MOTOR SKILL ACQUISITION IN NURSING

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A survey of nursing education has revealed that motor skills in nursing have been taught in one of two ways. In the first approach, each nursing motor skill is taught as an entity with little regard to the underlying principles. The second approach is completely opposite to the first. The learning focus is on the principles involved in each technique. The student must deduce how a technique is to be performed.

Both of these approaches have limitations — shortcomings that nurse educators are quick to point out. In both learning situations, the student is so preoccupied with the mastery of the motor skill that little time or energy is left to develop intellectual nursing skills. This limitation has led nursing educators to re-evaluate how motor skills are learned.

A review of the learning theories shows research has been done on the acquisition of motor skills. This review suggests the cybernetic theory of learning is most adaptable to the teaching of nursing skills.

This paper will examine the cybernetic theory of learning and its application in the nursing setting. First, a motor skill will be defined, the characteristics of a skilled act will be discussed and the stages in the learning of a skill will be examined. Implication for nursing education will follow.

DEFINITION

The word skill has several usages. When the emphasis is on the activity or the achievement, such as driving a car or preparing a dressing, skill is defined as "a particular, more or less complex activity which requires a period of deliberate training and practice to be performed and which often has some recognized useful function" (Borger and Seabourne 1966: 127). This definition stresses the approach that the skill has been achieved through learning.

Another use of the word skill places emphasis on the level of performance of the individual, rather than on the characteristics of the task. In this context, a person is referred to as a skilled individual, such as a skilled operating room nurse or a skilled golfer.

However, an operational definition of the word skill is often more useful because it examines the mechanisms involved. Fitts (1964: 244) offers this excellent operational definition of a skill:

> . . . one in which the receptor-effector-feedback processes are highly organized, both spacially and temporally. The central problem for the study of skill is how such organization and patterning takes place or comes about.

This definition stresses the integration of the sequence of action during the performance of a skill and emphasizes the constant use of the information received from the senses. It is obvious that the operational definition of a skill is the most useful in terms of learning theories.

CHARACTERISTICS OF A SKILLED ACT

Four basic elements constitute a skilled performance. A skilled act (1) involves a chain of motor responses, (2) requires the coordination of perceptual input with these motor responses, (3) involves an hierarchy of responses, and (4) depends heavily on feedback. Each of these elements will be discussed briefly.

In a highly developed motor skill, a chain of responses is established where one response serves as a stimulus for the next. This creates a chain of responses. Tying a tie is an example of this situation.

Secondly, in a motor skill, the perceptual input is coordinated with the motor responses. The way an individual perceives a situation will determine the action she initiates. This is readily seen in sports activities such as baseball or hockey.

Thirdly, any complex task can be broken down into a series of subroutines. These subroutines can be taught separately and later reorganized to form the integrated pattern of the complex task, governed by the over-all plan. Subroutines are fixed and run off automatically once the sequence is established. The subroutines will be repeated over and over again unless they are changed by the over-all plan. Fitts and Posner (1967:57) suggest that adults learn new skills by reorganizing or repatterning existing subroutines. Thus it becomes imperative that children be exposed to a wide variety of motor experiences in their early years to insure an adequate level of subroutines.

Temporal patterning reflects the capacity of the respondant to integrate the subroutines into a smooth complex movement. This quality of a complex skill refers to the time that has elapsed between the execution of each subroutine, rather than the total time needed to complete a movement.

Finally, feedback is one of the most important characteristic of a skilled performance. Feedback can be classified as (a) intrinsic and (b) extrinsic.

Intrinsic feedback "refers to the fact that responses produce stimuli which have consequences for subsequent responses" (Ellis 1972:11-12 and 194).

Extrinsic feedback is the information the learner receives about his performance from a second person. The extrinsic feedback can be either quantitative or qualitative. Quantitative feedback indicates the amount of discrepancy that exists between the correct response and the response given. Qualitative feedback indicates whether the performance is correct or not. As a rule, learners appreciate quantitative feedback because it enables them to make precise corrections in their performance.

It can be seen from this approach that feedback has two properties. First, it informs the learner as to the effectiveness of his performance. Second, feedback has reinforcing properties that tend to reward the appropriate performance. Unfortunately, these two properties of feedback are difficult to separate. In cases where humans were required to learn motor skills without feedback, no appreciable evidence of improvement was noted, when compared to an external frame of reference. However, in certain situations man has been observed to perform according to a subjective criteria for performance.

This raises the question of feedback withdrawal. It has been noted that the effect of withdrawing feedback is dependent upon the level of training. The performance will deteriorate with the withdrawal of feedback if the level of training is low or moderate. However, after an extended training session, little or no decrease in performance is noted. Psychologists have suggested that after periods of practice in which external feedback is received, the standard for the correct response is internalized. By this notion, self-reinforcement is a form of internal feedback that has developed over a series of trials with external feedback.

STAGES OF LEARNING A SKILL

Although the learning of a skill is largely a continuous process, three principal phases of learning have been identified. The phases are not rigidly defined and tend to gradually merge together. However, the identification of these phases facilitates the study of skill learning. The classification system described in this paper is the system proposed by Margaret Robb (1972:51-73). Utilizing the work done by Paul Fitts, Robb has suggested three phases of motor skill learning: the plan formation, the practice session, and the execution.

PLAN FORMATION

In this initial phase, the learner must understand what is expected for the mastery of the skill. Fitts (1965:178) identified this first phase of learning as the "cognitive phase". After the learner has grasped the nature of the skill and its objectives, she will establish an executive or over-all plan. In her attempt to establish this executive plan, the learner will first intellectualize the skill by verbalizing the related concepts. She will then identify the sequence of the subroutines necessary to complete the task. This will be done within the capacities and limitations of the receptor and perceptual mechanisms of the learner.

The receptor mechanism in the learner consists of her ability to detect and recognize the appropriate signals. This ability will be influenced, among other things, by the intensity of the stimulus. If a stimulus stands out in contrast with the background, it is more likely to be detected. For example, a beginner in tennis may find it easier to see a red ball against a grey background as compared to a white one.

. The sensory capacities of the learner will either enhance or limit her receptor abilities. Limited ability in depth perception, vision and hearing may greatly reduce one's ability to learn a skill. Furthermore, no amount of practice will improve sensory acuity. The problem is illustrated by a student nurse with a certain loss of hearing, who tries to learn to read a sphygmomanometer. No amount of practice will improve her skill.

Man is also limited in his capacity to interpret more than one stimulus coming from different sensory sources. This situation is dealt with in one of two ways: either some material is placed in a holding pattern and dealt with at a later time, or the stimulus is simply ignored as irrelevant information. For example, in a crowded room a person will only hear one person talking, or the music playing.

The perceptual mechanism of man interprets the information received by the senses. It is sometimes difficult to separate man's sensory capacities from his perceptual processes. Man's choice of stimuli in this case is determined by the perceptual process. In learning a new skill, the student may be uncertain as to the focus of her attention. Some will be unable to see a movement pattern. In such a case, a verbal description may be helpful. Others may need to experiment with the pattern themselves to grasp the sequential pattern of the subroutines. Other students have difficulty in the discrimination of relevant and irrelevant information. If too much information is given during the performance of a skill, a selection process takes place. Some information will be processed, the remainder will be filtered

out. It is interesting to note that when a student views the demonstration of a skill which is also being explained, the student may not process all the information available.

In summary, the student must formulate an executive plan after she has understood what she is to do. During this first phase of motor skill learning, the student's receptor and perceptual mechanisms will determine to what extent she will be able to reach her goal, the mastery of a new skill.

THE PRACTICE SESSION

Once the learner has mapped out her executive plan, she must practice to fix the sequential order of responses in her system. Fitts (1965: 183) calls this practice session "the fixation phase". The amount of practice needed to achieve this end will depend on the complexity of the skill and the capacities and past experience of the learner.

During this second phase, the learner must master the delicate balance of timing and the control of each subroutine. She may also need to refine her coordination. At times this may prove difficult. Like the first phase, the learner's receptor and perceptual mechanisms will provide the necessary information to detect and process the appropriate stimuli.

Studies have been undertaken to investigate the length of practice session necessary to provide optimal learning. Kientzle (1946) found that performance is enhanced by mass practice, especially if the skills result in fatigue or boredom. Smith and Smith (1966: 38) demonstrated that a series of short practice sessions is more efficient than the same amount of practice in one continuous session. However, there is no optimal schedule for the learning of all skills. Factors such as the complexity of the task, the learner's capacity, her limitations, and her motivation should be analysed to determine the optimal practice session.

Fleishman, in a series of studies published in 1972, investigated the importance of practice in the acquisition of a skill. The results indicated that as practice continues, changes occur in the particular combination of abilities contributing to the performance. Fleishman found as well that these changes are progressive and systematic, and eventually become stabilized. There appears to be no single schedule for the learning of all skills.

The schedule of practice leads to the topic of whole and part learning. When a complex task is divided into its parts, the practice of each part is a shorter practice unit than the practice of the whole. However Annett and Kay (1956) point out that the decision about what constitutes a part is not normally made in a logical manner. As

Robb (p. 64) has illustrated "many a task is complicated by separating it into its parts". The nature of a skill as well as its temporal patterning should be carefully analyzed to determine the dependency of the various subroutines.

Practice for practice's sake is not sufficient — it must be accompanied by feedback. When a learner has an executive plan, she will know when she has achieved the expected results. However if her performance is not to her liking, the student may not know where in the sequence of subroutines she has erred. For those students who perform poorly, the teacher should offer meaningful feedback. This should include the identification of the error to the student, followed by a suggestion to correct the error. Errors are necessary to learning because they stimulate feedback and are vital for eventual success.

This second stage of mastering a skill consists of meaningful practice with appropriate feedback. This fixation period usually takes a longer period than the first phase, when the executive plan is established.

AUTOMATIC EXECUTION
In the third phase, the learner, now exhibiting a decrease in stress and anxiety, is able to perform the skill with a certain ease. Fitts (1965: 180) labels this phase the "automatic phase". This implies that the learner can execute the over-all plan without effort. The sequence has thus been relegated to a lower level.

The student can only concentrate on some other factor related to the task when the movement pattern has become automatic. Teachers frequently make the premature assumption that this phase has been reached. In the nursing setting, an instructor might exhibit this tendency in the comment: "Your dressing was well done, but you hardly said a word to the patient". Unless the student has reached the third phase in performing a dressing, she will be unable to conduct a therapeutic conversation with her client.

It must be remembered that learning proceeds over a long period of time, and seldom stops. This third phase is rarely completed. The phase is concluded when the learner relegates the acquired skill to a lower level. This indicates mastery of the skill.

The process of learning a skill has been divided into three phases. The first phase consisted of the formation of an executive plan. It also involved the identification of the sequence of subroutines involved in the task. The second concentrated on the practice of the skill in connection with feedback. Finally, the student reached the third phase where the execution of the skill was automatic, and relegated to a lower level.

IMPLICATIONS FOR NURSING EDUCATION

In planning for the acquisition of motor nursing skills, the phases can be applied as follows.

Phase I would emphasize student understanding of the motor skills to be undertaken. The student must understand what she is to do. She is formulating her executive plan, and defining her objectives. The teacher must support the student by offering live demonstrations of the techniques. During the demonstration, the teacher will restrict her comments to the description of the sequences of the skill. Other superfluous information could cause the student to filter out the details of the demonstration as irrelevant information. Other audio-visual aids, such as a film, a film-loop, or a videotape may be used instead of the live demonstration. However, careful selection of these aids should be made to avoid unnecessary and distracting information.

Students should be encouraged to handle unfamiliar equipment to obtain a feel for it. In this way, students can use their auditory, visual and perceptual modes to formulate their executive plan. Before the students begin the practice phase of learning a skill, they should be able to verbalize their executive plan to the teacher. In this way, potential problems caused by omissions or misinterpretation of the subroutines may be identified and remedied. The length of time spent in this phase will vary from a few minutes to over an hour.

Once the student has established her executive plan, she is ready to enter Phase II. The practice session is the time the student will internalize the new skill. A simulator model in the nursing laboratory can provide the students with an almost real situation with a minimum of stress.

Demonstrations, usually in the form of film loops or video-tapes, may be used to provide a comparison of the proper practice, and the student's performance.

The teacher's role during Phase II is to provide external feedback in the form of quantitative information. Thus, the evaluation of the student's performance will state how much discrepancy exists between the student's response and the correct one.

The decision to divide a technique into sections or components should be made in consultation with the students. For example, the technique of catheterization is made up of three separate techniques: gloving, the preparation of a sterile field, and the actual catheterization. Each part can be mastered separately and then practiced as a whole.

Students should be encouraged to practice in several short practice sessions. Studies have shown that these are more productive than one long session. The number of practice sessions will depend on the student's ability and the complexity of the task.

The transition between Phase II and Phase III is a gradual one. The student will have reached this phase when she can exhibit the new skill with ease, in the absence of anxiety and stress. Once the student has reached this stage, she should demonstrate her new skill in an actual situation with a client. The student should go to the clinical laboratory with one objective — to practice that one skill. The number of practice sessions would depend on the need of the student and the experiences available in the clinical setting. Again in this phase the teacher would offer feedback to the student in the form of quantitative information. Gradually, during this stage, external feedback would become unnecessary because the student's knowledge of the correct form of the new skill would serve as internal feedback.

Once all the basic nursing skills have been mastered in this manner, the student would be ready to return to the clinical setting to deliver total client care. She would be in a position to develop her intellectual nursing skills with the mastery of motor skills nearly complete. Simultaneously, the student would be in a good position to assume greater responsibility for the care she delivers.

CONCLUSION

Nursing consists of motor and intellectual skills. Faced with the responsibility of client care, student nurses place a high priority on the mastery of motor skills. This priority exists because the lack of these technical skills is most obvious to everyone — the client, the clinical instructor and the student. This has meant the relegation of intellectual skills to an inferior status.

It is proposed that at the beginning of a nursing program, a certain period of time should be set aside for students to master the basic motor skills. The learning strategy proposed is based on the cybernetic theory. The application of the theory to the nursing setting illustrates how motor skills could be taught efficiently and effectively.

Once they have mastered these basic motor nursing skills, the students will be in a better position to develop the intellectual skills relevant to nursing. Thus, a better delivery of nursing care should result.

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This author says students place a high priority on the mastering of motor skills. What do you think of her approach to teaching these skills? Do you have other ideas? If so, please take time to write a letter to the editor, so we may have as much input as possibile in this area of teaching.—Ed.

L'auteur souligne que les étudiants valorisent beaucoup la maîtrise des habiletés motrices. Que pensez-vous de son approche dans l'enseignement de ces habiletés? Avez-vous d'autres suggestions? Si oui, n'hésitez pas à écrire une lettre à la rédaction afin d'augmenter l'apport dans ce domaine d'enseignement.

L'acquisition de l'habileté motrice en nursing

Cet exposé propose un plan basé sur la cybernétique pour favoriser l'acquisition de l'habileté motrice en nursing.

Quoique l'acquisition d'une habileté motrice soit un processus continu, trois phases distinctes ont été identifiées pour en faciliter l'étude:

1) La formulation d'un plan d'exécution. Dans cette phase initiale, l'élève doit avoir une vue d'ensemble de la technique à maîtriser. Ensuite, il élabore un plan d'exécution qui comprend la verbalisation des concepts pertinents et l'identification des étapes nécessaires pour compléter la technique.

2) La session de pratique. Durant la session de pratique, l'élève doit maîtriser les étapes de la technique dans un temps donné. Le nombre de sessions dépend surtout de la complexité de la technique, ainsi que des talents et des expériences de l'élève. A partir de son plan, l'élève peut déterminer s'il maîtrise la technique avec un minimum de stress et d'anxiété. Sinon le professeur peut identifier les lacunes à l'aide du feed-back.

3) L'exécution automatique. L'élève a maintenant acquis un niveau d'habileté suffisant pour exécuter la technique presque sans effort. Il peut donc se concentrer sur d'autres aspects reliés à la technique tel que la conversation avec le client. C'est la maîtrise de la technique.

En se servant des trois phases, un plan est proposé pour l'enseignement des techniques en nursing.