A STUDY OF THE EFFECTS OF SELF-EVALUATION USING A PERFORMANCE EVALUATION TOOL ON LEARNING A PSYCHOMOTOR SKILL.

by

MARY FEWSTER

B. Sc. N. University of British Columbia, 1973

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN NURSING

in the School of Nursing

We accept this thesis as conforming to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

May, 1975.
In presenting this thesis in partial fulfilment of the requirements for an advanced degree at the University of British Columbia, I agree that the Library shall make it freely available for reference and study. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by the Head of my Department or by his representatives. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Department of Nursing

The University of British Columbia
Vancouver 8, Canada

Date 22 April, 1975
ABSTRACT

Two questions were explored in this study. Does knowledge of the standard of performance to be achieved and self-evaluation facilitate the learning and retention of a skill? Is student self-evaluation using a performance evaluation tool as effective a method of evaluation as instructor evaluation? Five null hypotheses were tested in an experimental study using forty students selected at random from the second year of a baccalaureate in nursing program.

A clinical skills laboratory was planned to study the type of feedback the students received while learning the skill catheterization. The experimental group of twenty-one students received feedback from an instructor and a performance evaluation tool while the control group of nineteen, received feedback from an instructor only. Students in the experimental group attended the laboratory at different times than the control group.

The laboratory was planned according to the following outline. Prior to the laboratory all students received an introduction that included the objectives, principles of catheterization and a brief outline of the procedure. The laboratory began with both groups observing a videotaped demonstration of the procedure twice. The experimental group also received the performance evaluation tool, after which both groups received feedback from an instructor during their first performance of the task. The experimental group then rated themselves using the tool.
Both groups practiced for one hour without instructor feedback. The task was then performed a second time with the experimental group using the tool for feedback and the control group receiving instructor feedback at the end of the task. One week later both groups performed the task for the third time for the purpose of testing the retention of the skill.

Observers trained in the use of the performance evaluation tool, rated the students on the first, second and third performance. When the scores of each group were compared a significant difference was found on the first performance, indicating that the performance evaluation tool facilitated learning by informing the learner of the standard to be achieved, specifically the critical errors to be avoided. The scores on the second performance after one hour of practice were not significantly different. The scores one week later were significantly different, indicating that self-evaluation using the tool while learning facilitated retention of the skill. When students' scores on self-evaluation were compared with observers scores using the product-moment correlation coefficients, no significant correlation was found. However, there was a higher correlation of student scores with observer scores on the second self-evaluation.

It was concluded that self-evaluation using a tool describing the standard of performance to be achieved does facilitate the learning and retention of a psychomotor skill. While student self-evaluation was not as accurate as instructor evaluation, given experience in self-evaluation students learned to evaluate themselves more realistically. Self-evaluation using a criterion-referenced tool can be recommended as a useful technique in teaching a psychomotor skill.
ACKNOWLEDGEMENTS

I wish to express appreciation to my committee, Dr. J. Quiring and Mrs. J. Kotaska for their guidance and support and for all the many hours of time and effort on my behalf. I am particularly grateful to the students and instructors who participated in the study, for without their cooperation the study would not have been possible. I am also indebted to the observers who gave of their time to forward this study.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>The Problem</td>
<td>2</td>
</tr>
<tr>
<td>Definition of Terms</td>
<td>6</td>
</tr>
<tr>
<td>Assumptions</td>
<td>7</td>
</tr>
<tr>
<td>Hypotheses</td>
<td>8</td>
</tr>
<tr>
<td>II. REVIEW OF THE LITERATURE</td>
<td>9</td>
</tr>
<tr>
<td>Introduction</td>
<td>9</td>
</tr>
<tr>
<td>Mastery Concept Applied to Learning</td>
<td>10</td>
</tr>
<tr>
<td>Stimulus - Response Theory of Learning</td>
<td>12</td>
</tr>
<tr>
<td>and effect of feedback</td>
<td>12</td>
</tr>
<tr>
<td>Nursing Evaluation Tools for Psychomotor</td>
<td>19</td>
</tr>
<tr>
<td>Performance</td>
<td>19</td>
</tr>
<tr>
<td>Summary</td>
<td>24</td>
</tr>
<tr>
<td>III. METHODOLOGY</td>
<td>25</td>
</tr>
<tr>
<td>Overview</td>
<td>25</td>
</tr>
<tr>
<td>Development of the Learning Module</td>
<td>27</td>
</tr>
<tr>
<td>Identification of Variables.</td>
<td>31</td>
</tr>
<tr>
<td>Statistical tests used to Analyze the Data</td>
<td>35</td>
</tr>
<tr>
<td>Summary</td>
<td>36</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>PAGE</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>IV. ANALYSIS OF THE DATA</td>
<td>37</td>
</tr>
<tr>
<td>Discussion of the Findings</td>
<td>47</td>
</tr>
<tr>
<td>Limitations of the Study</td>
<td>50</td>
</tr>
<tr>
<td>Summary</td>
<td>50</td>
</tr>
<tr>
<td>V. SUMMARY, CONCLUSIONS AND RESEARCH IMPLICATIONS</td>
<td>51</td>
</tr>
<tr>
<td>Summary</td>
<td>51</td>
</tr>
<tr>
<td>Conclusions</td>
<td>54</td>
</tr>
<tr>
<td>Indications for Further Research</td>
<td>55</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>57</td>
</tr>
<tr>
<td>APPENDIXES</td>
<td>62</td>
</tr>
<tr>
<td>APPENDIX A. Diagram of Experimental Laboratory Design</td>
<td>63</td>
</tr>
<tr>
<td>APPENDIX B. Information to Instructors and Students</td>
<td>65</td>
</tr>
<tr>
<td>APPENDIX C. Catheterization - Introduction</td>
<td>67</td>
</tr>
<tr>
<td>APPENDIX D. Catheterization Videotape Script</td>
<td>73</td>
</tr>
<tr>
<td>APPENDIX E. Performance Evaluation Tool</td>
<td>77</td>
</tr>
<tr>
<td>APPENDIX F. Catheterization Laboratory Evaluation</td>
<td>82</td>
</tr>
<tr>
<td>APPENDIX G. Table of Inter-Rater Reliability Test</td>
<td>85</td>
</tr>
<tr>
<td>APPENDIX H. Tables Related to Analysis of Student Performance Scores</td>
<td>86</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Comparison of Scores Excluding Critical Errors Obtained by Control and Experimental Groups on the First Performance of a Catheterization</td>
<td>38</td>
</tr>
<tr>
<td>2. Comparison of Scores Excluding Critical Errors Obtained by Control and Experimental Groups on the Performance of a Catheterization After One Hour of Practice</td>
<td>39</td>
</tr>
<tr>
<td>3. Comparison of Scores Excluding Critical Errors Obtained by Control and Experimental Groups on the Performance of a Catheterization one week After the First Performance</td>
<td>40</td>
</tr>
<tr>
<td>4. The Correlation Coefficients of Scores Obtained by Students on Self-evaluation with the scores obtained by observers after the Students' First Performance of a Catheterization</td>
<td>41</td>
</tr>
<tr>
<td>5. The Correlation Coefficients of Scores, Excluding Deductions for critical errors, obtained by Students on Self-evaluation and observers on the Students' First Performance of a Catheterization</td>
<td>42</td>
</tr>
<tr>
<td>6. The Correlation Coefficients of Scores Obtained by Students on Self-evaluation with the scores obtained by observers After One Hour of Practicing Catheterization</td>
<td>43</td>
</tr>
<tr>
<td>7. The Correlation Coefficients of Scores, Excluding Deductions for Critical Errors, Obtained by Students on Self-evaluation One Hour After Practice with Scores Obtained by Observers</td>
<td>44</td>
</tr>
<tr>
<td>8. Total Critical Errors Made for the Three Performances of a Catheterization</td>
<td>44</td>
</tr>
<tr>
<td>9. Chi-Square Test for the Number of Asepsis Errors on the First Performance of a Catheterization</td>
<td>45</td>
</tr>
<tr>
<td>10. Chi-Square Test for the Number of Dressings Performed Prior to the Laboratory</td>
<td>46</td>
</tr>
<tr>
<td>TABLE</td>
<td>PAGE</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>11. The Correlation Coefficients of Student Performance Scores Obtained by Different Observers</td>
<td>85</td>
</tr>
<tr>
<td>12. Comparison of Scores Obtained by Control and Experimental Groups on the First Performance of a Catheterization</td>
<td>87</td>
</tr>
<tr>
<td>13. Scores Excluding Deductions for Critical Errors of the Control and Experimental Groups on the First Practice and After One Hour of Practicing Catheterization</td>
<td>88</td>
</tr>
<tr>
<td>14. Comparison of Scores Obtained by Control and Experimental Groups on the Performance of a Catheterization after one hour of practice</td>
<td>89</td>
</tr>
<tr>
<td>15. Comparison of Scores Obtained by Control and Experimental Groups on a Performance of a Catheterization one week after the First Performance</td>
<td>90</td>
</tr>
<tr>
<td>16. Scores Excluding Deductions for Critical Errors of the Control and Experimental Groups one week After the First Performance of a Catheterization</td>
<td>91</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION TO THE STUDY

Evaluation of student nurse performance, especially clinical evaluation poses a problem to most nurse educators. Common areas of difficulty are found in the evaluation process itself; the dependence on the instructor to collect and interpret data, the unreliability of evaluation data and the time lapse between the event and the evaluation feedback. It became apparent to the writer that the method of clinical evaluation used was closely related to the standard of performance attained by the student. Methods of evaluation that facilitate learning need to be studied and ways of overcoming the difficulties inherent in instructor evaluation of student performance explored.

Self-evaluation through the use of process recordings and the clinical diary, to give just two examples, have been found to facilitate learning. The writer was interested in studying the effect of self-evaluation on learning a psychomotor skill. A number of general questions related to evaluation were identified: Is student self-evaluation as effective a method of evaluation as instructor evaluation in facilitating learning? Given the same time to learn a psychomotor task, will


self-evaluation enable a student to achieve a higher standard of performance than a student who receives instructor evaluation? Can a tool be developed that will provide immediate, reliable feedback to the student on her standard of performance? From these general questions, specific questions were formulated and an experimental study designed to discover the answers.

THE PROBLEM

Statement of the problem.

The study was designed to explore the problem of whether self-evaluation enhances the learning and retention of a psychomotor skill. The study answered three questions:

1. Is there a difference in the standard of performance of students who use a self-evaluation tool with a clearly stated standard of performance, while learning a skill, compared to students who do not use the self-evaluation tool?

2. Is there a difference in the retention of the skill after one week, by students who used the self-evaluation tool, compared to students who do not use the tool?

3. Is student self-evaluation using a specially prepared tool with a stated standard of performance, as effective a method of evaluation as instructor evaluation?

Significance of the problem.

A review of the literature indicated that grading clinical performance, objectives of clinical evaluation and techniques for assessing student progress are among the most widely discussed concerns in nursing education today.
"Evaluation of Student Nurse Clinical Performance. A Problem that Won't Go Away", is the title given by Vivian Wood to her review of the problem. This article clearly identifies the limitations of existing evaluation tools. Many tools are invalid and unreliable, but the main cause of the problem lies in the evaluation process itself.

Evaluation can be divided into formative and summative evaluation. Formative evaluation is feedback of information on performance while learning which is the focus of this study. Summative evaluation is grading the performance in relation to group norms after the task has been learned. Many of the problems of clinical evaluation are caused by the confusion of these two types of evaluation. Frequently, samples of behaviour the student exhibited while still learning are used as a basis for a final grade. Margo McCaffery states, "To provide a suitable climate for learning, it is important that the student be allowed enough time to learn the application of knowledge without the continuous threat of being graded." Further, evaluation of performance while learning should be criterion-referenced, the judgment of "pass" or "fail" being made entirely on whether or not the learner has met the objectives, rather than norm-referenced where the judgment is based on how well the learner performed the task in relation to others.

---


Margo McCaffery, "What is the Student Learning in the Clinical Laboratory", *The Journal of Nursing Education*, (November 1968), p. 4.

Biggs, op. cit., p. 5.
In a study reported by Fay L. Bower, both methods were found to have advantages. The experience with criterion-referenced evaluation was demonstrated as being a reliable method for evaluating student performance and an excellent way to promote student accountability of his own learning. With criterion-referenced evaluation the student can be judged in terms of his ability to master the criteria. Biggs believes that students are more likely to evaluate their own performance realistically when their feedback is criterion-referenced.

The writer's interest in the problems investigated in this study developed out of a concern that the most common form of formative evaluation for a psychomotor skill learning is provided by the instructor. While instructor evaluation of student performance is essential, it has many limitations as a method of facilitating learning. Among the most frequently mentioned limitations are the problems of ambiguity, subjectivity and instructor bias. From the student's point of view, instructor evaluation based on observation may be threatening and interfere with learning. Instructor evaluation may also encourage double

---

8 Biggs, op. cit., p. 9.
standards of performance in a student whose performance level depends on whether or not she is being observed. Instructor evaluation may also be delayed too long to be effective, or may not be available at all¹². The studies pertinent to this problem reveal the need to more clearly define clinical objectives in very specific behavioural terms that indicate a standard of performance, so that both the student and the instructor share a common term of reference when evaluating.

Because of the many limitations inherent in instructor evaluation, it seemed important to explore alternate methods of formative evaluation that could either supplement instructor evaluation or facilitate evaluation when the instructor is unavailable. With the trend in nursing education being towards the use of self-directed learning techniques, a self-evaluation tool for a psychomotor skill, if found to facilitate learning, could be a useful technique.

¹²Flanagan, op. cit., p. 96.
DEFINITION OF TERMS

For the purpose of the study the terms used were defined as follows:

Feedback. Knowledge of the results of performance. Two types of feedback were, verbal comment by an instructor and self-evaluation using the Performance evaluation tool.

Formative evaluation. Feedback of information on performance while learning.

Critical steps. Those steps in the performance of a psychomotor skill that are crucial to its success in terms of safety and comfort to the patient.

Performance Evaluation Tool. List of specific behaviours essential for successful performance and a list of critical errors that indicate a failing performance. Each behaviour has an assigned value, so that a performance score may be computed.

Self-evaluation. Self-assessment of ability to perform a psychomotor skill using the performance evaluation tool.
ASSUMPTIONS

This study is based on the following assumptions:

1. Feedback is most effective when it is received immediately after the given behaviour\(^\text{13}\).

2. Feedback is more effective when the individual is ready to receive it and actively participates in the feedback process\(^\text{14}\).

3. There are certain steps in a nursing procedure that are critical in terms of successful performance\(^\text{15}\).

4. Early attempts to perform a psychomotor skill tend to be easier and more successful when the student has knowledge of the critical steps\(^\text{16}\).

5. When a standard of performance is defined in terms of specific behaviours, the student is more likely to achieve the expected standard\(^\text{17}\).

---


HYPOTHESES

There were five null hypotheses tested in this study.

1. There is no significant difference in the performance scores of students taught with the Fewster Performance Evaluation Tool on the first performance of a catheterization, when compared to the scores of students not taught with the tool.

2. There is no significant difference in the performance scores obtained by students who used the Fewster Performance Evaluation Tool for self-evaluation, when compared to students who did not use the tool, after one hour of practice.

3. There is no significant difference in the performance scores obtained by students in the experimental group when compared to students in the control group, after one week.

4. There is no significant correlation between the self-evaluation scores recorded by students using the Fewster Performance Evaluation Tool and the observers' scores, using the same tool, of the students' first performance.

5. There is no significant correlation between the self-evaluation scores recorded by students using the Fewster Performance Evaluation Tool and the observers' scores, using the same tool, of the students' performance after one hour of practice.
CHAPTER II

REVIEW OF THE LITERATURE

INTRODUCTION

This chapter presents a review of the literature related to the factors that affect the learning and retention of a psychomotor skill. The concept of mastery learning is first explored in order to identify the many variables that affect the students' mastery of a task. As the independent variable in this study is the type of feedback the student receives while learning, the stimulus-response theory of learning with reference to feedback that reinforces the stimulus-response connections is reviewed. Feedback is considered as having an information function and studies related to the type of information-feedback that facilitates learning are mentioned. Feedback also has an incentive function that is related to self-evaluation, and studies that show this relationship are reviewed along with studies in which self-evaluation was used to improve performance on a task. As the dependent variable in this study was the score obtained on performing the catheterization task, the chapter concludes with a review of existing nursing evaluation tools that measure psychomotor performance.
MASTERY CONCEPT APPLIED TO LEARNING

According to Carroll's model of factors affecting success in school learning, the learner will succeed in learning a given task to the extent that he spends the amount of time that he needs to learn the task\(^1\). Although this theory has limitations in practice because a student does not have unlimited time to learn, the units of this model are helpful in identifying the variables involved in learning the task. Carroll defines a learning task as, "the learner's task of proceeding from incapability of performing a specified act to capability of performing it".\(^2\)

Time needed in learning is determined by aptitude, ability to understand instruction and the quality of instruction. Aptitude for a task is regarded as a function of prior learning relevant to the task, and a series of traits or characteristics of the learner which enter into the task. The ability to understand instruction is defined as the ability of the learner to understand the nature of the task and the procedure he is to follow in learning the task. It is at this point that the student's abilities interact with the method of instruction.


\(^2\)Ibid., p. 723.
The quality of instruction is defined by Carroll as, "the degree to which the presentation, explanation and ordering of the elements of the task approach the optimum for a given learner". Bloom with others have had success investigating the quality of instruction variable with respect to mastery learning. One strategy Bloom used was formative evaluation in which the student determined for himself whether or not he had mastered the task. Bloom's formative evaluation tools were criterion-referenced, they diagnosed or pointed out the area of difficulty, and prescribed, indicated what the student must still do for mastery. Each formative evaluation was administered at the end of the task practice. For the student who had thoroughly mastered the task the evaluation served to reinforce the learning, using this method Bloom found that more students achieved mastery. A study in 1965 before formative evaluation was used, twenty percent of the students received grade A on the final examination. In 1966, using formative evaluation, eighty percent received grade A and in 1967, ninety percent received grade A. Another factor which could have influenced the results was that teaching strategies were changed to improve areas identified by the formative evaluation tool that were not mastered. Bloom concludes that frequent feedback accompanied by specific help in instruction can reduce the time required to learn a task.

---

3Ibid., p. 726.


5Ibid., p. 7.
Thorndyke first formulated a learning theory that describes behaviour in terms of stimulus-response connections that could be strengthened or weakened. He showed that repetition alone did not strengthen the connections and that some positive after-effect or feedback was required. Later, the nature of the feedback in the form of knowledge of results was determined to affect learning in three ways. Annett states that knowledge of results has an information function, a reinforcing function and an incentive function of reward and punishment.

**Information function of feedback.**

Bilodeau further defines feedback as any consequence or result of performance perceived by the learner, either during or following his response which provides him with an indication of the correctness, accuracy or adequacy of that response. The importance of providing knowledge of the correct response as opposed to only partial knowledge of the response was shown in a study by Irion and Briggs. Using a

---


teaching machine and twenty alternative multiple choice questions they showed that giving the correct answer after each attempt was significantly better than giving a right or wrong indication. The same is true for psychomotor skill learning, immediate knowledge of results and performance is proportional to the completeness of feedback cues. The feedback related to a motor skill is divided into intrinsic and extrinsic feedback. Intrinsic feedback is that which is normally present at a basic physiological level from nerves of sensation. Extrinsic feedback is information supplied by the teacher in some form of performance measure that is not normally available to the learner. Annett states that while achievement of a specific standard will not occur without extrinsic feedback; learning will occur on the basis of intrinsic feedback. He suggests that it is important to inform the learner of the standard of the correct response and to draw attention to the feedback he receives by intrinsic means, either before or after his performance. It is important to realize that feedback on a response effects performance on a succeeding response.

The incentive function of feedback - self-evaluation.

The incentive function of feedback was tested by Locke and Bryan. These researchers found that subjects given specific standards


performed at a higher level on a complex psychomotor task than subjects
told to "do their best". They also found that knowledge of the score
was effective in influencing the setting of their goals. Mace
discovered that specified standards intensified effort per unit time
and prolonged effort over the practice period. The conclusion drawn
from these studies was that feedback is more effective when the student
is given clearly stated standards of behaviour to achieve and against
which he can measure his own performance.

The act of placing a value on one's own abilities, capacities,
knowledge and skills is called self-evaluation. The behaviours that
are valued are usually those that play a part in accomplishing a goal.
Lovejoy defined self-evaluation as the response linked to the need to
think well of oneself, or self-esteem and self-esteem he regarded as
the chief motive of human behaviour. More recent writers believe
that self-awareness never exists apart from self-evaluation and that

---

12 Edwin Locke and Judith Bryan, "Goal Setting, Rule Learning
and Knowledge of the Score", American Journal of Psychology, Vol. LXXIX,

13 C. A. Mace, "Incentives: Some Experimental Studies", Industrial

14 James C. Diggory, Self-Evaluation: Concepts and Studies,

15 A. O. Lovejoy, Essays in the History of Ideas, (New York:

16 A. L. Hallowell, "Behavioural evolution and the emergence of
the self", in Evolution and Anthropology, (Washington, D.C.: Anthropol-
there is a fundamental drive to evaluate ourselves. Self-evaluation is considered as placing a value on our purposive acts in terms of their success or failure. Festinger believes that self-evaluations may be biased toward the favourable end of the scale. It is possible that self-evaluation is not always realistic in terms of actual performance, for each individual has a different level of self-evaluation.

The literature shows that there are differing opinions of how an individual's level of self-evaluation is achieved. Cooley sees standards of self-evaluation as matters of individual choice. Mead distinguishes between the "Feeling of self" as being a product of social interaction and self-evaluation as being dependent on one's abilities and capacities as realized in the performance of definite functions. Festinger agrees with this view, he holds that the power of the group to influence its members is relatively unimportant with regard to abilities.

---

18. Ibid., p. 117.
Snygg and Combs theorize that self-evaluation is low or high as the individual's experience shows him to be adequate or inadequate in gratifying his needs. Wylie states that there is some evidence that children's self-concepts and their self-evaluations are similar to what they believe their parents think of them. This finding could explain why some individuals have a level of self-evaluation that is sometimes unrelated to their actual ability.

Experiments have shown that the level of self-evaluation can be altered when success and failure on a task are experimentally manipulated. The changes after a single experiment are more likely to involve self-ratings on the experimental task itself than a more global self-regard. "There is some evidence that changes in self-rating upward after success are more frequent than changes downward after failure." It appears that there may be a level of self-evaluation for a specific task.

The level of self-evaluation varies with individuals and in relation to specific tasks. What criteria does a person use to evaluate himself? An individual will self-evaluate a cognitive or manipulative ability without the intervention of another person. If he is informed of his adequacy or inadequacy, his own evaluation may agree or disagree. Recent studies have shown that a feeling of success or failure is

---


24 Ibid., p. 181.
determined by the relation of performance to the level of aspiration. In studies by Hoppe, subjects' level of aspiration was generally raised after experiencing success and lowered after failure. Hoppe concluded that a person chooses his level of aspiration so as to resolve the conflict between setting it low enough to avoid failure and high enough to assure maximum success. In situations where the goal is imposed on the subject, such as setting a standard of performance as described in the feedback studies, the subject's level of achievement and the goal to be achieved may not be identical. Hoppe found that there is greater anxiety to achieve the goal when the experimenters are present.

Diggory and Morlock looked at the level of aspiration in relation to an imposed goal. They found that actions related to successive levels of aspiration become a stepwise approach to the goal. Even though the subjects may become discouraged about achieving the goal, the level of aspiration increases as long as the performance curve rises. These studies show the incentive function of self-evaluation as a form of feedback.

Later studies introduced quantitative methods of studying self-evaluation in terms of numerical performance scales and amount of product per unit time. These studies have shown that the level of aspiration is sensitive to instruction and to conditions such as

---

25 Diggory, op. cit., p. 117.
26 Ibid., p. 118
27 Ibid., p. 178
comparison of one performance on a task, to performance on a subsequent task. Diggory, Riley and Blumenfeld found that the closer the average performance to the goal and the clearer the definition of the goal, the better the performance

To summarize, self-evaluation is a response to the basic need of self-esteem. Self-evaluation can be manipulated so that it improves learning and assists the individual to reach a performance goal. Although a goal may be imposed, individuals develop their own standards of performance which are closely related to their level of aspiration. As the performance level is raised, the level of aspiration moves nearer to the goal.

Estimates of performance are higher when the rate of improvement is high, when the average distance between performance and goal is small, when the deadline for the operation is distant or vaguely located, and when the goal is important to the subject.

All nursing skills must eventually be performed independently. The nursing student should acquire skill in evaluating realistically and in improving performance independently. "It is entirely possible that no person will acquire a high degree of skill as long as he remains completely dependent upon someone else for guidance and monitoring of his activities". While the nursing student needs guidance by having standards of performance set for her, these standards are more likely to become her own through a process of self-evaluation.

---

28 Ibid., p. 130.
29 Ibid., p. 203.
NURSING EVALUATION TOOLS
FOR PSYCHOMOTOR PERFORMANCE

H. Flitter writes,

If we could break down clinical experience into behavioural objectives as clearly as we can classroom aspects of nursing, we would have the beginning step for developing evaluation devices to appraise these experiences. 31

A formative evaluation tool that is criterion-referenced includes the specific behaviours essential for mastery of a task, with a value assigned to the behaviours, according to Wood's definition, it is a measurement tool 32. The quality of the tool depends on the specificity of the described behaviours and the reliability and validity of measurement criteria.

A search of the literature reveals that very few such measurement tools have been developed and tested. "Most of the research tends to be specialized in measuring techniques, particularly grading." 33 The checklist or observation sheet provides feedback to the user of correct behaviours and most closely approximates a formative evaluation tool. An advantage of this type of tool is that it has been shown to be a valid and reliable form of evaluation. Most of the studies reported test the observers use of the tool and do not consider the use of the tool by the student.

32 Wood, op. cit., p. 337.
In a study by Jean Hayter, thirty one teachers were asked to observe and grade using their own system, a videotaped performance of three students taking care of a patient in shock. The highest number to agree on a single grade for student one was fourteen, forty five per cent. After using an observation guide that listed specific activities to assess the student's performance, there was seventy four per cent agreement about the student's achievement. This example of instructor evaluation, while not a controlled study, points out the improvement of the quality of evaluation when the observer's attention is directed toward behaviours essential to successful achievement of the objectives. A similar tool developed for use by the student should also direct the student's attention to successful behaviours, enhance learning and facilitate reliable self-evaluation.

Katherine Hoffman developed a tool to evaluate a psychomotor skill. The tool to be used by an observer consists of two parts. The first part is an observation sheet of steps in the task, and the second part is a criteria sheet listing behaviours that indicate both successful and failing behaviours. The tool is divided into two parts to ensure observer reliability. Based on the results of her study which proved the hypothesis that "there are certain steps or aspects of a nursing procedure which are highly related to successful performance", Hoffman suggests a methodology for the development of an evaluation tool.


for a psychomotor skill.

Develop systematic step-by-step statements of the actions in the behaviour which are observable. Develop statements of quality performance which illustrates the operation of criteria in terms of specific action. For example, in terms of safety to the patient, successful performance in catheterization would be characterized by the consistent use of aseptic technique.36

Dianne Anderson and Jean Saxon operationalized Hoffman's methodology and developed a tool for evaluating "Moving the patient from supine to side-lying position".37 They report a high degree of validity, objectivity and practicability in the use of the tool by observers. However, they use it for rating the student's performance and do not comment on its use as a form of feedback to enhance the student's learning. Topf developed a checklist for recording effective and ineffective behaviours in evaluating the development of communication skills.38 Although this tool, as the others mentioned, is especially useful in identifying the presence or absence of the behaviour, it does not rate or place a value on the behaviour, other than to indicate a pass or fail. Margaret Dunn developed an instrument for rating the performance of professional practitioners when administering an intramuscular medication, in which she assigned a value to each

---

36 Ibid., p. 152


behaviour, and a total score was assigned. A high degree of reliability was established between the scorers, and the tool was found to be reliable in evaluating and describing performance\(^\text{39}\).

Only one study was found in which a checklist designating pertinent points was used by the student to facilitate learning. In the course of her study on the effect of timing of videotape feedback on sophomore nursing student's achievement of skill in giving subcutaneous injections, Julia Quiring gave all the subjects a checklist to use as they observed their videotaped performance\(^\text{40}\). However, the effect on learning of the checklist itself was not studied.

Many methods of self-evaluation are presently being used in nursing. There is the process recording,\(^\text{41}\) the clinical diary,\(^\text{42}\) and the anecdotal record. Palmer had students write one anecdote a week that


included among other topics, reactions to nursing measures and evaluation of performance. Lenz and Bauer developed the nursing care study in which the student writes a detailed plan for patient care, process recordings and clinical diary entries. The main emphasis of these self-evaluation methods is on self-reporting and self-analysis. Also of value are the self-evaluation tools that indicate a standard of performance against which a student can measure himself and for which he can strive to attain.

A nursing study was not found that researched the effect of feedback in the form of a self-evaluation tool, on the learning and retention of a psychomotor skill. Neither was an adequate tool found to measure the performance of the catheterization skill, however, existing tools provided guidelines for the development of an evaluation tool.


SUMMARY

The concept of mastery learning combined with knowledge of results and self-evaluation is useful in designing a teaching method that will facilitate learning. The student who evaluates himself as mastering a task, gains a feeling of confidence and a sense of mastery which increases his incentive for learning. It is acknowledged that a particular teaching method may not be the most effective method for all students, but a combination of immediate feedback from an instructor, and self-evaluation using a performance evaluation tool, may assist most students to achieve mastery and maintain the standard over time.

As no studies were found in the literature that tested these theories in relation to learning a nursing psychomotor skill such as catheterization, a study in this area seemed justified.
CHAPTER III

METHODOLOGY

OVERVIEW

To investigate the effect on learning a psychomotor skill of self-evaluation using a tool describing a standard of performance to be achieved, an experimental study was designed. A learning module was prepared on the skill, catheterization which included, an introduction with a brief outline of the procedure, a videotape of catheterization using a retention catheter. Students in the experimental group had the Fewster Performance Evaluation tool included in their module. A laboratory was planned specifically to study the type of feedback the students received while learning the skill. All students were given the introduction prior to the laboratory. At the beginning of the laboratory the experimental group studied the tool which informed them of the standard to be achieved. Students in the control group did not have this information. Students in both groups observed the videotaped demonstration twice, after which they received instructor feedback during their first performance of the procedure. Students in the experimental group then rated themselves using the Performance Evaluation Tool. Both groups practiced for one hour with no feedback from an instructor, the experimental group were able to use the tool for feedback. At the end of the practice period the procedure was performed completely for the second time after which the control group received instructor feedback and the experimental group used the tool for feedback. A diagramatic description of the laboratory is given in Appendix A.
Observers rated the student's performance on the first performance, the second performance after one hour of practice, and on the third performance one week later. These scores were used to compare the effect of the different types of feedback on the learning and retention of the skill. A comparison was also made of the scores obtained by students on self-evaluation with those obtained by the observers of the students' performances.

STUDY SUBJECTS

The population selected for the study were nursing students in the second year of a baccalaureate degree program. The sample of forty students were selected at random from a total population of 105. Students were randomly assigned, twentyone to the experimental group and nineteen to the control group. Students were excluded from the study if they had observed a catheterization within the last 8 weeks, performed a catheterization or, failed a pretest on the application of the principles of asepsis.

Information given to subjects.

Each student was informed by her instructor, and again at the beginning of the laboratory that she was participating in a study of a particular method of learning a psychomotor skill, the instructions are included in Appendix B. The students understood and accepted that the laboratory was a required learning experience. The students were also informed that their anonymity would be preserved and that they could have access to the results of the study on request.
The rights of the individual student.

The rights of the individual student to receive the guidance needed in learning the skill was considered by planning the content of the laboratory with the instructor and by having the student's instructor attend the laboratory. The instructor observed the student's performance and was aware of students who required further guidance to master the task.

DEVELOPMENT OF THE LEARNING MODULE

A learning module was prepared that included an introduction to the catheterization laboratory with a brief outline of the procedure, a videotape of a catheterization, and a performance evaluation tool.

There are several reasons for choosing catheterization as the skill to be learned. Firstly it is a skill for which a standard can be clearly defined. Secondly, if it is not performed accurately and with skill, injury and infection can occur, also the patient may experience discomfort and embarrassment. Thirdly, with the decrease in the frequency of catheterizations performed, students have less opportunity to observe the skill in the clinical setting. For these reasons catheterization is a skill that should be mastered as much as is possible within the limitations of the classroom laboratory before approaching a patient.

The introduction to the catheterization laboratory was prepared in consultation with an instructor with expertise in the subject. (Appendix C) This part of the module was given to students to study prior to attending the laboratory.
A fifteen minute videotape of the procedure performed on a model was made. The script for the videotape included a description of each step as outlined in the performance evaluation tool. Sources of difficulty in performing the task that had been identified during a task analysis and from the investigator's own experience in teaching student nurses, were explained more fully. See Appendix D for the videotape script.

The development of the performance evaluation tool was based on the methodology suggested and tested by K. Hoffman\textsuperscript{1} and later adapted by Margaret Dunn\textsuperscript{2}. The first step was a task analysis of different procedures used to insert a foley catheter into the bladder of a female patient. Observations were made of three different procedures in separate institutions. Different levels of nursing staff were observed performing the procedure, an instructor, a general duty registered nurse, and a practical nurse. Sources of difficulty in performing the task were identified by direct observation and questioning. Reference was also made to nursing fundamental textbooks\textsuperscript{3,4} and a composite procedure prepared. Each step in the procedure was then stated in behavioural terms and where appropriate the quality of behaviour described, e.g. gently cleanse labia with downward strokes. A list of critical errors was compiled using those behaviours that could cause injury, infection, and discomfort to the patient, as the criteria.

\textsuperscript{1} Hoffman, op. cit., p. 152.
\textsuperscript{2} Dunn, op. cit., p. 504.
The step-by-step description of the procedure was then submitted to a panel of judges to establish content validity. The panel comprised an instructor who teaches the skill, and head nurses and nursing staff on two gynaecology wards in different institutions. The judges were asked to review each step for clarity and accuracy. The panel was also asked to mark the steps considered crucial in terms of safety, comfort and success in achieving the objective of placing a Foley catheter in the bladder. The list of critical errors was also submitted to the panel with the criteria for a critical error, on which they were asked to comment. Opinions of the judges was received both verbally and in writing.

The next step was to assign a value to each step in the procedure. This was done by assigning a value of two, to the steps critical to a successful performance on which there was a consensus of opinion among the judges and one, to all other steps to a total of fifty. A value of minus twenty-five was assigned to a critical error with the condition that twenty-five be deducted from the total score if one or more errors occur. Low values were assigned to each step in order to improve the reliability of the performance score. Values were assigned to each step to make it possible to compute a numerical value for the performance of each subject. Those behaviours which could not be observed in the laboratory setting were included in the tool but were not given a value. The performance evaluation tool is given in Appendix E.

The performance evaluation tool was used by the experimental group for self-evaluation and by the observers to score the performance of all subjects in the study.
Pretest of the Learning Module

The module was pretested using a group of six students selected at random from the same population as the research sample. The objectives of the pretest were to assess:

1. the effectiveness of the videotaped demonstration as a method of teaching the catheterization skill.

2. the performance evaluation tool for clarity of the steps and the scoring method.

3. the laboratory design as an effective method of teaching the skill.

The objectives were measured by the students' comments on a questionnaire and their performance scores at the end of the laboratory. The questionnaire is given in Appendix F.

Some limitations were found in the videotape related to the intricacy of some of the steps and the length of the task. It was decided that these could be overcome by showing the videotape twice at the beginning of the laboratory followed by opportunity for discussion. The performance evaluation tool presented no difficulties with the scoring and was clearly understood when a minor change in the description of two of the steps was made.

During the pretest it was observed that all the students made the critical error of continuing to use equipment as being sterile when it was contaminated. Based on this observation, it was decided to begin the laboratory with a pretest on the application of the principles of asepsis and to exclude students from the study who failed the pretest. Details of the pretest are found in Appendix B.
The catheterization laboratory module was revised and pretested using another six students drawn at random from the same population as the research sample. The module and total laboratory plan was found to be effective as a method of teaching the catheterization skill as most students mastered the skill.

IDENTIFICATION OF VARIABLES

Independent variable.

The independent variable in this study was the type of feedback the student received on her performance of a catheterization. The feedback was of two types: self-evaluation using the performance evaluation tool, and verbal feedback from an instructor.

1. Self-evaluation feedback. The students in the experimental group were given the performance evaluation tool with an explanation of its use before observing the videotaped demonstration. This group was informed that the purpose of the tool was to bring to their attention the steps critical to a successful performance, and after their first performance, to help in identifying the steps that required further practice. To facilitate cognitive learning the students were requested not to use the tool as a guide during the first performance. The scoring system was explained; i.e. the value for each step to be awarded when the step was performed as described, no half marks to be awarded, and for one or more critical errors, twenty-five to be deducted from the total score. Column number one was to be used for evaluating the first performance and column number two for evaluating their performance after one hour of practice. It was emphasized that the tool would help to show their progress.
2. Verbal feedback from an instructor. Students in both the control and experimental groups were given verbal feedback to ensure immediate reinforcement of correct behaviours and correction of errors during the first performance of the task. Verbal feedback was described as informing the student that an error or omission had occurred, requesting the student to identify the error or omission, providing the information only when the student was unable to answer and answering student questions. The instructors were informed of their role in writing, and verbally at the beginning of the laboratory; information given to instructors is in Appendix B. The instructor was the student's own clinical instructor or one of two registered nurses from the fourth year Bachelor of Science in Nursing program, teaching course who volunteered as instructors for the study.

Dependent variable.

The dependent variable was the performance score. Scores were obtained by observers using the performance evaluation tool. One observer scored one student except on the first performance when the observer scored two students simultaneously. When an observer missed part of a student's performance, the student was eliminated from the study. Three scores were obtained for each student in both the experimental and control groups: on the first performance, the performance after one hour of practice, and the performance one week later.

Reliability of the performance scores. A total of seven observers were used in the study. The observers were all registered nurses, five were students in the fourth year Bachelor of Science in Nursing program teaching course, and two were Master of Science in Nursing students with experience in teaching. The investigator was one of the observers.
Inter-Rater Reliability. The observers were trained in the use of the tool by first observing the videotaped demonstration of catheterization. Next, the observers scored a videotaped performance in which errors and omissions had been made. The differences in the scores were discussed and the videotape reviewed until 100 percent agreement was reached. During the study each observer's score was checked for reliability by two observers scoring the same performance. Each of the six observers scored one student, the seventh observer scored in every situation. The product moment correlation coefficients were applied to the scores and a value $r .993$ was obtained and accepted as being a significant correlation well above the .01 level. More detail is given in Table 11, Appendix G. To reduce scoring variables. Variability in the scoring of the control and experimental groups was reduced by having the same four observers score both groups on the first performance and the performance after one hour of practice. The other three observers scored the performance of students in both groups on a random basis one week later.

Observers' effect on student performance. The students were unaware that their first performance was being scored by an observer. Only two observers were in the laboratory at any one time, the investigator, who was known to be organizing the laboratory, and the other who was referred to as the laboratory assistant. The observers attempted to stay in the background, although this was difficult, as close observation was necessary for some steps. The students' attention was mainly directed toward their instructor and their own performance so that the effect of observers on student performance was minimal. On the second and third scored performance, the students were informed that their performance
was being evaluated by the observers. The reason given was in order to provide feedback at the end of the performance, or after the self-evaluation, for students in the experimental group. Each student was told that her performance would not be interrupted unless a critical error was not recognized, and that the final score would be discussed only with herself.

To prevent contamination of results. To avoid the research conditions for the experimental group also influencing the control group, students in the experimental group were in the laboratory at different times than the control group. The performance evaluation tool used by the experimental group was handed in at the end of the laboratory so that it was not seen by the control group. Students were not informed that self-evaluation specifically was being studied.

The active variables affecting learning that were controlled by the experimental conditions are as follows:

1. Prior learning relevant to catheterization,
   a. observation of a catheterization within the previous eight weeks, excluded the student from the study.
   b. performance of a catheterization, excluded the student from the study.
   c. application of the principles of asepsis, each student in the study passed a pre-test on asepsis.
   d. knowledge of principles used in performing a catheterization, each student was given the principles to study prior to the laboratory.

2. Time allowed to learn the catheterization task. Each student had the same time of two and a half hours in the laboratory.
STATISTICAL TESTS USED TO ANALYZE THE DATA

The analysis of the data centered around testing the five null hypotheses. The performance scores of the control and experimental groups were computed in two ways. Firstly, the score including deductions for critical errors was computed and secondly, the score excluding deductions for critical errors.

To test hypotheses one, two, and three using the scores including deductions for critical errors, the Mann-Whitney U Test was used. This test was used because with twenty-five points deducted for a critical error the data did not meet the test criterion of interval scaling. The Mann-Whitney U Test is used with scores that can be rank ordered and tests whether two groups of scores are significantly different. The two-tailed test was used and a significance level of 0.05 considered acceptable. A t test was used to compare the scores excluding the critical errors that were obtained by both groups. The level of significance for the two-tailed test was set at 0.05.

To test hypotheses four and five the product-moment correlation coefficients were used to correlate the student score on self-evaluation with the score obtained by the observer. A significance level of 0.05 will reject the null hypotheses. The inter-observer scores were tested for reliability by applying the correlation coefficients test. A correlation of r = .8 or above was accepted.

---

6 Ibid., p. 155.
SUMMARY

An experimental study was designed to test the hypotheses using catheterization as the skill to be learned. A learning module was prepared. A formative evaluation tool for the catheterization task was included in the module for the experimental group only, after being tested for reliability. This tool, entitled the Fewster Performance Evaluation Tool, was used by the experimental group of students to evaluate their own performance while learning the task in the laboratory. The control group of students received evaluation from an instructor. Performance scores of the two groups were measured by observers who used the Fewster Performance Evaluation Tool. Three scores were obtained for the two groups: the score on the first performance, the score after one hour of practice and the score on performance one week later. The scores were used to compare the performance of students in the two groups. A comparison was also made of the scores obtained by the students on self-evaluation with those obtained by the observers of the students' performances. The statistical tests used to analyse the data were described.
CHAPTER IV

ANALYSIS OF THE DATA

This study was undertaken to answer the following questions:
Is there a difference in the performance scores of students who use a self-evaluation tool with a stated standard of performance, while learning a skill, compared to students who do not use the self-evaluation tool? Is self-evaluation using a specially prepared tool comparable to instructor evaluation. Five null hypotheses were tested to answer these questions and the analysis of the data is presented in relation to each hypothesis. For the sake of brevity and clarity many of the tables related to the analysis are presented in the Appendix.

Findings in Relation to Hypothesis One.

The first hypothesis tested was that,

There is no significant difference in the performance scores of students taught with the Fewster Performance Evaluation Tool on the first performance of a catheterization when compared to the scores of students not taught with the tool.

The performance scores, including the deductions for critical errors of both groups were rank ordered and compared by using the Mann-Whitney U Test. The finding was, $z = 2.05$ which is significant at the 0.04 level for the two-tailed test and hypothesis one was rejected. Appendix H, Table 12, page 87 gives the score and a summary of results. The performance scores of both groups excluding the deductions for critical
errors were compared using a t test. This data gives the difference between the scores based on performance of each step in the catheterization task. A two-tailed test indicated a value, $t = 1.696$ which is not significant at the 0.05 level, Appendix H, Table 13, lists the raw scores. Table 1 summarizes the results.

### Table 1

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>$\bar{X}$</th>
<th>SD</th>
<th>df</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>21</td>
<td>43.571</td>
<td>2.399</td>
<td>38</td>
<td>1.696*</td>
</tr>
<tr>
<td>Control</td>
<td>19</td>
<td>42.053</td>
<td>3.240</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*not significant at 0.05 level

Findings in Relation to Hypothesis Two.

The second hypothesis tested was that,

There is no significant difference in the performance scores obtained by students who used the Fewster Performance Evaluation Tool for self-evaluation when compared to students who did not use the tool, after one hour of practice.

The performance scores including deductions for critical errors of both groups were compared using the Mann-Whitney U Test. The finding was, $z = 0.8606$ which is significant at the 0.3898 level for the two-tailed test, Appendix H, Table 14. This difference is not significant at the 0.05 level and hypothesis two was not rejected. The performance scores
of both groups excluding the deductions for critical errors were compared. A two-tailed test indicated a $t = 1.522$ which is not significant at the 0.05 level. Appendix H, Table 13, lists the raw scores and Table 2 summarizes the results.

Table 2

Comparison of Scores Excluding Critical Errors Obtained by Control and Experimental Groups on the Performance of a Catheterization After One Hour of Practice

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>$\bar{X}$</th>
<th>SD</th>
<th>df</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>21</td>
<td>47.476</td>
<td>1.914</td>
<td>38</td>
<td>1.522*</td>
</tr>
<tr>
<td>Control</td>
<td>19</td>
<td>46.263</td>
<td>3.052</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*not significant at 0.05 level

Findings in Relation to Hypothesis Three.

The third hypothesis tested was that,

There is no significant difference in the performance scores obtained by students in the experimental group when compared to students in the control group, after one week.

The performance scores including deductions for critical errors were compared using the Mann-Whitney U Test. The finding was, $z = 2.3716$ which is significant at the 0.01 level for the two-tailed test and hypothesis three was rejected. Appendix H, Table 15 lists the ranked scores and summarizes the results. The performance scores of both groups excluding deductions for critical errors were compared using a $t$ test. A two-tailed $t$ test indicated $t = 2.077$ which is significant at the 0.05 level.
Appendix H, Table 16, lists the raw scores and Table 3 summarizes the results.

Table 3
Comparison of Scores Excluding Critical Errors
Obtained by Control and Experimental Groups
on the Performance of a Catheterization
One Week After First Performance

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>$\bar{X}$</th>
<th>SD</th>
<th>df</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>16</td>
<td>48.313</td>
<td>2.056</td>
<td>28</td>
<td>2.077*</td>
</tr>
<tr>
<td>Control</td>
<td>14</td>
<td>46.571</td>
<td>2.533</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*significant at the 0.05 level

Findings in Relation to Hypothesis Four.

The fourth hypothesis tested was that,

There is no significant correlation between the self-evaluation scores recorded by students using the Fewster Performance Evaluation Tool, and the observers' score, using the same tool, of the students' first performance.

The product-moment correlation coefficients were used to correlate the scores obtained by students on self-evaluation with those obtained by the observers. The finding was, $r = 0.274$ which is not a significant correlation for nineteen degrees of freedom at the 0.05 level and hypothesis four was not rejected. A list of raw scores and a summary of the results are found in Table 4, page 41. The scores excluding deductions for critical errors, when correlated using the product-moment correlation coefficients resulted in, $r = 0.572$ which is significant at the .01 level for nineteen degrees of freedom. A summary of these results is given in Table 5, page 42.
Table 4
The Correlation Coefficients of Scores Obtained by Students on Self-evaluation with the Scores Obtained by Observers after the Students' First Performance of Catheterization

<table>
<thead>
<tr>
<th>Student Number</th>
<th>Observer Score</th>
<th>Student Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>8</td>
<td>45</td>
<td>40</td>
</tr>
<tr>
<td>9</td>
<td>44</td>
<td>43</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>26</td>
</tr>
<tr>
<td>11</td>
<td>39</td>
<td>15</td>
</tr>
<tr>
<td>12</td>
<td>46</td>
<td>41</td>
</tr>
<tr>
<td>13</td>
<td>44</td>
<td>43</td>
</tr>
<tr>
<td>14</td>
<td>18</td>
<td>42</td>
</tr>
<tr>
<td>15</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>16</td>
<td>43</td>
<td>48</td>
</tr>
<tr>
<td>17</td>
<td>43</td>
<td>45</td>
</tr>
<tr>
<td>18</td>
<td>20</td>
<td>48</td>
</tr>
<tr>
<td>19</td>
<td>45</td>
<td>46</td>
</tr>
<tr>
<td>20</td>
<td>18</td>
<td>42</td>
</tr>
<tr>
<td>21</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Raters</th>
<th>Mean</th>
<th>SD</th>
<th>( \rho )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observers</td>
<td>29.286</td>
<td>12.791</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>32.714</td>
<td>14.125</td>
<td>0.274*</td>
</tr>
</tbody>
</table>

*not significant at 0.05 level

\( \text{df} = 19 \)
Table 5
The Correlation Coefficients of Scores, Excluding Deductions for Critical Errors, Obtained by Students on Self-Evaluation and Observers on the Students First Performance of a Catheterization

<table>
<thead>
<tr>
<th>Raters</th>
<th>Mean</th>
<th>SD</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observers</td>
<td>43.571</td>
<td>2.399</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>42.238</td>
<td>4.999</td>
<td>0.572*</td>
</tr>
</tbody>
</table>

*significant at the 0.05 level

DF = 19

Findings in Relation to Hypothesis Five.

The fifth hypothesis tested was that, there is no significant correlation between the self-evaluation scores recorded by students using the Fewster Performance Evaluation Tool and the observers' scores, using the same tool, of the students performance after one hour of practice.

The product-moment correlation coefficients were used to correlate the scores obtained by the students on self-evaluation with the scores obtained by the observers. The finding was $r = 0.392$ which is not a significant correlation for nineteen degrees of freedom at the 0.05 level and the fifth hypothesis was not rejected, Table 6, page 43. The scores excluding deductions for critical errors were correlated using the product-moment correlation coefficients. The finding was, $r = 0.709$ which is a significant correlation for nineteen degrees of freedom at the 0.01 level, Table 6.
Table 6

The Correlation Coefficients of Scores Obtained by Students on Self-evaluation with the Scores Obtained by Observers One Hour After Practicing Catheterization

<table>
<thead>
<tr>
<th>Student Number</th>
<th>Observer Score</th>
<th>Student Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>21</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>6</td>
<td>49</td>
<td>47</td>
</tr>
<tr>
<td>7</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>8</td>
<td>49</td>
<td>24</td>
</tr>
<tr>
<td>9</td>
<td>48</td>
<td>49</td>
</tr>
<tr>
<td>10</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>11</td>
<td>48</td>
<td>45</td>
</tr>
<tr>
<td>12</td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td>13</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>14</td>
<td>46</td>
<td>49</td>
</tr>
<tr>
<td>15</td>
<td>22</td>
<td>48</td>
</tr>
<tr>
<td>16</td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td>17</td>
<td>47</td>
<td>46</td>
</tr>
<tr>
<td>18</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>19</td>
<td>46</td>
<td>45</td>
</tr>
<tr>
<td>20</td>
<td>23</td>
<td>45</td>
</tr>
<tr>
<td>21</td>
<td>23</td>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Raters</th>
<th>Mean</th>
<th>SD</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observers</td>
<td>40.286</td>
<td>12.207</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>44.000</td>
<td>9.311</td>
<td>0.392*</td>
</tr>
</tbody>
</table>

*not significant at 0.05 level

df = 19
The Correlation Coefficients of Scores, Excluding Deductions for Critical Errors, Obtained by Students on Self-evaluation One Hour After Practice with Scores Obtained by Observers

<table>
<thead>
<tr>
<th>Raters</th>
<th>Mean</th>
<th>SD</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observers</td>
<td>47.429</td>
<td>1.912</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>47.571</td>
<td>2.135</td>
<td>0.709*</td>
</tr>
</tbody>
</table>

*significant at the 0.01 level

df = 19

Analysis of Critical Errors.

The performance scores were computed in such a way that if one or more critical errors were made twenty-five points were deducted from the total score, resulting in a failure. Table 8, lists the critical errors of both groups for the three performance scores computed.

Table 8

Total Critical Errors Made for the Three Performances of a Catheterization

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>15</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Experimental</td>
<td>13</td>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>
Because the most common critical error made by students in both groups was, "Continuing to use equipment as being sterile when it was contaminated", a chi-square test was used to assess whether the control and experimental groups differed significantly in the number of asepsis errors made on the first performance. Table 9 gives the number of errors and the result of the test which was, $\chi^2 = 0.92$, for one degree of freedom $\chi^2$ is not significant at the 0.05 level. The number of asepsis errors in the second performance was six for both groups and for the third performance none were made.

Table 9

<table>
<thead>
<tr>
<th>Group</th>
<th>No Errors</th>
<th>Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Experimental</td>
<td>11</td>
<td>10</td>
</tr>
</tbody>
</table>

$\chi^2 = 0.92$

df = 1

To assist in the interpretation of the critical errors data, the chi-square was used to assess whether the control and experimental groups differed significantly in their prior experience of asepsis. The number of dressings performed prior to the laboratory may have affected
the students' performance. Table 10, gives the number of dressings performed by students in each group with a summary of the results. The finding, $X^2 = 3.75$ for two degrees of freedom was not significant at the 0.05 level. It was concluded that the students in the two-groups were randomly distributed and that prior experience of the application of asepsis principles did not skew the data.

Table 10

<table>
<thead>
<tr>
<th></th>
<th>0 - 3</th>
<th>4 - 6</th>
<th>7 - 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>8</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Experimental</td>
<td>6</td>
<td>11</td>
<td>4</td>
</tr>
</tbody>
</table>

$X^2 = 3.75$

$df = 2$

$p > 0.05$

The results of the data analysis have been described briefly. The performance scores including deductions for critical errors were used to test the five hypotheses. The performance scores excluding deductions for critical errors were also analyzed to assist in the interpretation of the data. An analysis of the critical errors made by both groups was described to assist with the interpretation of the performance score data.
DISCUSSION OF THE FINDINGS

The first null hypothesis was rejected at the 0.04 level of significance. The results indicated that students using the Fewster Performance Evaluation tool to learn the skill performed significantly better on the first practice. The tool directed the students' attention toward the standard to be achieved, and as shown in the other studies, discussed previously, subjects informed of the goal achieved a higher standard than those who were not informed of the goal. The scores of both groups based only on performance of each step, were not significantly different. It was concluded that the Performance Evaluation tool facilitates learning mainly by informing the learner of the critical errors to be avoided, as fewer critical errors were made by the experimental group.

The second null hypothesis was not rejected. The results indicated that self-evaluation using the Fewster Performance Evaluation tool made no significant difference to the learning of the skill during the one hour practice period. Students in both groups performed each step equally well after one hour of practice. Although few students achieved mastery, seven students in the control group and six in the experimental group made critical errors and failed the performance after one hour of practice. One interpretation of these results was that, instructor feedback to both groups during the first performance was adequate in guiding the student to reach her maximum potential for learning, during the one hour practice period. Knowledge of results, in the form of a score provided by the tool, had little further effect
in facilitating learning for the experimental group. The incentive function of feedback also was not enhanced by the tool sufficiently to affect learning. Another reason for the similarity in the performance of the groups may have been the complexity of the task, that made self-evaluation ineffective in improving performance, even with the aid of a tool. Student anxiety caused by using the tool for the first time may also have interfered with further learning. The performance scores of both groups showed some improvement when compared to the scores on the first performance.

The third null hypothesis was rejected at the 0.01 level of significance. This result indicated that the students who used the Performance Evaluation tool performed the skill at a significantly higher standard one week later, than the students who did not use the tool. Only one student in the experimental group failed compared to three in the control group. The fact that five students in each group did not return for the third performance may have skewed the results. It was concluded that using the tool for self-evaluation of the last performance in the laboratory, helped to reinforce learning. Both groups demonstrated an improvement in the standard of performance. The experimental group showed a significantly greater improvement in the performance and retention of the skill than did the control group. This finding supports the research that shows, when a goal is imposed the level of aspiration may not be the same as the goal, but successive performances will bring the subjects nearer to the goal. The fact that students with knowledge of the goal came closer to achieving the goal
than students without knowledge of the goal, also supports previous research findings. Self-evaluation using the tool may also have facilitated the retention of the skill by means of more actively involving the student in the evaluation than students who received only instructor evaluation. The amount of practice during the previous week was considered as not influencing the results, as only two students in the control group stated they had practiced once since the laboratory.

The fourth and fifth hypotheses were not rejected, indicating that there was not a significant correlation in the self-evaluation scores recorded by students when compared to the observers scores. However, when the scores without the critical errors were analyzed, a correlation at the 0.01 level were found. These findings indicate that either the students did not recognize the critical errors they made, or that they may have been unfamiliar with the tool and did not record their errors. The scores after the second scored performance at the end of the laboratory indicate a move towards a higher correlation. Several reasons for this might be suggested: 1) the students were more aware of their errors, 2) there were less errors to record which reduced the probability of a difference, and 3) the students were more familiar with the tool. The raw scores support the research that subjects tend to rate themselves higher than the actual performance warranted. It was concluded that student self-evaluation of each step in the task was comparable with instructor evaluation, but as students tended not to recognize critical errors, self-evaluation was not comparable to instructor evaluation.
LIMITATIONS OF THE STUDY

Recognized limitations of the study were:

1. Students may have received feedback by overhearing instructor comments given to other students in the laboratory.

2. Each group of seven to eight students had a different instructor to answer their questions and to identify errors they did not recognize. This introduced a variable in the manner by which a student was given feedback.

3. The study sample was small and restricted to students in a baccalaureate nursing program.

SUMMARY

The research data were analyzed and the results presented in relation to each of the five null hypotheses. An analysis of the critical errors was included to assist with the interpretation of the data. Hypotheses one and three were accepted and hypotheses two, four and five were rejected on the basis of the results. Interpretation of the data generally showed that the Performance Evaluation tool facilitated learning by informing the learner of the standard to be achieved. Self-evaluation using the tool did not make a significant difference to learning the skill during the one hour practice period. A difference was observed in the performance scores one week later, from which it was concluded that self-evaluation facilitated retention of the skill. Student self-evaluation scores were not comparable to instructor evaluation scores in that the students tended to rate themselves higher than their actual performance warranted.
CHAPTER V

SUMMARY, CONCLUSIONS AND RESEARCH IMPLICATIONS

SUMMARY

The purpose of this study was to investigate the effect on learning a psychomotor skill of self-evaluation using a tool describing the standard of performance to be achieved. Two specific questions were explored. Does knowledge of the standard of performance to be achieved and self-evaluation facilitate the learning and retention of a skill? Is student self-evaluation using a performance evaluation tool as effective a method of evaluation as instructor evaluation? In order to answer these questions an experimental study was designed and the following five null hypotheses tested.

1. There is no significant difference in the performance scores of students taught with the Fewster Performance Evaluation Tool on the first performance of a catheterization, when compared to the scores of students not taught with the tool.

2. There is no significant difference in the performance scores obtained by students who used the Fewster Performance Evaluation Tool for self-evaluation, when compared to students who did not use the tool, after one hour of practice.

3. There is no significant difference in the performance scores obtained by students in the experimental group when compared to students in the control group, after one week.
4. There is no significant correlation between the self-evaluation scores recorded by students using the Fewster Performance Evaluation Tool and the observers' scores using the same tool, of the students' first performance.

5. There is no significant correlation between the self-evaluation scores recorded by students using the Fewster Performance Evaluation Tool and the observers' scores using the same tool, of the students' performance after one hour of practice.

A sample of forty student nurses was drawn at random from the second year of a baccalaureate in nursing program. A laboratory was planned to specifically study the type of feedback the students received while learning the psychomotor skill catheterization. Twenty-one students in the experimental group received feedback from an instructor and a performance evaluation tool and nineteen students in the control group received feedback from an instructor, they did not use the tool.

A learning module was prepared which included an introduction to the laboratory with a brief outline of the procedure and a videotaped demonstration of the skill using a retention catheter. A performance evaluation tool was developed for students in the experimental group to use for self-evaluation. Seven observers were trained in the use of the tool for the purpose of scoring the students' performances in the laboratory. The catheterization laboratory was planned according to the following outline.

Prior to the laboratory all students were given the Catheterization Laboratory Introduction to study. At the beginning of the laboratory
the experimental group studied the performance evaluation tool which informed them of the standard to be achieved. Students in the control group did not have this information. Students in both groups observed the videotaped demonstration twice, after which they received instructor feedback during their first performance of the procedure. The experimental group then rated themselves using the Performance Evaluation tool. Both groups practiced for one hour with no feedback from an instructor, the experimental group were able to use the tool for feedback. At the end of the practice period the procedure was performed completely for the second time. The experimental group then used the tool for feedback while the control group received instructor feedback. One week later students in both groups returned to the laboratory to perform the procedure for the purpose of testing the retention of the skill.

Observers rated the students' performance on the first performance, the second performance after one hour of practice, and on the third performance one week later. These scores were used to compare the effect of the different types of feedback on the learning and retention of the skill. A comparison was also made of the scores obtained by students on self-evaluation with those obtained by the observers of the students performances.

The data were analyzed in relation to each of the five null hypotheses. Hypothesis one was rejected, indicating that the performance evaluation tool facilitated learning on the first performance mainly by informing the learner of the standard of performance to be achieved, specifically the critical errors to be avoided. The second null hypothesis was not rejected, indicating that self-evaluation using the performance evaluation tool made no significant difference to learning
the skill during the one hour practice period. The third null hypothesis was rejected and it was concluded that self-evaluation using the tool while learning facilitated the retention of the skill. Both groups demonstrated an improvement in the standard of performance, however, the experimental group achieved a higher standard on the third scored performance. The fourth and fifth null hypotheses were not rejected when the scores were correlated. It was concluded that student self-evaluation was not as accurate as instructor evaluation mainly because students tended not to recognize their critical errors.

CONCLUSIONS

This study found that a performance evaluation tool facilitated learning on the first performance of a psychomotor skill by informing the learner of the standard to be achieved. The standard of performance was enhanced specifically by knowledge of those critical elements of the skill that were crucial to the patient's safety and comfort. While self-evaluation did not make a difference to the learning of the skill during the one hour practice period, it did facilitate retention of the skill. Active participation of the student in the evaluation process reinforced learning and influenced the standard of performance one week later.

The finding that students tend not to recognize their critical errors emphasizes the need of instructor feedback on the first performance of a skill. There was a higher correlation of student self-evaluation scores when compared to observer scores on the second performance. This showed that given the experience in self-evaluation, students are more likely to evaluate themselves realistically.
Students using the performance evaluation tool achieved a higher standard of performance than students who received only instructor evaluation. The final scores were lower than expected because some of the students lacked understanding of the principles of asepsis. Self-evaluation using a criterion-referenced evaluation tool was shown to facilitate the learning and retention of the catheterization skill and can be recommended as a useful technique in teaching a psychomotor skill.

INDICATIONS FOR FURTHER RESEARCH

Since the usefulness of the Performance Evaluation Tool was not tested in the clinical setting, this is a subject strongly recommended for further research. A question still unanswered is, Do students taught to self-evaluate with a criterion-referenced tool achieve a higher standard of performance in the clinical setting? An answer to this question might be used to improve the standard of nursing care and the effectiveness of clinical evaluation.

Further study is needed comparing the effects of self-evaluation on the student's level of self-esteem and confidence. The question of whether a student who self-evaluates while learning a skill is more likely to develop an accountability for her own learning and standard of performance could be explored. The performance evaluation tool was recognized as having both a guidance function and a self-evaluation function. As the separate effects of these functions on learning was not identified in this study, this would be an area for further research.

It would be advantageous to extend this study to other less complex psychomotor skills. Such a study may provide more information
of the effect of self-evaluation using a criterion referenced tool on learning a psychomotor skill.

Finally, the effects of self-evaluation using a performance evaluation tool that includes only the critical elements of the skill such as those behaviours crucial to the patient's safety and comfort, could be compared with a tool that also includes all the steps in the task. This type of study would provide information that could be used to plan more effective teaching methods and to develop more effective evaluation tools.
BIBLIOGRAPHY

A. BOOKS


B. PERIODICALS


McCaffery, Margo. "What is the Student Nurse Learning in the Clinical Laboratory?", The Journal of Nursing Education. (Nov. 1968), p. 4.


C. UNPUBLISHED THESIS

APPENDIX A

DIAGRAM OF EXPERIMENTAL LABORATORY DESIGN
<table>
<thead>
<tr>
<th></th>
<th>EXPERIMENTAL GROUP</th>
<th>CONTROL GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Performance Evaluation tool</td>
<td>x</td>
<td>no tool</td>
</tr>
<tr>
<td>2. Viewed Videotaped demonstration twice</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>3. First performance with instructor feedback</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>4. Self-evaluation using the tool</td>
<td>x</td>
<td>no self-evaluation</td>
</tr>
<tr>
<td>5. Practice Period using tool for feedback</td>
<td>x</td>
<td>x no tool</td>
</tr>
<tr>
<td>6. Second Performance followed by Feedback from the tool</td>
<td>x</td>
<td>x instructor</td>
</tr>
<tr>
<td>7. Third Performance one week later</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>8. Score discussed with student at the end of performance</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
APPENDIX B

INFORMATION TO INSTRUCTORS AND STUDENTS
CATHETERIZATION LABORATORY

INFORMATION TO INSTRUCTORS AND STUDENTS

To: All Instructors
From: M. Fewster
Date: January 3, 1975

Date: See schedule
Time: Please plan for students to attend the lab in two groups

8:30 - 11:30 - 3 or 4 students
10:30 - 13:30 - remainder of students

Instructor is requested to attend the lab to guide and correct the student who does not recognize errors in her performance and to answer student questions.

Information for students

The lab which is a required experience for all students is also part of a master's thesis on a particular method of learning a nursing skill. All students may have access to the results of the study on request.

Student Preparation for the lab.

1. Study Module 14 - Catheterization
2. Review module 3 - principles of surgical asepsis.
   The lab will begin with a pre test of the principles of surgical asepsis.

   The student will:  - open a sterile tray
   - add sterile equipment to a sterile tray
   - maintain sterility of the equipment and tray
   or  - recognize contamination of equipment and tray

3. Review module 4 - putting on sterile gloves.

After the Lab Post-Test

Each student will be asked to return to the lab one week later to perform the catheterization procedure once.
APPENDIX C

CATHETERIZATION - INTRODUCTION
Introduction

There is much concern associated with the catheterization procedure because of the increasing number of urinary bladder inflections with subsequent kidney infections resulting from unskillful technique. Another factor of concern is that the procedure itself can be uncomfortable and embarrassing for the patient. In view of these concerns, it is essential that the nurse has an opportunity to practice and master the catheterization technique before approaching a patient. When the procedure is later performed for a patient, the nurse who has mastered the technique will not only perform the task skillfully, but will also be free to concentrate on reducing the patient's discomfort and embarrassment.

This module is designed to give you the opportunity to practice and to help you master the catheterization technique.

Objectives

1. Applies the principles underlying the catheterization procedure:
   1.1 selects the type of catheter that is appropriate to the purpose of the catheterization.
   1.2 applies principles of safety and comfort.
   1.3 recognizes errors in the application of principles.

2. Demonstrates the catheterization procedure:
   2.1 performs all essential elements in procedure to insert a retention catheter.
   2.2 uses surgical aseptic technique.
   2.3 manipulates equipment and materials with dexterity.
   2.4 performs the task with economy of time and movement.
   2.5 evaluates performance and makes changes to improve.

Prerequisite knowledge and skills

1. Anatomy and physiology of urinary tract  - Zoology 153
2. Principles of surgical asepsis  - Module 3
3. Putting on sterile gloves  - Module 4
4. Care related to the elimination of urine  - Module 11
Objective:
1. Selects the type of catheter that is appropriate to the purpose of the catheterization.

Definition: Catheterization is insertion of a tube through the urethra into the bladder for the purpose of withdrawing urine.

Purposes:
1. To prevent and relieve bladder distention.
2. To prevent complications caused by incontinence of urine.
3. To keep the bladder empty to prevent post-operative damage.
4. To remove residual urine for measurement.
5. To obtain a sterile urine specimen for laboratory examination.

Urinary Catheters

A catheter is a hollow tube made of rubber, plastic or metal. Catheters are graded in size according to the French scale. No. 14 and no. 16 are commonly used for catheterization of the adult female. The larger the lumen of the catheter, the larger the number of the catheter.

LOOK AT THE CATHETERS ON DISPLAY

Types of Catheters

There are many types of catheters, the two types most commonly used are the:
1. Straight rubber catheter.
2. Foley retention catheter.

The straight catheter is used when the catheter does not have to be retained in the bladder. It is removed immediately after the bladder is emptied of urine.

The Foley catheter is used when the catheter has to remain in the bladder. It is a retention catheter. This catheter is kept in place by an inflated balloon.

ANSWER THE FOLLOWING QUESTION

For what purposes would a retention catheter be inserted?

a) 

b) 

c) 

Objective:

1.2 Applies principles of safety and comfort underlying the procedure.

<table>
<thead>
<tr>
<th>Principles</th>
<th>Nursing action to ensure safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The urinary bladder is free of micro-organisms.</td>
<td>-use surgical aseptic technique.</td>
</tr>
<tr>
<td>2. The lower third of the urethra is potentially contaminated.</td>
<td>-cleanse the urinary meatus immediately prior to insertion of the catheter.</td>
</tr>
<tr>
<td>3. The rectal area is contaminated with E. Coli.</td>
<td>-when cleansing proceed from anterior to posterior pelvic floor.</td>
</tr>
<tr>
<td>4. Bacteria may ascend the urethra to the bladder.</td>
<td>-use one swab for each stroke.</td>
</tr>
<tr>
<td>5. Unbroken skin and mucous membrane provide a barrier to micro-organisms.</td>
<td>-good visualization of meatus with light and separation of the labia.</td>
</tr>
<tr>
<td></td>
<td>-use catheter size ordered or appropriate to size of meatus.</td>
</tr>
<tr>
<td>6. Friction and pressure will damage mucous membrane.</td>
<td>-lubricate catheter</td>
</tr>
<tr>
<td></td>
<td>-insert catheter gently</td>
</tr>
<tr>
<td></td>
<td>-discontinue insertion if obstruction is encountered.</td>
</tr>
<tr>
<td></td>
<td>-tape catheter to thigh.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comfort</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Muscle relaxation facilitates the introduction of a catheter into the urethra.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>8. Knowledge of what to expect relieves anxiety and aids relaxation.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Catheterization of Urinary Bladder for Female Patients.

To insert a Retention catheter. Explain procedure to the patient.

1. Wash hands.

2. Assemble all equipment:
   Sterile catheter tray or disposable set,
   1 pair sterile gloves,
   2 Foley catheters size 14 or 16,
   10 cc. syringe,
   Urinary drainage bag,
   Mask,
   Paper bag,
   Protective material - blue pads
   Aqueous Zephiran 1:750.
   Sterile water soluble lubricant,
   Sterile water,
   Adhesive tape and scissors,
   Examination light.

3. Put on a mask

4. Wash hands

5. Open tray: Pour solutions into bowls
   Squeeze lubricant into basin.

6. Open catheter packet - Place inside catheter packet on tray.

7. Open Syringe packet - place on tray.

8. Close tray

9. Take equipment to bedside

10. Open outer cover of tray

11. Put on gloves

12. Inflate balloon with sterile water and deflate - use syringe

13. Lubricate catheter approximately 3 inches.

14. Drape patient with one towel over each thigh and overlapping on bed between thighs.
15. Use forceps, moisten cottonballs in aqueous zephiran and cleanse vulva, separate labia, cleanse urinary meatus.

16. Keeping labia separate pick up catheter approx. 3 inches from tip and insert gently into meatus about 3 inches until urine flows into the basin.

17. Inflate balloon with sterile water

18. Gently draw back on catheter until resistance indicates that the balloon is resting on the bladder neck.

19. Tape catheter to thigh

20. Attach catheter to drainage tubing.

21. Record findings.
APPENDIX D

CATHETERIZATION VIDEOTAPE SCRIPT
SCRIPT FOR DEMONSTRATION OF CATHETERIZATION
DEMONSTRATED BY M. FEWSTER
NARRATED BY D. WRIGHT

1. Preparation of Patient
   - Explain the reason for the procedure.
   - Provide opportunity for questions and discussion.
     e.g. What is the patient's previous experience of
     this procedure?
   - Assess the perineal area and if necessary, wash with
     soap and water.

2. Wash hands.

3. Collect all equipment.
   - Sterile catheter tray or disposable set.
   - 1 pair sterile gloves.
   - 1 Foley catheter size 14, 5 cc balloon, or size ordered.
     (If you predict having difficulty, collect 2 catheters
     and two pairs of gloves)
   - 10 cc Syringe.
   - Urinary drainage bag.
   - Paper bag.
   - Protective material to place under the patient.
   - Adhesive tape
   - Scissors
   - Drape sheet
   - Aqueous Zephran 1:750
   - Sterile water soluble lubricant
   - Sterile water
   - Examination light if one is not available at the bedside.

4. Put on a mask.

5. Wash hands.

6. Open tray using aseptic technique.
   - Pour solutions. Squeeze lubricant into basin.
     Remove catheter from packet and place on tray.
     Remove syringe from packet and place on tray.
   - Close tray.

7. Place tray on overbed table at the foot of the bed.

8. Stand on the right side of the bed if you are right handed.

9. Pull the drapes to ensure privacy.
10. Place the patient in a flat, dorsal position with one or two pillows.

11. Fold bed linen to foot of bed and drape with a sheet.

12. Position bed at a convenient height, to prevent back strain and for ease of movement.

13. Position lamp so that light falls directly on the perineal area.


15. Attach urinary bag to bed and pin tubing to bed.

16. Position patient's legs, flex knees, spread apart with slight external rotation. You may require assistance if patient is unable to hold this position. Pillows may also be used to support legs.

17. Adjust the light.

18. Open outer cover of tray.

19. Put on sterile gloves.

20. Open inner cover of tray.

21. Remove catheter from packet.
   Inflate balloon with sterile water to test for patency and to check that balloon will deflate.
   Deflate balloon and lubricate the tip of the catheter approximately 3". Place the catheter in the basin with the lubricant.

22. Position sterile drapes. Place one towel over each thigh overlapping on bed between thighs.

23. Arrange equipment in order of use. Place materials for cleansing so that reaching over the sterile field is avoided, this reduces the risk of contamination.

24. Pick up cotton balls with forceps.
   Gently cleanse labia majora with downward strokes towards the rectum.
   Use one swab for each stroke.

25. Place thumb and one finger between labia minora, separate and pull up to facilitate good visualization and cleansing. This hand is now considered unsterile.
26. Identify urinary meatus and vagina to avoid confusing the two. The meatus appears as a dimple approximately mid-way between the clitorus and the vagina. Be aware that there are many variations of its position.

27. Keep hand in position so that the labia do not close over the meatus, as this would contaminate the area.

28. Pick up the lubricated catheter holding it at least 3" from the tip.

29. Ask the patient to take a deep breath and exhale as you insert the catheter.

30. Insert the catheter using a smooth, steady movement. Place directly into the meatus about 3", until the urine flows into the basin.

31. Withdraw the catheter if you meet an obstruction.

32. Discard the catheter if it touches an unsterile object.

33. Transfer hand from labia to hold catheter in position.

34. Inflate balloon with the amount of sterile water indicated on the catheter, e.g. 5 cc or 30 cc (15 cc).

35. Gently draw back on catheter until resistance indicates that the balloon is resting on bladder neck.

36. Attach catheter to drainage tubing.

37. Remove gloves.

38. Tape catheter to thigh.

   - Dry vulva, remove protective material.
   - Position comfortably.
   - Pin tubing securely.

40. Check that urine is draining.

41. Discard equipment.

42. Wash hands.

43. Record and report findings.
   - Size and type of catheter used.
   - Colour, character and amount of urine.
   - Any abnormalities - unusual discomfort experienced by patient difficulties in inserting catheter.
APPENDIX E

PERFORMANCE EVALUATION TOOL
Use of Evaluation Tool by Student

1. Observe video tape of catheterization procedure

2. Read evaluation tool
   - note the behaviours critical to a successful performance marked with (*)
   - note the critical errors that result in an unsuccessful performance (on page 3)

3. Practice the procedure without reference to the tool.

4. After performing the procedure, evaluate your performance using the tool.

5. Perform procedure again including corrections identified on evaluations.
## PERFORMANCE EVALUATION TOOL

### Insertion of a Retention Catheter into the Bladder

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Prepare patient:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. explain reason for procedure</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. look at perineal area to assess cleanliness</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c. wash perineal area if necessary</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2. Wash hands</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>3. Assemble all equipment:</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>a. sterile catheter tray or disposable set</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. 1 pair sterile gloves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. 1 Foley catheter, size 14, 5 cc. or as ordered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. .10cc syringe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. urinary drainage bag</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. paper bag</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. blue pad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. aqueous zephiran 1:750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. sterile water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. sterile water soluble lubricant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. mask</td>
<td></td>
<td></td>
</tr>
<tr>
<td>l. adhesive tape</td>
<td></td>
<td></td>
</tr>
<tr>
<td>m. scissors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n. examination light</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Put on a mask</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>5. Wash hands</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>6. Prepare tray, maintain sterility of materials on tray</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. open tray: use aseptic technique</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. pour solutions into bowls. Pour aqueous zephiran into bowl with swabs</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c. squeeze lubricant into basin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. open Foley catheter packet, place inside catheter packet on sterile tray</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>e. open syringe packet, place syringe on tray</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>f. close tray</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7. Place tray on overbed table across foot of bed</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>8. Pull drapes, close securely</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Position bed at working height</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13</strong></td>
<td></td>
</tr>
</tbody>
</table>
10. Prepare Patient:
   a. place in a flat dorsal position 1
   b. fold bedlinen to foot of bed 1
   c. drape with a sheet 1
   d. place blue pad under buttocks 1

11. Attach paper bag to bed 1

12. Open urinary drainage bag, and fix to bed 1

*13. Position patient's legs, flex knees and spread apart with external rotation as far as is comfortable - support with pillows if necessary 2

*14. Position lamp so that the light falls on perineum

15. Open outer cover of tray 1

16. Put on sterile gloves 1

17. Open inner cover of tray 1

18. Remove catheter from packet, inflate balloon
   use syringe and sterile water, deflate balloon 1

19. Lubricate catheter approximately 3 inches, place in basin

20. Position drapes, one towel over each thigh overlapping on bed between thighs 1

21. Cleanse vulva: place bowl with swabs on towel between legs 1
   a. pick up moistened cotton balls with forceps 1
   b. gently cleanse labia with downward strokes 1
   c. use one swab for each stroke and discard into paperbag 1
   * d. place thumb and one finger between labia minora, separate and pull up 1
   * e. cleanse vestibule until it looks absolutely clean 2

*22. Identify urinary meatus and vagina

23. Insert catheter:
   * a. keep hand in position so that labia does not close over meatus 1
   b. place basin with catheter on towels between legs 1
   c. pick up catheter, hold at least 3" from tip 1
   d. ask patient to take a deep breath and exhale 1
   * e. insert catheter directly into meatus, use a smooth steady movement while patient is exhaling 2
   f. gently push catheter into urethra approx. 3" until urine flows into the basin 1

Total 27
* g. withdraw if you encounter an obstruction
* h. discard catheter if it touches an unsterile object
  i. transfer hand from labia to hold catheter in position
* j. inflate balloon with sterile water
  k. gently draw back on catheter until resistance is felt
24. Attach catheter to drainage tubing
25. Remove gloves
26. Tape catheter to thigh
27. Make the patient comfortable:
   a. remove towels - dry vulva
   b. position comfortably
   c. adjust drainage tubing
   d. lower bed to original height
28. Discard equipment
29. Wash hands
30. Record and report findings:
   a. size and type of catheter inserted
   b. colour, character and amount of urine
   c. any abnormalities

Total 10

Critical Errors Observed

1. Continuing to use equipment as being sterile when it is contaminated.
2. Not cleansing vestibule and meatus.
3. Allowing labia to close over meatus and inserting the catheter without recleansing.
4. Attempting to insert the catheter when unable to see meatus clearly.
5. Using an unlubricated catheter.
6. Pushing catheter into urethra against an obstruction.

If one or more of the above are observed deduct 25 points from the total score.

Total score page 1
Total score page 2
Total score page 3
Deduct
Total

Time Taken 1._______

2._______  STUDENT NUMBER________________
APPENDIX F

CATHETERIZATION LABORATORY EVALUATION
CATHETERIZATION LABORATORY EVALUATION

   a) State the steps or terms not clearly understood on the tool.

   b) Suggest ways of stating steps to make them more clearly understood.

   c) Comment on method of scoring.

   d) Any other comments.

2. Videotape of catheterization procedure.
   a) Comment on video-tape as a method of teaching this procedure.

   b) State steps you would have preferred to see:
      i. more clearly
      ii. for a longer time.
      iii. for a shorter time.

   c) Comment on narration.
APPENDIX G

TABLE OF INTER-RATER RELIABILITY TEST
The Correlation Coefficients of Student Performance Scores Obtained by Different Observers

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>OBSERVER A</th>
<th>OBSERVER B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>4</td>
<td>49</td>
<td>45</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>24</td>
</tr>
<tr>
<td>6</td>
<td>22</td>
<td>23</td>
</tr>
</tbody>
</table>

\[ r = 0.993^* \]

\* \( p < 0.01 \) significance level
APPENDIX H

TABLES RELATED TO ANALYSIS
OF STUDENT PERFORMANCE SCORES
TABLE 12

Comparison of Scores Obtained by Control and Experimental Groups on the First Performance of a Catheterization

MANN - WHITNEY U TEST

<table>
<thead>
<tr>
<th>CONTROL GROUP SCORES</th>
<th>RANK</th>
<th>EXPERIMENTAL GROUP SCORES</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>40</td>
<td>46</td>
<td>39</td>
</tr>
<tr>
<td>43</td>
<td>33</td>
<td>45</td>
<td>37.5</td>
</tr>
<tr>
<td>42</td>
<td>31</td>
<td>45</td>
<td>37.5</td>
</tr>
<tr>
<td>42</td>
<td>31</td>
<td>44</td>
<td>35.5</td>
</tr>
<tr>
<td>37</td>
<td>27</td>
<td>44</td>
<td>35.5</td>
</tr>
<tr>
<td>23</td>
<td>26</td>
<td>43</td>
<td>33</td>
</tr>
<tr>
<td>21</td>
<td>23</td>
<td>43</td>
<td>33</td>
</tr>
<tr>
<td>19</td>
<td>18</td>
<td>42</td>
<td>31</td>
</tr>
<tr>
<td>18</td>
<td>12</td>
<td>39</td>
<td>28</td>
</tr>
<tr>
<td>18</td>
<td>12</td>
<td>22</td>
<td>24.5</td>
</tr>
<tr>
<td>18</td>
<td>12</td>
<td>22</td>
<td>24.5</td>
</tr>
<tr>
<td>18</td>
<td>12</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>17</td>
<td>8</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>17</td>
<td>8</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>17</td>
<td>8</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>16</td>
<td>5.5</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>12</td>
<td>2.5</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>2.5</td>
</tr>
</tbody>
</table>

\[ R_1 = 314 \quad R_2 = 502 \]

\[ U = 275 \]
\[ T = 40.5 \]
\[ z = 275 - \frac{19 \times 21}{2} \]
\[ \frac{275}{40(39)} - 40 \]
\[ \frac{\sqrt{\left(40^3 - 40\right)^2}}{12} \]
\[ z = 2.05 \]
\[ p = 0.0404^* \]

\[ *p \text{ is equal to or less than 0.05 level} \]
TABLE 13
Scores Excluding Deductions for Critical Errors of the Control and Experimental Groups on the First Practice and After One Hour of Practicing Catheterization

<table>
<thead>
<tr>
<th>First Performance Score</th>
<th>Performance Score After One Hour of Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>Experimental Group</td>
</tr>
<tr>
<td>48</td>
<td>47</td>
</tr>
<tr>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>44</td>
<td>45</td>
</tr>
<tr>
<td>43</td>
<td>45</td>
</tr>
<tr>
<td>43</td>
<td>45</td>
</tr>
<tr>
<td>43</td>
<td>45</td>
</tr>
<tr>
<td>43</td>
<td>45</td>
</tr>
<tr>
<td>43</td>
<td>44</td>
</tr>
<tr>
<td>42</td>
<td>44</td>
</tr>
<tr>
<td>42</td>
<td>44</td>
</tr>
<tr>
<td>42</td>
<td>44</td>
</tr>
<tr>
<td>42</td>
<td>43</td>
</tr>
<tr>
<td>42</td>
<td>43</td>
</tr>
<tr>
<td>41</td>
<td>43</td>
</tr>
<tr>
<td>38</td>
<td>43</td>
</tr>
<tr>
<td>37</td>
<td>43</td>
</tr>
<tr>
<td>37</td>
<td>42</td>
</tr>
<tr>
<td>36</td>
<td>41</td>
</tr>
<tr>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>37</td>
<td>37</td>
</tr>
</tbody>
</table>
TABLE 14

Comparison of Scores Obtained by Control and Experimental Groups on the Performance of a Catheterization after One Hour of Practice

MANN-WHITNEY U TEST

<table>
<thead>
<tr>
<th>CONTROL GROUP SCORES</th>
<th>RANK</th>
<th>EXPERIMENTAL GROUP SCORES</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>39</td>
<td>50</td>
<td>39</td>
</tr>
<tr>
<td>49</td>
<td>33</td>
<td>49</td>
<td>33</td>
</tr>
<tr>
<td>49</td>
<td>33</td>
<td>49</td>
<td>33</td>
</tr>
<tr>
<td>49</td>
<td>33</td>
<td>49</td>
<td>33</td>
</tr>
<tr>
<td>49</td>
<td>33</td>
<td>49</td>
<td>33</td>
</tr>
<tr>
<td>48</td>
<td>25.5</td>
<td>48</td>
<td>25.5</td>
</tr>
<tr>
<td>47</td>
<td>20.5</td>
<td>48</td>
<td>25.5</td>
</tr>
<tr>
<td>47</td>
<td>20.5</td>
<td>48</td>
<td>25.5</td>
</tr>
<tr>
<td>46</td>
<td>17</td>
<td>48</td>
<td>25.5</td>
</tr>
<tr>
<td>46</td>
<td>17</td>
<td>47</td>
<td>20.5</td>
</tr>
<tr>
<td>45</td>
<td>15</td>
<td>47</td>
<td>20.5</td>
</tr>
<tr>
<td>24</td>
<td>13</td>
<td>46</td>
<td>17</td>
</tr>
<tr>
<td>22</td>
<td>9</td>
<td>46</td>
<td>17</td>
</tr>
<tr>
<td>20</td>
<td>6</td>
<td>42</td>
<td>14</td>
</tr>
<tr>
<td>19</td>
<td>4.5</td>
<td>23</td>
<td>11.5</td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>23</td>
<td>11.5</td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>22</td>
<td>9</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>22</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>19</td>
<td>4.5</td>
</tr>
</tbody>
</table>

\[ U = 231 \]
\[ T = 85.5 \]
\[ z = \frac{231 - 19 \times 21}{2} \]
\[ \sqrt{\frac{231}{40(39)}} \left(\frac{40^3 - 40}{12} - 85.5\right) \]
\[ z = 0.8606 \quad p \approx 0.3989^* \]

*not significant, p is greater than 0.05 level
### TABLE 15
Comparison of Scores Obtained by Control and Experimental Groups on a Performance of a Catheterization One Week After the First Performance

**MANN-WHITNEY U TEST**

<table>
<thead>
<tr>
<th>CONTROL GROUP SCORES</th>
<th>RANK</th>
<th>EXPERIMENTAL GROUP SCORES</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>27</td>
<td>50</td>
<td>27</td>
</tr>
<tr>
<td>50</td>
<td>27</td>
<td>50</td>
<td>27</td>
</tr>
<tr>
<td>49</td>
<td>21</td>
<td>50</td>
<td>27</td>
</tr>
<tr>
<td>48</td>
<td>15.5</td>
<td>50</td>
<td>27</td>
</tr>
<tr>
<td>48</td>
<td>15.5</td>
<td>50</td>
<td>27</td>
</tr>
<tr>
<td>48</td>
<td>15.5</td>
<td>49</td>
<td>21</td>
</tr>
<tr>
<td>47</td>
<td>11.5</td>
<td>49</td>
<td>21</td>
</tr>
<tr>
<td>46</td>
<td>9.5</td>
<td>49</td>
<td>21</td>
</tr>
<tr>
<td>44</td>
<td>7.5</td>
<td>49</td>
<td>21</td>
</tr>
<tr>
<td>44</td>
<td>7.5</td>
<td>48</td>
<td>15.5</td>
</tr>
<tr>
<td>41</td>
<td>5</td>
<td>48</td>
<td>15.5</td>
</tr>
<tr>
<td>21</td>
<td>2.5</td>
<td>48</td>
<td>15.5</td>
</tr>
<tr>
<td>21</td>
<td>2.5</td>
<td>47</td>
<td>11.5</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>46</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>42</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>4</td>
</tr>
</tbody>
</table>

\[ R_1 = 168.5 \quad R_2 = 296.5 \]

\[
U = 160.5 \\
T = 57.5 \\
z = \frac{160.5 - 14 \times 16}{2} = \frac{\sqrt{160.5 \left( \frac{30^3 - 30 - 57.5}{12} \right)}}{30(29)} \]

\[ z = 2.3716 \quad p = 0.0178^* \]

* significant \( p < 0.05 \)
TABLE 16

Scores Excluding Deductions for Critical Errors of the Control and Experimental Groups One Week After the First Performance of a Catheterization

<table>
<thead>
<tr>
<th>CONTROL GROUP</th>
<th>EXPERIMENTAL GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>49</td>
<td>50</td>
</tr>
<tr>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>48</td>
<td>49</td>
</tr>
<tr>
<td>48</td>
<td>49</td>
</tr>
<tr>
<td>47</td>
<td>49</td>
</tr>
<tr>
<td>46</td>
<td>49</td>
</tr>
<tr>
<td>46</td>
<td>49</td>
</tr>
<tr>
<td>46</td>
<td>48</td>
</tr>
<tr>
<td>45</td>
<td>48</td>
</tr>
<tr>
<td>44</td>
<td>48</td>
</tr>
<tr>
<td>44</td>
<td>48</td>
</tr>
<tr>
<td>41</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>42</td>
</tr>
</tbody>
</table>