavior change). Is cognitive retention long term? Are students compliant with psychomotor skill procedures? Do learning styles or affective factors interfere with or enhance learning and compliance?

Specific to this study, do nursing students exhibit long term cognitive retention and compliance with the American Heart Association (AHA) blood pressure measurement procedure? What factors influence compliance? Blood pressure measurement was chosen as the skill to study because of its importance to health care, the complexity of the theoretical concepts and psychomotor skills, and the frequency of its use by nursing students. In addition, noncompliance with this procedure had been reported among health care professionals (Gleichmann, Gleichmann, Mannebach, Mellwig, & Philippi (1989) and observed among nursing students.

Background

Blood pressure reflects the interrelationships between various physiologic factors: cardiac output, peripheral vascular resistance, blood volume, blood viscosity, and elasticity of the arteries. A shift from the norm in any one of these factors can bring significant stress to the client's entire system, requiring specific medical and nursing interventions.

The AHA has established a procedure for accurately measuring blood pressure. Because blood pressure measurement guides medical and nursing interventions, accuracy of measurement is of
extreme importance. Erroneous measurement can result in incorrect medical and nursing interventions jeopardizing the client's health status.

Effective use of blood pressure as an assessment tool requires an understanding of the physiological role blood pressure has in maintaining homeostasis. Secondary to this cognitive knowledge, the motor skills necessary to measure blood pressure accurately must be developed. Therefore, accurate blood pressure measurement requires integration of knowledge, comprehension, and application. Adams (1987) stated that "Any behavior that has been called skilled involves combinations of cognitive, perceptual and motor processes with different weights". Benner (1984) discusses experience as the factor which moves nurses from the novice to the expert stage. The novice has bits of information, theoretical knowledge and weak psychomotor skills to which they can assign little meaning due to lack of experience. Nursing students are still consciously struggling to retrieve and integrate the required information and skills from a vast amount of newly acquired knowledge.

Research points to the fact that differences exist in the rate at which students attain mastery in knowledge, comprehension, and application. Knowledge tasks are learned at a faster rate, in more depth, and with greater retention than comprehension or application tasks (Lyon & Gettinger, 1984). A student may be able to recite by memory all of the components of the cardiovascular system (knowledge), yet lack the understanding (comprehension) of how these components operate together to
maintain a stable internal environment, thus the student may fail to see the significance of accurate blood pressure measurement (application).

A longitudinal research study to examine the effects of continuity, sequence, and integration among courses supports the notion that repeated use of subject matter presented in a hierarchical sequence leads to enhancement of retention, and more meaningful learning (Arzi, Ben-Zvi, Ganiel, 1985). Meaningful learning implies that to some extent students have experienced integration of a group of individual concepts and sees the "whole" as useful.

Tennyson and Cocchiarella (1986) speak of two cognitive processes involved in learning: conceptual knowledge and procedural knowledge. While conceptual knowledge involves the storage of information, it also includes an understanding of "... a concept's operational structure within itself and between associated concepts." By using conceptual knowledge to solve specific problems, one then develops procedural knowledge. It is believed that this procedural knowledge enhances transfer of learning and application.

Transfer of learning from the laboratory to the clinical environment may be problematic for students. Del Rey, Wughalter, and Carnes (1987) studied the effects of contextual interference, such as psychomotor skill modules in a simulation laboratory, on memory and transfer concluding that level of expertise strongly influences acquisition, retention, and transfer of learning.
These findings may explain the results reported by Sullivan, Gruis, and Poole (1977) that while students may perform each skill competently in the lab, they display disorganization, frustration and anxiety in the clinical setting. Additionally, Singer (1977) concluded that situational learning modules designed for problem-solving and discovery learning promoted transfer of learning and the learning of new tasks if sufficient time was allotted for this type of learning.

Learning style may affect cognitive retention and compliance. Hodson (1982) in studying field orientation identified that:

"... the habitual manner in which individuals process information including perception, storage, transformation, and utilization of information from the environment [is] ... related to the process of cognition rather than cognitive content or level of skill [which is] ... a spontaneous individual mode of operation that crosses personality, affective, and cognitive factors and which is relatively stable across time and task."

Whether one is field-dependent or field-independent is not an indicator of ability to learn, but an indicator of how one learns. Experiments have shown one's field orientation may influence how one reacts in certain situations. Field-dependent individuals are influenced by the "field" as a whole unit relying on external cues from the environment to guide their actions. They are usually more attentive to social stimuli than the field independent individual. Field independent individuals are more likely to analyze separate aspects of a given field relying on internal cues to guide their actions. Field orientation could
influence the student's compliance with newly learned psychomotor skills in the clinical environment.

**Review of Literature**

Few studies were identified which related to compliance with the blood pressure measurement procedure. When physicians and nurses responded to a questionnaire regarding blood pressure measurement, their knowledge levels were found inadequate (Gleichmann, et al. 1989). This study suggests that non-compliance with proper technique exists at all levels of expertise and indicates that positive role models may not be present in the clinical environment.

Spitler and Boxley-Harges (1989) observed associate degree student nurses performance of blood pressure measurement. Cognitive retention was demonstrated while affective learning (compliance) was not. If cognitive retention was satisfactory, further research is needed to identify factors that lead to noncompliance.

Gomez & Gomez (1987) found that students who practiced taking blood pressures in a patient care setting displayed more confidence and accuracy in taking blood pressures than those who practiced in a college laboratory. Practice settings may influence skill acquisition, retention, and transfer.

The purpose of this study was to determine the level of cognitive retention and compliance with the AHA blood pressure procedure. In addition, factors thought to be related to compliance or noncompliance were studied.
Methodology

Sample

The randomly selected, cross-sectional, convenience sample of nursing students in a midwestern baccalaureate program (N = 100) had successfully completed a cognitive test at a 90% level, performance evaluation and practice in a clinical environment during the sophomore year. The subjects (N = 75) completing all components of the study were first semester junior (n = 16), second semester junior (n = 21), first semester senior (n = 18) and second semester senior (n = 20).

Instruments

The AHA blood pressure measurement performance checklist was used by trained observers for determining compliance with the procedure.

Cognitive retention was measured using a modified version of the AHA cognitive instrument. The instrument was modified to include only items specifically related to the measurement procedure.

Factors related to compliance were measured using a subjective questionnaire designed by the investigators. The items on this instrument were derived after discussing the study with faculty, practicing nurses, comments heard from students and reviewing the literature.

Learning style was measured by the Group Embedded Figures Test (GEFT) (Oltman, Raskin, Witkin, & Karp, 1971) designed to differentiate individual learning styles based on perception.
Procedure

Institutional Review Board approval was obtained. Second semester sophomore nursing students were trained by the investigators to serve as non-participant observers. They were taught the AHA blood pressure measurement procedure and interrater reliability was established.

Subjects were asked to participate in a blood pressure measurement study. This was the only information provided prior to the observation to prevent review and practice of the AHA procedure. The observers completed the AHA performance checklist as the subjects selected a cuff from a packet of different size blood pressure cuffs and took a blood pressure. The full purpose of the study was then revealed and the GEFT, demographic, cognitive and subjective instruments were completed.

Data Analysis

Frequencies, percentages and correlations were used in analyzing the data.

Results

Do nursing students retain theoretical information related to blood pressure measurement? Is there a difference in the level of retention of blood pressure measurement cognitive information among nursing students as they progress through the curriculum? Cognitive retention data is given in Table 1.

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The mean of the cognitive retention scores for each group was approximately 60%. There were no significant differences among the groups. Sixty percent does not indicate that long term retention occurred. However, later discussion will show that information that was retained was not applied.

Are nursing students compliant with blood pressure measurement techniques? Only three of the 75 subjects observed were totally compliant with the AHA blood pressure measurement procedure. The perceptions that nursing students are not compliant with the AHA procedure was confirmed. For purposes of reporting, the items on the AHA blood pressure measurement checklist have been grouped (See Table 2).

Position deviations included failure to position the client comfortably and to support the arm. Subjects did not palpate to locate the brachial pulse. 61.6% of the subjects applied the cuff without regard for the need to center the bladder over the brachial artery. In addition, subjects chose the wrong cuff size, placed the cuff over clothing and did not place the cuff the recommended one inch above the antecubital area. Auscultation deviations included placing the stethoscope under the cuff and not palpating for the auscultatory gap resulting in random inflation of the cuff to 200 mmHg or higher.
The steps for actual auscultation were performed correctly by 76% not including the item of inflating the cuff 30 mmHg above the palpated systolic. In examining the data, it became evident that in training the observers the investigators neglected to make it clear that the participants would fail any item following the palpation for the auscultatory gap if they failed that item. Thus, the percentage reported for the auscultation procedure reflects only the correctness of the psychomotor activities observed.

Are there any relationships between compliance in measuring blood pressure and cognitive retention, affective factors, grade point average, the number of nursing courses completed, the estimated number of blood pressures taken and learning style? There were no significant relationships found. The independent nature of the various instruments could account for lack of significant correlations.

What factors are related to compliance with blood pressure measurement? The subjective questionnaire included items about beliefs, self-confidence, and role models. The following percentages were calculated by using the data from the subjects who strongly agreed/agreed with the Likert scale subjective items. 96.3% of the subjects (n = 54) reported that they believed the blood pressures they took were accurate and 61.3% of the subjects (n = 75) believed it was all right not to comply with the blood pressure measurement procedure. 44.0% said they did not have enough time to take blood pressures as they were
taught with 12.0% undecided about the time issue. 24.0% were uncomfortable using the AHA procedure with clients. 62.7% reported being uncomfortable using the procedure in front of superiors (nurses/doctors). 93.3% reported that nurses observed were not using the recommended procedure. 84.0% responded that physicians did not use the recommended procedure while 12% were undecided about this item.

The GEFT normative data states that 10.8 ($N = 242$) is the mean for females. This sample had a mean of 11.10 indicating that 69% of the subjects were field independent learners.

**Discussion**

The results of this study indicated that cognitive retention was not acceptable and psychomotor skill compliance with the AHA blood pressure measurement procedure did not occur. It is imperative that nurse educators revise the curriculum so that learning (permanent behavior change) occurs.

Cognitive retention scores of 60% did not support the findings of Spitler and Boxley-Harges (1989) whose subjects exhibited cognitive retention, but were not compliant with the procedure.

The findings that the students knew more than they demonstrated supported Lyon & Gettinger's (1984) finding that knowledge is mastered faster than comprehension or application. As postulated earlier, students may be able to regurgitate facts, that does not mean they comprehend or can act upon those facts. Benner (1984) discussing the meaning of experience suggested that
"in the beginning, performance is halting and rigid, and one must pay attention to explicit instruction. Performance is rule governed" (p. 37). It seems logical that close supervision and reinforcement may be necessary until experience leads to ownership or the valuing of the information and skills. This is supported by Adams (1987) suggestion that skills may require more intense reinforcement. This evidence suggests nurse educators need to develop curriculum that overtly includes continuous reinforcement of previous learning.

76% of the subjects incorrectly identified the auscultatory gap as a perceived absence of sounds that may give a false diastolic reading. The investigators think this finding is especially significant as identification of the auscultatory gap is an essential aspect of accurate blood pressure measurement. Obviously, the importance of this step was not comprehended. This lack of knowledge resulted in failure to perform a vital component of the AHA blood pressure measurement procedure. The learning module needs to overtly incorporate the rationale for inclusion of this step and faculty must reinforce its importance when evaluating and supervising students.

In teaching students the correct method of measuring blood pressure should educators employ rote memorization of information and motor skills in a controlled laboratory setting, or should the emphasis be placed on problem-solving skills in appropriate settings that provide interjection of real-life variables? It is likely that both components are needed. The student must be
proficient in the motor steps required to measure blood pressure that can only be accomplished with repeated practice and possess the ability to adapt to changing situations. Sequencing learning activities in a hierarchical fashion with reinforcement and faculty support of laboratory learning in the clinical environment as discussed by Arzi, et al (1985), Tennyson and Cocchiarella (1986) and Del Rey et al. (1987) might lead to greater retention and compliance.

Additionally, it has been shown that increased automation of task performance leads to increased difficulty adapting the task to changing situations (Singer, 1977). Classroom activities and laboratory practice need to involve the learner actively in real life situations. This can be done by using multimedia technology (Clark, 1991; Nicastro, Culbert, Cantelmo, Stafford & Levenson, 1991; Schare, Dunn, Clark, Soled & Gilman, 1991).

An experiential learning taxonomy developed by Steinaker and Bell (1979) was compared to the actual blood pressure learning module used by the students as the researchers attempted to identify the problems leading to the results of this study. This taxonomy is a change model developed for education that leads to behavioral changes and ownership or valuing of the information learned. The five levels of the taxonomy are exposure, participation, identification, internalization and dissemination. As the blood pressure learning model was examined, it was evident that the students were exposed to the information through reading, audiovisual, and laboratory assignments. Participation
occurred as they practiced the psychomotor skills with their peers and were advised by simulation laboratory staff and faculty. Identification was present as the students successfully completed a performance evaluation with faculty and practiced the skills while teaching clients about blood pressures and the procedure during blood pressure screenings on campus.

However, the internalization and dissemination levels are not present. The students proceeded to a medical-surgical nursing course where there is no further faculty evaluation of the blood pressure measurement procedure, positive role models are not present, self-confidence and the value for being accurate have apparently not been developed. The procedure has not become a part of the students repertoire. Therefore, the beliefs/values have not been established; ownership has not occurred, therefore, no compliance.

Conclusion

Nurses must comprehend the theory supporting their actions and accurately and precisely perform psychomotor skills. Nurse educators must continually validate the comprehension and retention of theory and not expect students to transfer new knowledge from the simulated environment to the clinical environment without continuous faculty supervision/reinforcement and positive role models.

Using multimedia in the classroom and laboratory would allow the student to encounter life-like situations without the fear of error. The multimedia also should increase transfer of learning.
Further, a change model, such as, the experiential learning taxonomy should be the foundation for curricular redesign. This would require faculty to work collaboratively at all levels of the curriculum to provide for the reinforcement, internalization and dissemination phases of the taxonomy. This is in line with recommendations from the National League for Nursing (19) which states that continuity should exist throughout the curriculum with the building of learning occurring from course to course.

The subject’s identification of noncompliant health care professionals indicates that the social orientation may be a possible cause for noncompliance. Therefore, positive reinforcement and role-modeling must be established. Gleichmann et al. conducted inservice education session that resulted in dramatic improvement in blood pressure measurement knowledge. Faculty need to collaborate with staff in the teaching agencies to update knowledge and improve role-modeling.

Nurse educators should replicate this study or conduct similar studies to further define effectiveness of present teaching strategies.

References
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Hodson, K. E. (1982). The behavior of field-independent and field-dependent student nurses in the clinical setting as
assessed by an ecological approach. Ball State University, Doctoral Dissertation.


with previous learning. Paper presented at IUPUI Research Conference, Fort Wayne, IN.


Table 1. Means, standard deviations and ranges of cognitive retention: Total and sub groups.

<table>
<thead>
<tr>
<th>Group (N)</th>
<th>Total (75)</th>
<th>Y1S1 (16)</th>
<th>Y1S2 (21)</th>
<th>Y2S1 (18)</th>
<th>Y2S2 (20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>6.16</td>
<td>5.75</td>
<td>6.33</td>
<td>6.44</td>
<td>6.05</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.33</td>
<td>1.34</td>
<td>1.15</td>
<td>1.42</td>
<td>1.39</td>
</tr>
<tr>
<td>Range</td>
<td>4 - 9</td>
<td>4 - 9</td>
<td>4 - 9</td>
<td>4 - 9</td>
<td>4 - 9</td>
</tr>
</tbody>
</table>

p > .05

Y1S1 = Junior, 1st semester; Y1S2 = Junior, 2nd semester; Y2 S1 = Senior, 1st semester; Y2S2 = Senior, 2nd semester.
Table 2. **Compliance with AHA Blood Pressure Measurement Procedure.**

Scores (% Correct) N = 75

<table>
<thead>
<tr>
<th>Skill</th>
<th>Compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client Position</td>
<td>72.4%</td>
</tr>
<tr>
<td>Palpation Brachial Artery</td>
<td>38.4%</td>
</tr>
<tr>
<td>Cuff Application</td>
<td>18.4%</td>
</tr>
<tr>
<td>Auscultatory Gap</td>
<td>11.8%</td>
</tr>
<tr>
<td>Auscultation</td>
<td>76.0%</td>
</tr>
</tbody>
</table>