EFFECT OF REVIEW AND ITS FORMAT ON STUDENT PERFORMANCE OF A "MIXED ACTIVITY"

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CHAPTER I

INTRODUCTION AND OVERVIEW

As Physical Therapy education faces a rapidly expanding body of knowledge plus growing complexity in specialized areas, the capacities of students, teachers, and curriculums are being strained. The student is being challenged to acquire more knowledge, to develop the capacity to make decisions, and to gain more skills than ever before. The teacher is required to keep pace with this rapid increase in the amount of knowledge, to present it to students in a way which facilitates learning, and to cope with greater demands on time and effort due to increased student enrollments. The curriculum has major sections of instruction which were unheard of ten years ago. Clearly this growth and changing direction should not seriously compromise the basic body of knowledge and skill obtained by the students; yet the time allotted for undergraduate physical therapy education has not increased. Physical therapy educators are thus facing the rather formidable task of finding ways to deal with these demanding changes.

The response of educators has varied. Use of instructional media has blossomed. Many schools offer courses at least partially taught through the use of closed circuit television. Packages of programmed instruction in many areas are available for study. These techniques serve to make time available for the teacher to pursue

in lecture and in conference new and provocative developments. More and more of the onus of learning is being placed on the students.

In the past, time for review classes in physical therapy was built in as an integral part of the course. Today, with the pressure of increased content, the majority of teachers hold only a very brief, if any, form of review and expect the student to conduct his own review independently. This may be successful in cognitive areas where subjects are widely written about and texts are easily available. In subject areas where improved psychomotor skills and judgments are demanded, independent review is more difficult. Instructive texts are less readily available and students are required to rely upon notes taken in class. These are often incomplete or frankly erroneous and in any case only provide a description of what should be done. Unfortunately, they do not allow visual presentation of performance or the opportunity for students to reinforce learning through practice. Unlike verbal information, a forgotten skill cannot be regained through reading about it.

If learning is the objective of the education process and is defined as a relatively permanent change in behaviour which is the result of reinforced practice[1], it stands to reason that in some way the students must be provided with opportunity and instructional materials that will make learning effective. If the learning of physical therapy skill requires reinforced practice, methods will

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[1]Gregory A. Kimble, and N. Garmezy, Principles of General Psychology, Second Edition, New York: Ronald Press, 1963, 150.

have to be developed whereby a student can be guided in this necessary practice without consuming precious classroom hours. Self-instructional materials may be one answer that will make review efficient and effective and have a positive outcome in terms of student performance.

The problem in this study is that of review. If a physical therapy teacher prepares a structured review - a specific instructional sequence which has been previously taught - either for use during class time or use by students in their free time, how is she assured that it will benefit the students and reinforce knowledge and skill? How does the teacher know which format of a structured review will increase the efficiency of the learning process, aid in retention of the subject matter, and make the best use of student and teacher time? These are the questions to which the present study addresses itself.

Overview of the Thesis

Chapter Two presents a review of the literature. After a general comparison of methods used in universities, it examines modes of teaching in the Health Sciences, especially where the outcomes of learning demand advances in the cognitive, affective and psychomotor domains. Since the major question in this study concerns review and retention, the literature in this area is reviewed and found to have major gaps in comparing various formats of review generally. There is a paucity of information dealing with review in Health Science teaching.

Since this experiment in content is concerned with the evaluation of the clinical performance of students, it was necessary to review one further area in the literature. This area deals with how students can be evaluated for clinical competence, when competence must be assessed in intellectual, affective and psychomotor spheres of activity. Several studies in the literature offered a potential tool which served as an evaluation instrument in this study.

Chapter Three is concerned with the methodology used in this study. After describing the topic and population selection, it proceeds to explain the experimental procedures. Finally, the preparation of the review materials is explained and the test instrument is described and assessed.

Chapter Four presents the results of the study. The statistical results are presented and related to the research hypothesis. Descriptive results obtained in the experiment are delineated - comparisons of cost, of instructional review systems, of efficiency of presentation, and of student responses to the format of review and method of evaluation.

The final Chapter Five summarizes the results, and interprets and discusses them in the light of the limitations of the study and the findings of previous research. Finally, conclusions from the study are drawn, and applications are suggested for use in other areas of Physical Therapy.

CHAPTER II

REVIEW OF THE LITERATURE

Comparison of Teaching Methods

There is a large and growing body of literature comparing college teaching methods and trying to determine which method is most effective and most efficient. The results of these studies however, while sometimes demonstrating measurable and significant differences between two contrasting methods, do not agree in their conclusions.

Dubin and Taveggia (1968) reviewed four decades of research covering 91 independent studies in such diverse areas as Science, Language, Mathematics, Economics, Education and Engineering. These researchers did not simply add up the conclusions of the original workers but actually re-analyzed the data contained in the individual comparative studies to attempt to measure the differences obtained in group examination scores. Lectures, group discussions, tutorials, supervised and unsupervised independent study were represented. The results of these combined re-analyses demonstrated that when looked at collectively, there is no one method of teaching that can be clearly defined as better than another when evaluated by student performance on final examinations.

At least one author (Lumsdaine 1967) has refuted some of the results obtained in the preceding review of studies by pointing out

that the researchers failed to take into consideration the specific characteristics of the teacher as well as the individual methods used. It seems reasonable to assume that where one instructor may excell in front of a television camera another may be able to create explicit and concise programmed instruction. To quote Lumsdaine "one must be as specific as possible about the components of each instructional procedure being studied to compare student performance".[1] There is also substantial evidence that different teaching methods work well for different types of students (McKeachie 1967). Furthermore certain types of subject matter lend themselves to one mode of presentation rather than another. For example, television is generally considered more efficient than printed material in adding realism to vicarious experience and the use of this medium is recommended for the demonstration of perceptual motor skills where realism is important for instruction. As pointed out by McKeachie (1967), it is important to analyze the instructional objectives when choosing the mode of teaching as evidence exists that different teaching methods make a difference in learning outcomes on this basis.

An examination of the literature pertaining specifically to programmed instruction in the field of education, industry and the military (Cheris 1964, Hughes and McNamara 1961, Lumsdaine 1962, Lumsdaine and Glazer 1960, McKeachie 1967) revealed that, as a learning tool, programmed instruction is at least as effective as other modes

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[1] Arthur A. Lumsdaine, Improving the Quality of Relevance of Research in Teaching. In Improving College Teaching, Lee, C.B.T. ed., Washington D.C.: American Council in Education, 1967, 242.

of teaching. Acquisition of knowledge, transfer of learned materials to related uses and long term retention was found to be as efficient when using self-instructional programmed materials as when using more traditional types of teaching (Moore, Hawk, and Gagne 1973).

In the Health Sciences, a study at Dartmouth Medical School by Greene, Weiss and Nice (1962) reported achievement results in the course in Parasitology that had been partially taught using lectures and partially taught using programmed instruction. The examination questions were differentiated by the method of teaching and the results demonstrated that in areas in which the student had been taught by programmed instruction they scored significantly higher beyond the .01 level of confidence on achievement examinations than when taught by the lecture method. Furthermore, programmed instruction proved to be one and a half times as effective in use of time when based on an efficiency index. Despite wide differences among students on a pre-test, another study of a gross anatomy course (Peck and Benton 1970), found that students who were exposed to unit programming performed higher on the post-test than did students who received conventional lecture and laboratory teaching. However, on a retention test the conventional group excelled. This was explained by the author as due to more laboratory exposure time. In microscopic anatomy (Kahn, Conklin, and Glover 1972), when evaluated by a traditional microscopic examination, there was no significant difference between the scores of students receiving the self-instructional programme versus those taught by traditional procedures, despite the fact that the self-instructional group had only one-third the formal contact hours.

Two studies in a new Medical School in Rhodesia, where the faculty was faced with a lack of qualified teachers in bio-statistics and genetics plus a collection of students of widely different backgrounds, investigated the effectiveness of programmed instruction in these fields (Caskle and Davidson 1967 and Hawkridge and Mitchell 1967). Analysis of the scores of the students receiving programmed instruction when compared with students of previous years who had received conventional kinds of instruction revealed that the scores did not differ significantly. These authors proposed that one of the most efficient uses of programmed instruction was that it could be used to bring people of "widely varying social, ethnic and academic background up to the same level of attainment in the chosen subjects".[2]

Shafer, Weed, and Johnson (1973) reported a study where traditional teaching had been compared with self-instruction in red-cell morphology. They found that students performed equally well and invested similar time in learning. As far as the instructor was concerned, more time was required to prepare the self-instructional materials but less time was taken up during the course.

In yet another experimental study (Manning and Abramson 1967) comparing four modes of instruction - the programmed text, the lecture demonstration, text book and the lecture workshop - analysis

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[2]Winnifred M. Castle, and Lindsay Davidson, "An Evaluation of Programmed Instruction in a New Medical Faculty", British Journal of Medical Education, 1969, 3, 361.

of pre- and post-tests by an analysis of covariance indicated that there were no significant differences among the four instructional methods. However, when the instructional period for each mode was considered, the programmed text and the text books were shown to be more efficient than the other two. This result differs from those obtained by Stritter et al (1973) who compared self-instructional materials containing programmatic characteristics with other instructional methods (lectures, seminars, text books). Student performance on examinations of the National Board of Medical Examiners provided indications that learning by students through the use of self-instruction was clearly superior to learning through the other types of instruction offered.

In dental education, Poshadley (1965) studied the use of programmed instruction in teaching public health concepts to dental and dental hygiene students. Not only was the effectiveness of the programme demonstrated but it showed that student reaction to the programme was extremely positive in the areas of emphasis of important facts, omission of irrelevant data, logical organization and progression of materials. Similarly when Oral Histology and Embryology were taught in two ways (McCrea and Swanson 1970) by self-instructional programming and lectures, the programmed instruction group did significantly better on written tests, required less teaching time and declared that the self-instructional method was more motivating for them. In Endodontics (Light 1967), when scored on a multiple choice examination, the programmed instruction group performed slightly better than the group taught by conventional means but this difference

was not significant at the 0.05 level.

Similar results to those in dentistry have been found in nursing. In teaching an introduction to radiation therapy, the experimental group receiving self-instructional programming achieved higher scores than those attending a series of lectures from radiologists (Crayton and Lysaught 1964). In Physical Therapy, programmed instruction has been used in teaching physical therapy aides (Kristy and McDaniel 1967) and it was found that learning did occur. In the teaching of general Pathology to physical therapy students, no significant differences were found between students who were exposed to the traditional lecture series and those who were exposed to audio-tutorial methods (Bicksley, McDougal and Pipe 1973).

Television is another medium that has been widely discussed as an audio-visual aid to education and has received substantial attention from researchers. Regarding this particular medium, as McKeachie has pointed out -

> Although some experiments were not well enough designed to permit evaluation of their results, there are probably more good comparisons of television and live instruction than of any other teaching methods. The results are also much more consistent than are any other comparisons. In the great majority of experiments for which there were adequate controls, greater learning occurred in live classes than in those taught by television. Most of these differences were not statistically significant by themselves but their consistency is statistically significant.[3]

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[3]Wilbert J. McKeachie, New Developments in Teaching, Washington, D.C.: United States Department of Health Education and Welfare, 1967, 62.

McKeachie (1967) went on to say that the results of these studies do not necessarily mean that television has no place as a viable instructional medium. He advocated that it must be evaluated more fully in terms of type of presentation, perhaps where the visual properties are important, qualifications of the instructor, the students who are to receive the instructions and the instructional method used, as all these variables interact on a complex level.

In medical fields, closed circuit television has been in use for a number of years (Dittman and Lopez 1968, Osen 1958, Ramez 1964) as it offers many advantages which aid in the realization of educational objectives in these areas. There has been, however, particularly in undergraduate teaching a general lack of evaluation of this media. In the teaching of Pharmacology (Kesling 1959 and Ciancio, Pantera and Seigel 1974) found television teaching as effective as conventional types of instruction although live demonstrations held the attention of the class better and allowed the teacher to receive class feedback. One study on Rheumatology (Wright 1974) found that while the use of television compared with a lecture and slide show favoured television for immediate recall, three months later there was no significant difference in retention. In teaching Anatomy and Physiology to nursing students (Dearden and Anderson 1969), television was found to be most effective when follow-up sessions were held in connection with television presentations, although these findings were not significant in the final examinations. When tested for retention four months later the results were significant in favour of the follow-up classes.

One extension of the use of closed circuit television is the creation of video-tape cassettes which could be made following the principles of programmed instruction and could be used by students independently. Although this was advocated in medicine by Seus (1966) and in dentistry by Mangearacini and Sawyer (1973) the literature reports no follow-up or evaluation of their use.

The majority of research done on teaching and learning using programmed instruction and television, has been in the cognitive and affective domains, however, many professional schools cannot depend solely on instruction in intellectual and affective skills. In the Health Science professions for example, affective, intellectual and manipulative motor skills are required for personnel providing services to patients. Although the learning of motor skills may seem to be a limited part of the total educational process, it is a complex area in itself.

It has been clearly recognized that one of the basic requirements in Health Science education is instruction in these manual skills, yet almost no analysis of motor skills have been made with the aim of defining efficient sequences of activities and diagnosing inefficiencies in the responses of students. Furthermore, even after the motor skills have been taught, how to attain a high level of skill must come under consideration. However when a correct sequence of motor responses is demanded as criteria of performance, the direct practice approach has been advocated (DeCeico 1968) as an appropriate training method.

Some tasks demand an interaction between intellectual and motor skills. A motor skill does not necessarily imply non-intellectual activity. Often when the skill sought is motor in nature, previous conceptual knowledge and application of cognitive information as well as perceptual components are built-in activities preceding the motor response (McDaniel 1966). This has been termed "mixed activity" by Briggs (1960) and refers to "job activities in which during successive moments of activities, the man may be performing a motor act based on direct practice of a motor skill and then motor acts which are simple in themselves but which are the result of applying a great amount of factual information and concepts to a particular problem encountered in a job environment".[4]

Many of the tasks required of a physical therapist fall into this area which utilises cerebral-body-hand components to create a complex motor skill. It is difficult to separate these various components. Therefore the training appropriate to this type of performance would not consist solely of motor skill practice, or rote memorization or any other single type of learning. It would in fact consist of a mixture of several types of learning if effective performance was to be achieved. In the teaching of motor acts which require the interlacing of intellectual and motor skills it would seem that demonstration would be particularly effective (Chalmers 1974). However, both for the cognitive implications and in descriptive

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[4]Leslie J. Briggs, Problems in Simulation and Programming in the design of Complex Trainers. In A.A. Lumsdaine and Robert Glaser, Teaching Machine and Programmed Learning, Washington, D.C.: National Education Association of the United States, 1960, 329.

spheres language is also important.

Within the Health Sciences, prior research into determining the most effective methods for teaching a "mixed activity" is limited and fairly inconclusive. In dental education, when teaching techniques which involve psychomotor skilled learning, two studies, one instructing in peri-dontal suturing (Kopczyk et al 1973) and the other on cavity preparation (Vanek, Chan and Podshadley 1967) found that there were no significant differences between the technical abilities of students taught by self-instructional programmes versus those taught by lecture-lab method on the written examinations. Vanek found no significant differences on the practical examination while Kopczyk found self-instruction to be better at the 0.01 level. Both studies found that the time was better for self-instructional programming and Kopczyk found that long term retention of information was increased as well. Subjective evaluation of the students in both studies indicated that the majority favoured self-instructional materials as part of a regular course.

For teaching a Physical Therapy skill, for example goniometry, Campbell and Koli (1970) found that self-instructional materials were as effective as conventional lecture-demonstration methods. The accuracy of measurement was as good, written examination results were as high, and learning was more efficient. For this study the students worked in pairs and practised on each other. Similar results were obtained from a study where students had been taught to perform an electrical test (Rutan 1973).

In nursing there have also been attempts to programme a procedural skill. One article (Becker and Mihelcic 1966) reported the development of a self-instructional programme which taught the motor activity needed for the preparation and administration of an intramuscular injection. Unfortunately it was not a research study and no comparative information was provided regarding the outcome of this type of instruction versus more conventional methods.

A research study in the nursing literature (Feldman 1969) looked at the transfer of learning from programmed instruction to clinical performance and found that the efficiency of programmed learning does go beyond the regurgitation of verbal input to include an improvement in motor performance and clinical behaviour. The subject matter here was the practical application of aseptic technique after the concepts had been taught through programmed instruction. The results obtained showed that there was transfer to behaviour in clinical performance and that this effect is enhanced for most difficult procedures and showed least gains for simple and straightforward procedures.

When television was used to teach procedural activities in dental education and compared with either classroom or chairside demonstration, there were no significant differences in student achievement. (Grant 1962, Grossman, Ship and Romaro 1961). However, when television was compared with the film in the procedure for cavity preparation and restoration (Grainger and Darni 1970), the students who had seen the film scored significantly higher.

In clinical medicine, a cross-over trial in teaching the neurologic examination of the patient (Cantrell and Draven 1969) found that television instruction achieved equal results and was preferred by students to conventional teaching. Another cross-over trial in surgery teaching (Smith and Wyllie 1965) found that more than half the class received greater benefit from the use of television and furthermore that television appeared to help those outside the top 15% of students as categorized by previous examination results.

In the Health Sciences the weight of the evidence thus suggests that both television and self-instructional programmes are effective methods of instruction for the teaching of "mixed activities". These results have been largely gained from measuring scores on final examinations given to the students. While this usually involved some time lapse between teaching and testing the studies seldom focused on the retention of course material and failed to consider how these media could be used to aid retention.

Retention of Learned Subject Matter

An important consideration in any instructional system is in areas of retention and forgetting. Yet, only a few of the previous studies comparing methods of teaching were concerned with this problem. Several factors have been found to be positively related to retention. Intelligence, for example, has been postively related to the retention of course material under conditions of immediate recognition and recall (Watson 1939), and under conditions of delayed recall (LaBouvie

1973, Layton 1932, Lehey 1941 and Watson 1930). LaBouvie (1973) found that memory variables were most influential in predicting recall performances at early stages of acquisition. Orienting instructions by the teacher during the initial teaching as well as before testing retention also exert a potent influence on student performance (Cohen 1973). In addition, the type of organizing strategy used by the student to aid in memorization influences short term memory recall (Cohen 1973).

It has however, been found repeatedly in elementary school, secondary school, and university that major forgetting of subject matter occurs over periods of time (Sterrett and Davis 1954, Word and Davis 1931). Pressy, Robinson and Horrock (1959) determined that within a few years many of the concepts required in high school and college courses were not retrievable, and even within a one year period, 66 percent of the amount of elementary algebra was lost if algebra was not being taught during that period (Layton 1932). Studies on the retention of Botany knowledge have showed that 43 percent of this knowledge leaves after three months and nearly half the amount after six months (Johnston 1930). This study also determined that those students who had more information for the final examination retained relatively more subject material in testing after periods of time.

Even if students study a related subject, although not exactly the same, there is a 20 percent loss in achievement in fundamental mathematical operations in the first eight months (Lahey 1941).

If, however, students were studying increasingly complex material in the same subject and thus acquiring new related knowledge, studies (Worchester 1928, Davis and Rood 1947) showed that there was a high degree of retention and some generalization of abilities previously learned. This retention was attributed to opportunity to practice and over-learning.

Most of the learning theories promote the idea that the strength of learning and therefore the resistance of forgetting varies as the function of the number of practice repetitions. This theory seems to be borne out in the research. Over-learning has been shown to increase the absolute level of retention for rote materials (Krueger 1929) and for meaningful materials (Gilbert 1957). McTavish (1949), as cited in Lumsdaine (1962), determined that repetition or over-learning increased delayed retention when the material is presented by a film and he explained the effect as a combination of meaningful retention with rote retention of meaningful materials. Rock (1957) in his experiments on college level association learning, found that repetition was not important in the formation of associations but played a major role in strengthening these associations. All these studies showed that the susceptibility to forgetting is inversely related to the degree of original learning and support Ausubel's (1968) suggestion that if adequate attention was paid to considerations such as optimal types and pacing of review, retention losses might not be as inevitable.[5]

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[5]David Paul Ausubel, Educational Psychology: A Cognitive View, New York: Holt, Rinehart and Winston, 1968, 112.

Regarding review specifically, reports in the literature have been fairly consistent in their findings, and in general show that subjects receiving review retain significantly more than subjects receiving no review. Studies using non-meaningful materials such as nonsense syllables (Tulving 1968, Underwood 1964) support the idea that better retention occurs as a result of increased review in the form of repetition or practice. For meaningful related material such as learning a hierarchieal task, where it was assumed that retention would be facilitated by mastering each successive part of the material before proceeding to the next, students who were given a specific review (re-work through the problem) rather than a general review or a right-wrong feedback took less time during learning and less time to complete the test three weeks later (Merrill, Barter and Wood 1970). The rate of error was similar for both groups. However, the authors felt that the specific review represented an increase in learning efficiency. These findings supplemented an earlier study by Merrill (1965) where it was found that when subjects were given a correction review procedure, that, instead of facilitating performance they required more time in learning, more time in immediate testing and more time to complete the retention test three weeks later. They did not, however, make fewer errors than the subjects who did not receive the correction review procedure.

In another type of meaningful material, the recall of content in prose packages, several studies have found that spaced re-reading rather than contiguous repetitions was more effective in promoting retention of the subject matter (Ausubel and Youssef 1965,

Reynolds and Glazer 1964, Spitzer 1939). Ausubel and Youssef felt that spaced repetition gave the learner a second opportunity to interact with the material and to relate the meaning to his own body of knowledge. In other words it gives the meaning of the material opportunity to consolidate in the mind of the learner.

Reynolds and Glazer (1964) used programmed materials in Biology and inserted periodical review sequences (short review of preceding material) into the instructional programme. The retention of the subjects receiving the spaced review was compared with the control group and it was determined that the experimental group achieved a better performance thereby supporting the notion that a spaced review is a significant facilitator for the retention of reviewed material.

Since spaced reviews improved retention, the optimal time of spacing was questioned. Spitzer (1939) and Sones and Stroud (1940) found that immediate recall in the form of a multiple choice test was an effective method of aiding retention when the test was introduced soon after learning. The location of the review between the time of learning, the time of being tested, was also investigated by Peterson, Ellis, Toohil and Kloess (1935), Sones and Stroud (1940) Ausubel (1966) and Gay (1973). The relative effectiveness of the spaced reviews in these studies was not found to be dependent upon temporal position of the review. In an explanation of his findings Ausubel (1966) advocated the theory that early and delayed review counterbalance each other and that each position of review has its

own relative advantages. The main advantage of an early review is its consolidating effect on recently learned materials by providing a second opportunity to interact with the material. Delayed review on the other hand enhances retention by increasing motivation and effort to re-learn the forgotten material.

Another form of review, that of note taking and re-reading one's own notes has been investigated. Students who were allowed to review notes had significantly higher recall scores than students not permitted this review. This was true for short term recall (Divesta and Gray 1972), and for later retention (Fisher and Harris 1973 and Howe 1970).

Studies on the most effective type of review are relatively scarce in the literature. Merrill and Stolyhow (1966) reported that of three types of review procedures, general review, specific review, and correction review, used with students in a programmed problem solving presentation of an imaginary science, only specific review had a significant positive effect on performance. Further experiments by Merrill (1970) using programmed presentations demonstrated that the subject who received the specific review until the criterion trained performance was correct demonstrated better retention than those receiving no feedback, right-wrong feedback, reptition of a previous presentation or one specific review. The results demonstrated improvement in learning efficiency related to time but no greater efficiency related to error rate.

While the effects of reviews have been barely investigated

for verbal information and intellectual skills, the effect of review on psychomotor performance and evaluative judgment decision making has been totally ignored. There is, however, one encouraging note in this area. It appears that motor skills are relatively resistant to forgetting (Adams 1961 and Fleschman 1967). Good proficiency seems to be maintained even after a long period of absence. The greatest susceptibility to forgetting is found in procedural activities when choice of behaviour in step-like activities are desirable. The major problem for students is to reach the plateau of skill where the skill has been learned thoroughly enough so that forgetting would be minimal. It is assumed that this is the reason that review is so important in teaching a skilled activity, although it has not been experimentally demonstrated that reviews are beneficial in these types of performances.

This general review of the literature and its inadequacies in several areas led this researcher to ask the following questions:-

1. When teaching a "mixed activity" to physical therapy students, where the motor output depends on internalized cognitive material and an evaluative judgment must be made regarding a patient's response, does review positively affect student performance?
2. What kind of review format for this "mixed activity" would be most effective for the students and efficient for the teachers?

These questions provided the objectives of this experiment:-

1. To determine if a structured review of a physical therapy "mixed activity" can affect student skill performance significantly.
2. To determine if the format of structured review affects student skill performance significantly.

Hypotheses

The research hypothesis can thus be stated as follows:-

1. Student skill performance of a "mixed activity" is enhanced by subject matter review.
2. The format of the subject matter review affects student skill performance outcome.

The Evaluation of Clinical Performance

In an effort to design an experiment that would attempt to answer the questions posed in the last section is was necessary to review one further area in the literature. This area dealt with the evaluation of a "mixed activity". In the Health Sciences generally and in physical therapy specifically the major spheres involving "mixed activities" deal with the clinical performance of students.

If evaluation has been defined as the process determining the extent to which the educational objectives have been achieved, the evaluation of clinical performance by definition includes the assessment of knowledge in the cognitive domain, behavioural interpersonal relationships in the affective domain and skilled activity

in the psychomotor domain. The complexity and inter-relationship of these three spheres of activity present a difficult task for educators when they are trying to develop methods for meaningful evaluation. While there is general agreement that the evaluation of clinical performance should begin with a clear definition of the objectives of the instructional programme (Miller 1961, Stones 1969), there is no one method that has been developed that has gained widespread recognition and acceptance. Validity, "that characteristic measuring device which indicates the degree to which it measures what it is constructed to measure"[6] and reliability "that characteristic which indicates the consistency with which a measuring device measures a given variable"[7] always present problems due to the complexity of attributes being assessed. The objectivity of the instruments in obtaining similar results by different examiners as well as the practicality of construction, administration, grading and interpretation present other areas of concern.[8] No one technique is perfect. All present problems in these areas. Nonetheless there is a multiplicity of techniques and instruments advocated to test competence in clinical performance.

One written method of assessing clinical performance is based on a process analysis as it applies to the outcomes in professional education programmes. This process analysis of patient management, as advocated by McGuire (1963 and 1969) and Williamson (1965) for Medicine

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[6]George E. Miller, Teaching and Learning in Medical School, Cambridge: Harvard University Press, 1961, 205.

[7]Ibid., 205.

[8]Ibid., 206.

and adapted by McIntyre (1967) and DeTornyay (1968) for nursing, presents a brief case history and then allows the clinical problem to be developed through several stages by use of the erasable overlay. At each stage the candidate selects the procedure or route he wishes to follow with the patient and these choices fall into categories ranging from clearly indicated, possibly relevant, not indicated, to frankly contraindicated. Scoring is computed on the standardized rating scale and corresponding criteria for rating are described. This technique allows the evaluation of competence by assessing the efficiency and accuracy of the decision making process for diagnostic and therapeutic performance.

Direct observation of student performance is the technique traditionally used for evaluation in this sphere. Particularly, activities demanding psychomotor skill must be measured by observation of the student performing the required task and the major variables for measurement are precision, speed and accuracy (Kane, Woolley and Kane 1973). Free observation has, however, low objectivity and reliability due to the possibility of faulty perception or personal biases on the part of the examiner. It has, however, relatively high validity stemming from "the fact that the measurer receives all sensory data simultaneously and can work with this within their own relationships".[9]

One direction that observation of job activities led to is the critical incident method. This technique is a procedure developed by Flanagan (1954) where observed incidents that are felt to be significant and important in the success of a job are gathered by partially

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[9] Ibid., 231.

structured interviews from individuals who are considered the most competent to make judgments about the work area being investigated. These critical incidents or requirements are then edited and classified into groups. This technique is assumed to be an efficient procedure to use in identifying a set of behavioural criteria that is critical to good performance. It has been advocated for use in the measurement of clinical performance in medicine (Herzberg and Inkley 1960) in nursing (Bailey 1965) and in physical therapy (McDaniel 1964).

In order to facilitate the recording of observations various types of forms have been developed. While evaluator description of observed behaviour is still in use (Dickinson, Dimarion and Pfitzennaier 1973) the more widely used types of forms are check lists or rating scales.

A check list is a list of words, or sentences which denote the aspects of behaviour to be checked during the observation of the student. The sources of items for check lists are usually developed by groups of faculty members or professional staff and come from behavioural educational objectives, task analysis reports expressed in behavioural terms or critical incidents studies. Check lists have been developed for use in nursing (Dunn 1970, Steward and Graham 1968) and in physical therapy (Wilhelm 1969). The check list implies no judgment on how the student is doing the task; it only defines if the behaviour is present or absent. The elimination of the personal judgment of how well a student is doing gives the check list greater objectivity and higher reliability than a form of assessment requiring a personal appraisal.

Rating scales are closely allied to check lists in their structure and use. They however, not only define if the student is performing the desired behaviour but attempts to judge how well the students are meeting the objectives of the programme. Rating scales can be found in many varieties. The majority, however, have categorized behavioural educational objectives into areas, and then described the attributes in the categories in judgment terms. Most studies in this area have found it necessary to train raters in order to achieve a reasonable inter and intra rater reliability (Crocker and Muthard 1973, Hinz 1966, Mays 1973, Oakes 1969, Vigliano and Gaitonde 1965). Rating scales have been advocated for the evaluation of student clinical performance in medicine (Caroles and Kubany 1959, Hines 1966, Oakes 1969, Salzman 1963, Vigliano and Gaitonde 1965); in physical therapy (Chapman 1967, Kern and Michelson 1971, Mays 1973); in occupational therapy (Crocker, Muthard, Slaymaker and Sampson 1973); in nursing (O'Shea 1967) and in dentistry (Greene 1972, and Marwan 1973).

In rating scales, the more specific the criteria, the higher the reliability, validity and objectivity as there is less chance for rater bias. Despite the fact that scales are difficult to construct and leave room for bias, they do facilitate the process of student evaluation especially if they are designed to be used in specific training levels.

During the past ten years, another method for the measurement of student performance has gained recognition. This mode of

assessment calls upon the use of the simulated patient. The simulated patient is a normal person who is trained to assume and present on examination the characteristics and findings of an actual patient in the manner of a real patient suffering a stated pathological condition.[10] This technique involves the use of role playing either by the examiner himself or by a professional model and it has been found effective in evaluating affective behaviour (Barrows and Abramson 1964, Levine and McGuire 1970) cognitive knowledge (Levine and McGuire 1970) and motor skills (Barrows and Abramson 1964). The advantages of this are obvious (Barrows 1968). Several students can be presented with the same "patient" thus eliminating the variable of real patient behaviour. Findings can be discussed immediately in front of the patient and immediate feedback can be given to the student and particularly if the examiner is the patient he can report objectively having experienced the student's skills. Furthermore the reliability of this type of examination had been found to be acceptable even when two examiners are used (Levine and McGuire 1967, Levine and Noah 1967) and the validity barely missed statistical significance (Levine and McGuire 1970, Levine and Noah 1967). This type of evaluation met with high acceptance from candidates and 80 percent of the examiners were convinced that this method of evaluation provided valuable information about clinical competence unavailable from traditional and conventional methods of testing.

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[10] Howard S. Barrows and Stephen Abramson, "The Programmed Patient: A Technique for Appraising Student Performance in Clinical Neurology", Journal of Medical Education, 1939, 39, 803.

Appraising a student's clinical performance which requires judgment of cognitive, affective and motor skills is beset with problems of what should be observed and how to grade degrees of competence. Although there is general agreement that to evaluate this type of performance a student must be seen in the role (Miller 1961), the technique of using simulated patients can be seen to overcome many of the logistical and organizational problems that arise when students are numerous and patients and teachers are few. The findings in the literature regarding the methods and difficulties of evaluating student clinical performance led this researcher to the use of a simulated patient for the purposes of this experiment. As it was important that patient variability be eliminated, and that one individual do the testing, this method appeared to offer the best potential.

CHAPTER III

EXPERIMENTAL METHOD

I. Selection of Topic

Since the researcher was designated to teach a section of the course "Physical Therapy Treatment Procedures for Neurological Conditions" one specific area included in the course was chosen as the topic for this study. This was "The Evaluation of the Hemiplegic Patient" via the Brunnstrom method. It was chosen because it is extremely specific and demands exact procedures for patient evaluation. It furthermore lent itself to the testing situation and allowed two different profiles of hemiplegia to be created for presentation to the students for data collection purposes.

II. Selection of Students

A. Major Groupings

The 1974-75 class of 62 second year McGill Physical Therapy students scheduled to enroll in the course "Physical Therapy Treatment Procedures for Neurological Conditions" was used in this study. At Fall registration, the students were divided by a colleague into three groups for purposes unrelated to this study. Thus, the groups were not strictly random and contained 21, 20 and 21 students respectively.

B. Group Comparison

For statistical comparison of the three groups one student from

each of the larger groups was randomly withdrawn and selected characteristics of the students in the three groups were compared (Table 1).

Since the various characteristics compared were not independent but interdependent, a multivariate analysis was obviously the statistical method of choice. However, for the purpose of a pre-experiment comparison, univariate tests were chosen. When using univariate tests to compare interdependent characteristics it is customary to multiply each probability obtained by the number of characteristics compared. In this instance, however, since only minor differences were expected, this procedure would have pre-disposed the results in favour of those anticipated (Table 2). The chi square analysis demonstrated that existing differences had approximately a 90 percent probability of occurring by chance. The F ratios obtained were extremely low - so low in fact that probabilities were too high to be tabulated in regular statistical tables.

In summary, using the univariate statistical techniques, a comparison of selected characteristics of students in the three groups failed to show any statistically significant differences between the groups. In the comparisons of academic achievements in the Physical Therapy Treatment Courses Group I mean scores were consistently low and Group III mean scores were consistently high, however these differences were not statistically significant.

C. Experimental Testing Groups

Each group was further divided into two sections (A and B) to allow two hemiplegic profiles to be tested. A hemiplegic profile is a

TABLE 1

COMPARISON OF SELECTED CHARACTERISTICS

OF THE THREE GROUPS

	Group I	Group II	Group III
Sex - Female - Male	18 2	17 3	18 2
Mean Age - years	22.2	21.8	21.9
1st Language English Non English	 14 6	 14 6	 15 5
Mean grade point average (1st year university)	3.03	3.14	3.24
Mean Score Physical Therapy Treatment Course* (1st year university 100%)	67.75	68.80	69.35
Mean Score Physical Therapy Treatment Course (1st term, 2nd year university 100%)	68.50	71.10	72.95
Mean Score Physical Therapy Treatment Course (2nd term, 2nd year university 100%)	72.12	74.12	77.50

*A Physical Therapy Treatment Course is a couse taught by physical therapy educators which is designed to give the students evaluative and therapeutic skills and the understanding of utilization of these skills for the pathological conditions taught in a corresponding medical science course.

TABLE 2

ANALYSIS RESULTS OF THE COMPARISONS OF THE THREE GROUPS

Characteristics	Type of Analysis	Value	
Sex	Chi squared	X^2 = .40536	df = 2
Age	Analysis of Variance	F = .50237	V1 = 2 V2 =57
First Language	Chi squared	X^2 = .2180	df = 2
Grade point average (1st year university)	Analysis of Variance	F = 1.39862	V1 = 2 V2 =57
Physical Therapy Treatments Course (1st year university	Analysis of Variance	F = 2.23700	V1 = 2 V2 =57
Physical Therapy Treatments Course (1st term, 2nd year university)	Analysis of Variance	F = .33900	V1 = 2 V2 =57
Physical Therapy Treatments Course (2nd term, 2nd year university)	Analysis of Variance	F = 2.01833	V1 = 2 V2 =57

pre-determined set of actions and responses available to a hemiplegic patient (simulated) at a specific stage of neurological recovery. This was done to insure that students did not talk among themselves and discover that a certain profile of hemiplegia was always being presented. Otherwise they might have memorized the profile and the results would have become invalid. To create two sections, (A and B) the students were ranked within their groups according to how they had performed on the first term Treatment Course in Physical Therapy. After ranking, the top student was assigned to Section A, the second to Section B, the third to Section A, etc. This was done to create two academically comparable sections per group (Table 3). Section A for each group was always presented Profile A in the test situation and Section B was presented with Profile B.

Four students were lost to the experiment. One student from each section was lost from Group I as they did not attend a review session (self-instructional module). These two students usually rank in the lower third of their class and this fact may have affected the results of the experiment by allowing the mean scores for their sections to be somewhat higher. One student from each section in Group III was also lost as these students did not attend the initial teaching presentation (video-tape). Previous performances of these students rank them in the middle third of their groups. The loss of these scores probably had less effect on the group means in the experimental scores.

III. Experimental Procedures

A. Design of the Experiment

The experimental design is of the comparative type. Three groups

TABLE 3

GROUP BREAKDOWN INTO SECTIONS

GROUP I		GROUP II		GROUP III	
21 Students		20 Students		21 Students	
Section A	Section B	Section A	Section B	Section A	Section B
11 students	10 students	10 students	10 students	11 students	10 students

of students were exposed to similar initial teaching material but different methods of review of the subject. Achievement was measured at similar time intervals.

Due to the overall organization of the Physical Therapy Treatments Course, the three groups were taught in sequence. Thus, Group I was taught the Brunnstrom method between February 5th and February 12th; Group II between March 3rd and March 10th, and Group III between April 4th and April 11th. Each group received a total of 11 hours of instruction on the Brunnstrom method.

B. Procedure of the Experiment

At the beginning of each Brunnstrom series, each group was taught in the regular classroom and was given a brief introduction to the philosophy of the Brunnstrom method as well as a blank evaluation form. Each group was then taken to the T.V. studio and shown a one-hour video-tape (Appendix A) on the Brunnstrom evaluation of the hemiplegic patient and was instructed to follow the evaluation form as the tape directed. This was done to standardize the teaching input as far as possible. Following this the class was returned to the regular classroom and was given one hour to work in pairs to practice the procedures as demonstrated on the tape. This was unstructured practice, but the students were guided by the evaluation form they had received. The teacher was present only to answer specific questions as posed by individual students. No extra teaching was done.

The remainder of the Brunnstrom series dealt with the treatment techniques as advocated by Brunnstrom, as well as the Gait Analysis

of the Hemiplegic Patient. At the end of the last class on Brunnstrom each group was requested to complete an attitude test on the Brunnstrom Course (Appendix B). This was done to affirm that all groups who had received exactly the same input were reasonably content with the course.

The student response from all three groups was extremely positive (Table 4). All students felt that the content was relevant to their physical therapy training, that from the course they had acquired enough knowledge and skill to give them confidence to assess and treat a real hemiplegic patient and in general all students approved of the methods of instruction. Specifically, the majority of students found the instruction to be stimulating, of average difficulty, agreeable to participate in, helpful in gaining knowledge and skill in the subject, and that the time allotted was reasonable for the work covered. In the comment section, particular note was made of the value of the audio-visual tape with its simulated patient in learning the evaluation procedures. Several students expressed the wish that there would be real patients on which to practice. This procedure served to decrease any chance that the teacher could provide consciously or unconsciously, any extra teaching for the group receiving a certain type of review method.

The review sessions took place in class following the end of the Brunnstrom series. The type of review method was chosen randomly by an independent person after the last treatment class had been taught. Group I received the self-instructional package (Appendix C), Group II received a repeat of the initial teaching tape plus time to practice and Group III received no review class.

TABLE 4

RESULT OF THE STUDENT EVALUATION OF THE BRUNNSTROM COURSE

	GROUP I		GROUP II		GROUP III	
	Yes	No	Yes	No	Yes	No
1. Relevance of content of total Physical Therapy training	21	0	19	0	18	0
2. Materials presented allows you to assess patient	21	0	19	0	18	0
3. Materials presented allows you to treat patient	21	0	19	0	18	0
4. Were methods of instruction appropriate	21	0	19	0	18	0

For Group I at the beginning of the review session, the complete self-instructional package was given to the students along with directions as to how the module was to be used. The class was told that it was a review on the evaluation of the hemiplegic patient by Brunnstrom. The students were instructed to use the module as a work book to answer the questions as requested and to work with their partners if they needed help and when requested in the work book. Two hours were allowed for the review session after which time the work books were collected and the students were given a questionnaire on the use of the instructional package (Appendix D). During the review session the teacher was not available to provide extra teaching.

For the Group II review session the class was taken to the T.V. studio and again shown the original teaching tape. The class was then returned to the regular classroom and given an hour to do an unstructured review practice on the Brunnstrom evaluation. The teacher was not available to provide extra teaching.

For Group III no review session was held.

At the beginning of the Brunnstrom series each group was told that they would be evaluated on this section of the course. The proposed Evaluation format was a one-hour practical examination where they would be presented with a simulated hemiplegic patient with a stated medical history and they would be requested to evaluate, plan a treatment, and carry out a treatment on the patient. Students received grades in their total performance that were to count for 20 percent of their mark in the neurological treatment course. These marks served as a positive

factor to assure that all students would attempt to excel. Each student was allowed to decide on what mark he wished to achieve. This mark was to be decided looking at past performance and by the student judging what mark he felt he could attain. If he attained this mark which was known to the instructor before the examination he received the mark as part of his permanent record. If he did better than the desired mark the grade was raised. If he did not meet the teacher demands to receive the desired mark he was required to return for make-up teaching sessions until the teacher felt that he possessed the skills and knowledge to attain the desired grade. A total of nine students from three groups were returned for make-up sessions.

This mark contracting was done to meet the ethical requirements of the researcher. As the grades became part of the students permanent record it was questionable to whether it was fair to give two groups the review session and the third group no review and then score them on the same criteria. By contracting the final makrs were similar and the students after fulfilling obligations possessed similar amounts of knowledge and skill.

The actual practical examinations were scheduled the week following the end of the Brunnstrom series. Times for the individual examinations were scheduled to fit into the students' time-table and thus they were spread over a five-day period between 8 a.m. and 5 p.m. (Table 5).

When each student entered the exam setting he was given a brief history of the patient which included the date of onset of the

TABLE 5

SCHEDULE OF TEACHING
REVIEWS AND EXAMINATIONS

	Initial teaching - Audio-visual presentation plus practice (Date)	Type of Review	Type of Review	Examination Date
GROUP I	Feb. 5th	Self-instructional package	Feb. 14th Friday	Feb. 17th-21st
GROUP II	Mar. 4th	Repeat of A-V tape and practice session	Mar. 14th Friday	Mar. 17th-21st
GROUP III	Apr. 4th	No review Last class Apr. 11th Friday	———	Apr. 14th-18th

cerebral vascular accident, the localization of the lesion in the brain, side of the patient affected, the fact that she was independent in ambulation, that she has received previous physical therapy and that this was the first time a student had seen her. The student was instructed to treat the simulated patient as if she were a real patient and to evaluate her according to the Brunnstrom method and to record the results on the form provided (Appendix E). The students were to take only one-half hour for the evaluation after which the findings would be discussed and the treatment planned. The simulated patient (teacher-researcher) only acted like a patient with either profile A or B and did not discuss the evaluation until it was complete.

This completed evaluation form served as the sheet from which the scores were tabulated. The results of the evaluation were discussed but the form was not changed. The student then went on and carried out an appropriate treatment of the patient. The total grade marked out of 20 for the student depended on his total performance, the evaluation, approach to the patient, manual skills and techniques. However, only the completed evaluation forms were used as data for the experiment.

After the student left the examination room his name was placed on the form as well as the patient profile he had been given. The completed forms were then filed away until the three groups had been examined. Upon completion of the three groups an independent person replaced the names with randomly coded numbers so as to blind the scorer as to which group the students had been in and thus which type of review they had received. The coded forms were not regrouped until the scoring was complete.

After the examinations, the students were asked to complete opinionaires on the method of evaluation of the Brunnstrom technique (Appendix F) to determine major difficulties experienced by the students. The evaluation forms were scored as previously explained. Student opinionaires regarding the method of student evaluation were tabulated.

C. Possible Sources of Contamination due to Experimental Design

The sequencing of the three groups posed a problem in the research design. Ideally all three groups should have been dealt with at the same time. However, since a real class was used in the experiment, it had to take place within the confines of the regular course structure. The experimental design had to assume the same level of knowledge on the part of all students, however, with this sequential procedure questions can be raised regarding the entry knowledge and behaviour of each group. A pre-test was considered but it was felt that as well as testing it would probably teach, and Brunnstrom learning would occur. Furthermore no group had received in other areas of the neurological treatment course, an evaluation or treatment plan for hemiplegic patients that in any way resembled that utilized by Brunnstrom. As well, no student had been exposed to the Brunnstrom method in a clinical setting as these students had not started their hospital neurological rotations. The Brunnstrom method of evaluation and treatment is extremely specific and demands exact procedures for evaluation and recording observations. Despite this, however, one cannot be positive that the three groups entered the experiment with exactly the same previous knowledge and skills.

This sequential procedure also may have affected the students' examination results. How much time a student spent preparing for the examination obviously depended upon other demands being made on him at that time. Group I was examined just before mid-term examinations. Group II was meeting term paper deadlines, and was writing a physiology examination the week of the Brunnstrom testing and Group III examinations were given the week before final examinations. While the majority of students probably reviewed at least part of the material, it was impossible to judge how much these outside events influenced their performance on the Brunnstrom examinations. The inability to control independent study was an inherent limitation in this method of classroom experimentation.

The sequencing presented one further problem. It was impossible for the examiner (the simulated patient) to remain blind as to what type of review the students had received. Unconscious or conscious actions on her part may have assisted or deterred the students' performance. Exact consistency of the examiner performance was attempted but this may have influenced the scores.

Although the type of review for the first two groups was not known until after the completion of instruction, by the process of elimination it was known by the investigator-examiner that the third group would receive no review. It is conceivable that the teacher-examiner could have been influenced by this knowledge and that her classroom behaviour might have changed during the teaching of the course.

The method of testing offered another possible source of contamination. All testing should be done at exactly the same time and time interval. Bacause of the one-hour oral examination with one evaluation it was necessary to spread the examinations over a five-day period and to conduct them at various times during the day. If more evaluators were used other problems dealing with observer error could arise.

IV. Preparation of Materials

A. Subject Matter Selection

The subject matter used in the experiment was the evaluation of the hemiplegic patient via the Brunnstrom method. This subject was selected not only because of its basic importance in Physical Therapy but also because it met other criteria that had been set for the study.

1. The students must have an entry behaviour consisting of a knowledge of neuro-anatomy, developmental reflex behaviour, synergies of the hemiplegic patient, where a synergy is defined as a group of muscles which work together as a bound unit and produce a pattern of movement which is of a primitive and automatic nature and is mediated on a spinal core level, and the ability to teach basic exercises. They must not have the concepts of the Brunnstrom method or the specific manual techniques used in this method.

2. The students' understanding of Brunnstrom concepts and the performance of evaluation procedures can be measured objectively.

3. The original teaching presentation can be presented to the three groups of students so they receive exactly the same input.

4. The instructional material is capable of being extended to other areas in Physical Therapy.

B. Audio-Visual Tape

In order to satisfy criterion No. 3 in "subject matter selection" an audio-visual tape was developed by combining the efforts to two members of the teaching staff at the School of Physical and Occupational Therapy and the Instructional Communication Center at McGill University. The tape demonstrated the complete Brunnstrom evaluation of the hemiplegic patient with the exception of the assessment of the gait pattern. The teaching was done by the researcher who was responsible for this section in the Neurological Treatments Course and the other teacher simulated the typical actions and responses of the hemiplegic patient who was passing through the recovery stages.

The content of the tape demonstration consisted of:-

1. An introduction to the neuro-physiological approach to the evaluation of the hemiplegic patient as advocated by Brunnstrom.

2. A description of the synergic patterns of movement as observed in the hemiplegic patient (Brunnstrom defined).

3. The stages of recovery through which a hemiplegic patient passes (Brunnstrom defined). (Appendix G).

visual tape presentation was used as the initial teaching for the three groups and as a review method for one group.

C. Self-Instructional Package

A self-instructional package is a package of programmed instruction where the material is presented to a student in an organized logical sequence. It demands an overt response by the student to the material of the programme and it provides immediate feedback to the student.

The preparation of the self-instructional package on the Brunnstrom Hemiplegic evaluation was based on an analysis of task techniques necessary to assess this type of patient via the Brunnstrom Form. The specific purposes were to:-

1. Develop a self-instructional package based on the concept of task analysis and programmed instruction for the teaching of the evaluation of the hemiplegic patient to students in Physical Therapy.

2. Evaluate the package in terms of:-

   A. 1. Student understanding of the concepts taught

      2. Student performance in a simulated clinical setting

      3. Student attitudes towards this method of teaching procedural activities of manual skills

      4. Student benefits received by working with a partner at their own rate.

   B. 1. Time consummed in producing the package

      2. Cost of producing the package

3. Efficiency in presenting the package
4. Necessity for teacher presence during use of the package.

3. Investigate the feasibility and practicality of creating a bank of self-instructional packages in Physical Therapy to be used for teaching, review, or make-up classes by students.

In the construction of the self-instructional package, the steps as advocated by Russell[1] were followed.

1. Statement of exact objectives in terms of terminal student behaviours.
2. Construction of criterion items for the post-test to measure student acquisition of the required behaviours.
3. Construction of a pre-test to determine learner characteristics and entry behaviour.
4. Sequencing of the instruction and selection of the media appropriate to the objectives.
5. Student tryout (field testing) of the module by a group of students not involved in the experiment.
6. Evaluation of the module to measure effectiveness in terms of student performance and economy of the package.

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[1] James D. Russell, Modular Instruction: A Guide to the Design, Selection, Utilization and Evaluation of Modular Materials. Minneapolis, Minnesota: Burgess Publishing Company, 1974, 39.

simply compared to the master profile forms and the correct answers were tallied. No marks were deducted for incorrect or additional responses. By doing more than necessary to gain an adequate picture of the patient's status to allow effective treatment planning, the students lost time and often the form was not completed.

CHAPTER IV

RESULTS

A. Statistical Results

In Chapter II the research hypotheses were stated as follows:-

1. Student skill performance of a "mixed activity" is enhanced by subject matter review.
2. The format of subject matter review affects student skill performance outcome.

For purposes of statistical examination of the data obtained, two null hypotheses were created.

1. A review of related subject matter will not significantly enhance student skill of a "mixed activity".
2. The format of the review of related subject matter will not have a significant effect on student skill performance.

The examination format for the data collection was constructed so that each profile contained equal numbers of test items (43). The results of the scoring are shown in Table 6. Each score represents the number of items correct on the individual student's forms and the mean scores per profile per group are indicated. Preliminary scattergrams confirmed that the differences among population means were com-

TABLE 6

EXAMINATION ACHIEVEMENT SCORES

OF THE THREE GROUPS

	Group I Scores	Group II Scores	Group III Scores
		PROFILE A	
	36	17	28
	24	24	25
	39	22	23
	35	15	26
	37	38	25
	41	19	19
	33	24	17
	33	24	34
	23	28	22
	29	14	22
Mean Score	33	22.5	24.1
Range	23-41	14-38	17-34
		PROFILE B	
	31	29	19
	21	28	27
	34	16	21
	36	13	11
	35	23	30
	31	32	17
	28	16	33
	34	21	23
	41	24	13
Mean Score	32.3	22.4	21.5
Range	21-41	13-32	11-33

parable and that no other transformations of the data were required. Normal variables were in evidence and observations were independent. Consequently, since it was desirable to determine how much of the variation in the observations was due to the population differences and how much was due to random variability, a one-way analysis of variance was appropriate. This statistical test compared the contributions of these two kinds of variables and allowed the determination of the importance of the population differences. For Profile A, $F = 8.226$ and for Profile B, $F = 7.430$. And in each case the value of the F test statistic is greater than the probability level of 0.1% and less than the probability level of 1%, (Table 7). There is thus evidence of the difference between the population means beyond the 0.01 level of confidence. This finding allows rejection of the null hypothesis that there is no difference between the mean scores in the groups.

Each Profile result was then partitioned using Orthogonal Contrasts. An orthogonal set was created for each profile where the total treatment sum of squares was sub-divided into two components, each with a single degree of freedom (Tables 8 and 9). This procedure was performed to allow two comparisons to be made. The first comparison was between Review Method I (self-instructional package) and Review Method II (audio-visual tape repeat). The second comparison was between Methods I and II and No Review.

When Review Method I (self-instructional package) was compared to Review Method II (audio-visual tape repeat) the results

TABLE 7

ANALYSIS OF VARIANCE RESULTS COMPARING MEAN SCORES OF THE THREE GROUPS

	F. Ratios	VI/VII	Probability Level
PROFILE A	8.226	2/27	1% > P > 0.1%
PROFILE B	7.430	2/24	1% > P > 0.1%

TABLE 8

ORTHOGONAL SET OF PROFILE A SCORE RESULTS

	Group Score Totals			Degrees of Freedom	Sum of Squares	Mean Square	F. Ratio
	Review I	Review II	Review III				MS/Res.MS
	330	225 (weights)	241	df	SS	MS	
Review I vs. Review II	+1	-1	0	1	551.25000	551.25000	15.196804
Review I & II vs. No Review (III)	+1	+1	-2	1	88.81666	88.81666	2.448470
			Total	2	640.06666		
			Residual	27	979.40000	36.27407	

ation and materials (Appendix J) was made possible by the fact that McGill University has its own studio and technical staff. To do a similar project on a commercial basis the estimated cost would be approximately $2,482.95 (Appendix J).

In terms of cost the professional teacher time expended should also be considered. For the complete project the estimated total teacher output was 24 hours.

Self-Instructional Package

The self-instructional package consummed two full weeks of teacher time to write, plus one week of secretarial help with typing and duplication. The cost of the materials for 24 mini-packages was $9.50 (Table 12).

2. Efficiency of Presentation of the Audio-Visual Tape and the Self-Instructional Package

In the experimental situation the audio-visual tape required a television technician for one hour as well as the presence of the teacher. One further hour of teacher time was used to make sure the students were working on the review. Similarly the administration of the self-instructional package used two hours of teacher time to give instruction on the use of the package and for general surveillance purposes while the students worked.

3. Student Response to the Self-Instructional Package

One of the purposes of this project was to determine how the students would react to the use of the self-instructional materials

as a method of review of subject matter previously presented. Analysis of the questionnaire filled in by all the students revealed a very favourable attitude towards the use of this self-instructional material (Appendix D). It is interesting to note that all the students felt that all the material presented in the package improved their ability to assess a simulated hemiplegic patient and all felt more confident regarding their ability to assess a real hemiplegic patient in the clinical setting. In general, they found the mini-package to be helpful, very stimulating, of average difficulty and of reasonable length. All students seemed to consider this mode of presentation a good method of review.

4. Student Response to the Method of Evaluation

As added information regarding the benefits of the self-instructional package versus those of the other type of review, or no review, the student questionnaires on the Brunnstrom Examination were analyzed (Appendix E). While 100 percent of the students who answered the questionnaires liked the method of being evaluated and felt it was the best possible way of assessing psychomotor skills in the academic setting and as well was a positive learning experience, 33 percent of these students reported that the evaluation of the simulated patient which included filling in the evaluation form was the most difficult aspect of the test. It is interesting to note that only one of those students was in the group receiving self-instructional package which demanded participatory performance as well as recording the results; six of the students came for the group where the method was a repeat of the audio-visual tape plus opportunity to review with a partner.

CHAPTER V

SUMMARY, DISCUSSION AND CONCLUSIONS

Summary

This study set out to test two hypotheses, (1) that student skill performance of a "mixed activity" is enhanced by subject matter review, and (2) that the format of the subject matter review affects student skill performance outcome. To test these hypotheses, sixty-two second year physical therapy students at McGill University were divided into three comparable groups. Each group received identical initial teaching of the Brunnstrom Evaluation of the Hemiplegic Patient using a taped lecture demonstration with a simulated patient. The groups were then allowed practice time and were guided by the evaluation form.

Group I later received a structured review session using a self-instructional package covering the same subject matter. Group II received a review session which was a repeat of the initial teaching session and Group III received no review.

Each group was further divided into two sections according to previous academic performances, to create two academically comparable sections per group. Section A for each group was presented with a simulated hemiplegic Profile A in the test situation and Section B was presented with a simulated hemiplegic Profile B. Student

performance was measured by having the students complete the Brunnstrom Evaluation Form while assessing the simulated patient either, Profile A or Profile B.

The student achievement scores in the three Section A groupings were subjected to a one-way analysis of variance. It was found that significant differences existed among the three sections. An identical procedure for the three Section B groupings also demonstrated significant differences.

Each profile result was then partitioned by Orthogonal Contrasting to allow (1) Review Method 1 (self-instructional package) and Review Method II (audio-visual tape presentation plus practice time) to be compared and (2) Review Method I and II and no review to be compared. There was a significant difference between the scores of the two review methods which clearly indicated that the self-instructional package produced performance of this type of "mixed activity" superior to that produced by the repeat of the audio-visual tape. When the scores of the two review groups were compared to those receiving no review, the differences did not have statistical significance at the 0.05 level of confidence. This result questions the notion that any kind of review which allows representation of subject matter and extra practice produces superior performance of a "mixed activity".

To meet the additional objectives of this study the direct costs of producing the audio-visual tape and the self-instructional

package were compared and it was found that, because McGill University has its own department of Instructional Communication, the cost of producing the tape was approximately 17 percent less than that of the self-instructional package. However, if technical time had to be paid for at a commercial rate the tape would be approximately four times as expensive as the self-instructional package.

In comparing the efficiency of presentation of the two media, each required similar amounts of student and teacher time, however, in addition the tape showing demanded the presence of a television technician for one hour.

Student response to the self-instructional package was extremely positive as a method of review and student response to the method of evaluation was positive as well.

Discussion

A. Interpretation of Results

These results suggest that:-

1. A critical re-examination of the consequences of the review procedure designed to improve performance of a "mixed activity" may be in order.
2. More consideration must be given to the format of the review when trying to upgrade performance of a "mixed activity".

Consider first, the idea advanced by Peterson et al (1935) and Spitzer (1939) that students receiving review perform significantly

higher and retain significantly more subject matter than students receiving no review. This theory has been supported through the years by studies on non-meaningful materials (Tulving 1968, Underwood 1964), and on meaningful materials (Ausubel and Yousseff 1965, Barter and Wood 1970, Reynolds and Glazer 1964, Sones and Stroud 1940). All of these studies, however, dealt with the use of review in improving performance in a cognitive domain and the use of review in improving performance in a "mixed activity" has not even been experimentally questioned.

The results of this study raise the question of the value of review, if review is only defined as a repeat of previously taught material. When the results for Group I scores (self-instructional package review) and Group II scores (audio-visual tape repeat) were averaged and compared to the scores obtained by Group III who had received no review, the differences were not significant. In fact, if the mean scores (Table) are looked at, it can be seen that the scores attained by the Groups II and III are extremely close and in Profile A the mean score achieved by Group III was slightly higher than that by Group II. These results may be partially explained by the fact that in the pre-experimental analysis of the group characteristics, Group III consistently demonstrated the highest academic achievement while Group II was always in the middle section of a low-high scale. Although these differences were not statistically significant, they may contribute to the performance results attained by Group III even when they received no review.

This finding lends support to the notion that the degree of original learning is related to the resistance of forgetting (Gilbert and Slamecha 1959, Kruger 1929, and McTavish 1949). If in fact Group III learned the material more thoroughly during the initial teaching session this offers another possible explanation for these results. It is also important to remember that some of the difficulties with the design standardization may have contributed to Group III's mastery of the subject material. When the dates between initial teaching and examination onset were reviewed, Group III had a ten-day interval, Group II a thirteen-day interval and Group I a twelve-day interval. This may have been another contributing factor for the differences among the groups. Group III was also the last group taught. This was the final section of the Neurological Treatments Course for this group, and exposure to other concepts and techniques required for evaluation of neurological patients may have become generalized and these students may have been able to demonstrate more skill.

From the information obtained in this study, it remains impossible to determine exactly the causes of similar performances of Group II and III. Group II, which had received a review session in the form of a repeat of the initial teaching did not do particularly well, and it is this researcher's contention that this had to do with the format of the review session presented. When the scores from Group I (self-instructional package review) were compared to the scores from Group II (Audio-visual tape repeat) the results demon-

strated that Group I performance scores were significantly superior at the 0.05 level than those of Group II. These results strongly suggest that the format of the review was one of the major influences in creating this difference. This is reinforced by the fact that when the groups were analyzed pre-experimentally, Group I consistently demonstrated the lowest achievement scores in the Physical Therapy Treatments Courses of the three groups, although these differences were not significant. Furthermore this group was Group I's first exposure to the evaluation of neurological patients. They thus entered the course with no concepts or skills from which to generalize and no time for general maturity to occur.

These results support the findings of Merrill and Stolahow (1966) and Merrill (1970) that the type of review introduced influences the performance outcome in learning in cognitive domains. Merrill's study was the only report in the literature using programmed instruction as a format of review.

An examination of the results of the present study may however reinforce the perceived value of programmed instruction in learning. The prior findings suggest that programmed instruction does affect learning in both cognitive and psychomotor spheres. Many studies showed no significant differences while others showed programmed instruction to be significantly superior. In any case, the results show that learning took place not only through conventional but also through the use of programmed method of presentation.

Results reported in the literature using programmed instruction are even more positive than those on the use of television as an instructional medium. The few evaluative studies on undergraduate teaching in medical fields (Keasling 1959, Pantera and Seigel 1974, Wright 1974) found television teaching as effective as conventional types of instruction. Studies on procedural activities in areas of medicine (Cantrell and Craven 1969, Grant 1962, Grossman, Ship and Ramaro 1961, Smith and Wyley 1965) found that there were no significant differences when compared with conventional types of teaching. The results of these studies although they do not deal with review per se, lend support to the results of the present study. The results of studies on television teaching, though seldom proved inferior, (Greinger and Darni 1970, McKeachie 1967), most often do not support the idea that performance results are better when television is used.

In discussing the performance results obtained from these two forms of review, the question must be raised as to what inherent differences within each format could be offered as possible explanations for such different results. Obviously they both covered the same subject matter which was the evaluation of the hemiplegic patient via the Brunnstrom technique. The self-instructional package introduced each mini-package by a pre-test of the subject matter. Completion of this pre-test gave the student immediate feedback about gaps in his knowledge and if one accepts Ausubel's (1966) theory that delayed review increases motivation and effort to relearn

the forgotten material, it is conceivable that the students received a motivational stimulus form the pre-test. The audio-visual presentation offered no such feedback or stimulus.

Each unit in the mini-package began with the statement of behavioural objectives for the student. These objectives provided the student with information about what they should know and what they should be able to do by the end of each section. The tape, on the other hand, merely introduced the topic, briefly discussed the theory and made statements of what the tape would show. In light of these differences, perhaps it is reasonable to assume that the self-instructional package gave the students more information about the learning expectations and thus provided them with direction in which to proceed.

The audio-visual tape presentation provided a demonstration with commentary, while the self-instructional package reviewed related theory and provided didactic instructions in step-wise fashion as to what should be done, as well as frequent testing situations to make sure the student was learning the material. It has often been assumed that in teaching a skilled activity, demonstration with practice produced the best results (DeCeico 1968). The tape certainly fulfilled the demonstration requirements, and it did instruct the student to follow the evaluation forms; furthermore practice time was allowed at the end of the tape. It did not, however, demand the practice repetitions necessary to achieve skill.

The self-instructional package on the other hand demanded

that students learn the theory by use of the testing mechanisms, carry out the motor responses, make judgments about what was occurring and record the results. Although practice time was given to the audio-visual tape group at the end of the tape, it would appear that the students were either unable to repeat the procedures because they could not remember what to do and not enough guidelines were provided, or they were not motivated to practice since they had received no feedback from a test situation informing them that extra practice was necessary.

It is suspected as well that the two groups received different amounts of feedback from their practice partners. The self-instructional program gave the partners specific information about acting like a simulated patient and a form of check-list to make sure that all steps were performed. The audio-visual tape group received no such practice instructions and only had a blank evaluation form to follow.

This theory is somewhat confirmed in the student response to the method of evaluation. The results of the evaluation showed that several students in each group not receiving the self-instructional package had difficulty carrying out the evaluation and judging and recording the results. It would seem from the above that requiring actual participation, decision making and recording of judgments are key elements in improving skills in the "mixed activity" of patient evaluation.

Another purpose of this project was to evaluate the cost and efficiency of these two instructional media. As it turned out the audio-visual tape was much easier to make and slightly less costly due to the fact that McGill University has its own television studio and crew. In the experimental situation, a teacher and television technician were required during the showing of the tape. However, this medium could be used independently by the students. Cassettes of the tape could be made available to students in the Instructional Communicational Laboratory for use in their free time. It is doubtful, however, as indicated by the previous discussion of unstructured practice, if students would make good use of the practice time unless steps were taken to make it more directed and structured.

The development of the self-instructional package was a costly activity, more in terms of teacher and secretarial time than in terms of money for equipment or materials. It consummed a great deal of time to thoroughly organize the subject matter for this one small area of instruction and to field test it adequately. However, this was a one-time cost and repeated use would not require further investment except for duplication. For the experiment the students were supervised during the two-hour session to assure attendance and application, however, it is assumed that similar learning could occur outside the classroom environment provided the students were motivated to work. If self-instructional packages were available for purchase for a nominal fee they could be used by students outside of classroom hours.

B. Application of Results

This project has demonstrated that using a self-instructional programme, as described, to review a physical therapy evaluation procedure which is actually a "mixed activity" is entirely feasible, practical, efficient and effective in terms of student learning. It is even more efficient and effective for all the reasons discussed than a repeat performance of initial teaching - in this case an audio-visual tape.

In view of these findings, while caution must be taken regarding interpretation of these results due to some of the design biases, it is pertinent to suggest field applications of the content of this study.

Although this study has looked at only one small area in the field of Physical Therapy teaching, there seems to be no major reason why these packages could not be developed in other areas where students are known to have difficulty. Programmed instruction offers the opportunity to students to review material rapidly and efficiently not only for exmination purposes but throughout their entire careers as physical therapists.

In the present study the major concern has been with review methods as the researcher felt that the initial teaching of a "mixed activity" must be a visual presentation if practice of the motor skill by the students is required. It has been demonstrated, however, (Kohli 1971 and Rutan 1973) that the benefits received from programmed

instruction as a review technique are equally applicable as initial teaching sessions in physical therapy. Particularly if slide tape shows or mini-cassettes are included in the package, programmed instruction could possibly replace some of the more conventional teaching.

This offers several potential advantages. It could be assumed that if the students had completed the programme before coming to class they would arrive with similar levels of comprehension and skill in the subject matter. This uniform level of competence would mean that slower students could be brought up to the same level as brighter students in the class. This would thus allow the teacher to either present more challenging material or to devote time to more sophisticated skills and techniques. Furthermore, use of programmed material would make it possible for students who have missed classes to progress in the subject matter in their own time, and the serious consequences resulting from lapses in knowledge could be avoided.

Despite the obvious values and advantages of programmed instruction, the development of these materials is costly and time-consuming. However, teachers from several schools of Physical Therapy could form a team and participate in a co-operative effort to create this type of teaching material. This pooling of resources would not only allow the special skills and talents of teachers to be used to their best advantage for students in the participating schools, but it would lead to an exchange of concepts and ideas and serve to decrease

the cost to individual schools of creating the material. Programmed instruction developed by this method could be tested for effectiveness and eventually be made available to other schools for use by their students. Units of programmed instruction such as this would be extremely valuable for teaching undergraduate physical therapy education, for review purposes and in continuing education programmes.

C. Validity of Results

The findings reported here are valid only within the context of the present experiment and the limitations imposed by the difficulties in design. This experiment must be recognized as a preliminary effort which give direction for further studies. The findings may not be applicable to other Schools of Physical Therapy because no sampling was made from a universe of physical therapy schools and because only a very minute section of a physical therapy treatments curriculum has been programmed. It can be stated, however, that there is no reason why the results cannot be duplicated in other Physical Therapy Schools with characteristics similar to those of McGill University School of Physical and Occupational Therapy, especially where the learning objectives for the students are the same.

In any case it must be emphasized that one quality required today in a review technique is a means of achieving good performance results on an individual basis without major demands on class time. The increasing burden on students, faculties and curricula in most Physical Therapy Schools demands that the approach to review be one

that is efficient, effective and stimulating to students. The self-instructional package appears to meet these criteria and also fosters independence in learning.

The Conclusion

This study found no significant differences in the averaged achievement scores of students receiving review session of a "mixed activity" and students receiving no review session, (contrary to the first hypothesis). A re-examination of studies which have reported differences with and without review finds that reported differences occurred in areas of cognitive performance only and no studies in the literature dealt with the review of practical repetition of a "mixed activity". It seems likely from this that review, when only defined as a repeat of previously taught material, does not necessarily improve performance of a "mixed activity".

This study found significant differences between the achievement scores of students receiving one kind of review (self-instructional package) as compared to another kind of review (audio-visual tape repeat and practice) - (in support of the second hypothesis). No studies in the literature have actually compared these two methods as review techniques. A critical review of the reported research however, supports these findings in a general manner by determining that programmed instruction is a valuable learning tool. It seems likely that programmed instruction when used as a review medium offers its inherent qualities of rapid and individual learning, step-wise instruction, greater

adaptation to individual differences, direction towards specific educational objectives, better retention and increased student satisfaction.

Comparisons of production costs of the two media showed that the self-instructional package was approximately 17 percent more expensive in terms of money and time than when the audio-visual tape was produced in McGill's own studio. Both media proved efficient in their presentation in the experimental situation and minor adaptations could allow independent study and use. The programmed instruction was extremely well liked by the students receiving this form of review. From several points of view it would appear that programmed instruction is a positive method of presenting a review of a "mixed activity" in Physical Therapy.

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APPENDIX A

THE BRUNNSTROM EVALUATION OF THE HEMIPLEGIC PATIENT

AUDIO-VISUAL TAPE PRESENTATION

APPENDIX B

STUDENT EVALUATION OF THE BRUNNSTROM COURSE

McGILL UNIVERSITY

School of Physical and Occupational Therapy

ATTITUDINAL TEST

581-316B

SUBJECT MATTER _____ GROUP _____

1. Do you feel that the material in this mini-section was relevant to your training?

   Yes_____ No_____

   Comment

2. Do you feel that the material presented would allow you to assess this type of patient?

   Yes _____ No_____

   Comment

3. Do you feel the material presented would allow you to plan and carry out a treatment for this type of patient

   Yes_____ No_____

   Comment

4. Did you like the method(s) of instruction?

   Yes_____ No_____

   Comment

5. Please indicate the following: -- based on a continum

   "I found this instruction to be" -

Stimulating						Boring
Too difficult						Too easy
Fun						Dull
Helpful						Useless
Too long						Too short

6. Write any other comments you would like to make about this instruction in the space below. _____

_____

_____

APPENDIX C

SELF INSTRUCTIONAL PACKAGE

BRUNNSTROM HEMIPLEGIC EVALUATION

BRUNNSTROM HEMIPLEGIC EVALUATION

Prepared by Sharon Dauphinee
Adapted from Movement Therapy in Hemiplegia - Brunnstrom

Self Instructional Package

Instructor's Name:	Sharon Dauphinee
Institution:	McGill University
Course Title:	Physical Therapy 581-361B
Intended Students:	U-II
Topic:	The Brunnstrom Evaluation of the Hemiplegic Patient
Estimated Working time of Student	

This package consists of 4 mini packages.

1. Sensory testing of the Hemiplegic patient
2. Motor testing of the upper extremity
   - shoulder and elbow regions
3. Motor testing of the upper extremity
   - wrist and hand
4. Motor testing of the lower extremity

Mini Package I

Sensory Testing of the Hemiplegic Patient

Pre-Test

1. List five (5) essential steps in testing passive motion sense in the hemiplegic patient.

2. Which joints are tested for passive motion sense?

3. What other areas of the body are tested for sensation?

Answers to Pre-Test

1. - Explain to patient
   - Rehearse test with patient, eyes open. Move joint to be tested through range and ask patient to perform similarily with unaffected arm.
   - Perform test with patient blindfolded
   - Observe findings
   - Record findings

2. Shoulder, elbow, radio ulna, wrist, fingers, hip, knee, ankle, metatarsophalangeal of big toe.

3. - Palmar aspect of finger tips
   - Sole of foot.

If you miss any of the pre-test questions or if you don't feel you could perform these tests on a patient, please continue through this unit. Otherwise proceed to Mini Package II.

Introduction

In the evaluation of the hemiplegic patient a brief investigation by the physiotherapist of the sensory status of the patient is necessary. The findings are to be used in conjunction with the findings of the medical neurological examination.

The aspects of the sensation assessed are those related to the patient's ability to recognize movement in the affected limbs (position sense), localization of touch in the finger tips (light touch) and the appreciation of pressure on the sole of the foot (pressure sense).

These tests supply gross information only, but the knowledge gained will define the sensory difficulties related to motor function and therefore will assist the therapist in planning a treatment program.

Objectives

The student will be able to perform a sensory evaluation on another student who is simulating a hemiplegic patient.

Sub-Objectives

- perform the position sense tests
- perform the finger tip recognition test
- perform the sole sensation tests

Activities

I. Testing for Passive Motion Sense

A. 1) To test passive motion sense in the arm, seat the patient on a chair and explain that you are going to do a test to see if he can feel his arm moving.

2) Rehearse the test to make sure the patient fully comprehends what is expected of him. Support the arm and passively move the shoulder joint the elbow joint and the radio ulna joint and the wrist joint to various positions. Ask the patient to perform identical movements with the unaffected arm.

3) Blindfold the patient and repeat the previous procedure.

4) Your role is to observe the patient's response as to whether he can indicate that he feels the movement on the affected side, by performing the same movement on the unaffected side.

5) Record what you see on the evaluation form, i.e.,

PASSIVE MOTION SENSE, SHOULDER present ELBOW present . PRON.SUPIN. present - slow to respond . WRIST FLEX. EXT. absent .

B. 1) To test passive motion sense in the digits, seat the patient with the forearm pronated in front of him.

2) Rehearse the test. Test one finger at a time by passively moving each metatarsophalangeal joint through flexion and extension. Ask the patient to indicate that he feels the movement either by responding up and down appropriately or indicating by similar movements on the unaffected hand.

3) Blindfold the patient and repeat the previous procedure.

4) Observe the patient's response.

5) Record the response indicating differences among fingers if present, i.e.,

PASSIVE MOTION SENSE, DIGITS present in index finger and thumb. Absent in other fingers.

C. 1) To test passive motion sense in the lower limb, lie the patient in crook lying position on a plinth.

2) Rehearse the test. Support the affected leg and passively move the hip, knee, ankle, metatarsophalangeal joint of the big toe to various positions. Ask the patient to perform identical movements with the unaffected leg.

3) Blindfold the patient and repeat the previous procedure.

4) Observe the patient's response.

5) Record the patient's response, i.e.,

PASSIVE MOTION SENSE			
HIP	present	KNEE	present
ANKLE	absent	BIG TOE	absent

In testing passive motion sense which joints are evaluated?

Upper limb:

Lower limb:

List in general terms the steps you go through to record passive motion sense.

Re-read your answers above to make sure you recorded the following joints:

Upper limb: shoulder, elbow, radio ulna, wrist, metacarpophalangeal.
Lower limb: hips, knee, ankle, metatarsophalangeal

Your steps to evaluate passive motion sense should include:
- explain to patient
- rehearse test (no blindfold)
- perform test (you move joint of affected limb and patient copies with unaffected limb
- observe response
- record responses.

II. Testing for Fingertip Recognition

A. 1) To test fingertip recognition seat the patient with the forearm in pronation resting on a pillow in his lap.

2) Rehearse the test. Touch the palmer surface of each finger tip and ask the patient to determine either verbally or by pointing with the unaffected hand which finger is being touched.

3) Blindfold the patient and repeat the previous procedure.

4) Observe the patient's responses.

5) Record the patient's responses, i.e.,

FINGERTIP RECOGNITION present in thumb and index, absent in other fingers

B. Testing for Sole Sensation

1) To test sole senation seat the patient in a chair in his bare feet so that the feet rest on the floor.

2) Rehearse the test. Use a narrow flat object (i.e., tongue depressor) and place it in various positions under the foot, i.e.,
   - all the way across the ball of the foot in a side to side direction
   - under the medial side of the foot
   - under the lateral side of the foot
   - an inch away from the foot (not touching)

   Apply pressure downward through the knee to simulate weight bearing. Ask the patient to determine if there is an object under his foot and to describe its position.

3) Blindfold the patient and repeat the previous procedure.

4) Count the correct patient's responses

5) Record the patient's responses, i.e.,

SOLE SENSATION (No. of answers)	CORRECT	1
	INCORRECT	6

To make sure you understand this section answer the following questions:-

1. How do you assess fingertip recognition?

2. How does the patient respond?

3. How do you test sole sensation?

4. How does the patient respond?

Your answers should read like the following:-

1. Touch the palmer surface of each finger.

2. Describe verbally which finger touched or point with unaffected hand.

3. Place a narrow flat object under the patient's foot in several positions - apply pressure downward to simulate weight bearing.

4. Describe if there is an object under the foot and where it is.

Post-Test

Now it is time for you to simulate being a hemiplegic patient. Decide what sensory deficit you wish to exhibit and role play for your partner. Make sure your partner performs the following steps and check her judgments of your responses.

1. Explanation of purpose of tests.
2. Rehearsal and actual tests of: -
   - Passive motion sense, shoulder, elbow, radio ulna, wrist, metacarpophalnageal digits, hip, knee, ankle, metatarsophalangeal joint of big toe.
   - Fingertip recognition
   - Sole sensation
3. Observes responses.
4. Records responses.

_____	PASSIVE MOTION SENSE, SHOULDER _____	ELBOW _____
_____	PRON.-SUPIN. _____	WRIST FLEX.-EXT. _____
_____	PASSIVE MOTION SENSE, DIGITS _____	
_____	FINGERTIP RECOGNITION _____	
PASSIVE MOTION SENSE	HIP _____	KNEE _____
	ANKLE _____	BIG TOE _____
	SOLE SENSATION (No. of answers)	CORRECT _____ INCORRECT _____

Change roles and repeat the above procedure.

Mini Package II

Motor Testing of the Upper Extremity

Shoulder and Elbow

Pre-Test

1. What is the ability and state of the patient's upper extremity if he is to receive a "Stage II" grade?

2. How do you test for the components of the Flexor synergy (upper extremity) in Stage III?

3. What movements of the upper extremity do you ask the patient to perform to evaluate for Stage V?

Answers to Pre-Test

1. Components of the synergies first appearing either as voluntary or associated movements. Spasticity developing.

2. Ask the patient to lift up his arm as if he were to "scratch behind his ear". Evaluate shoulder elevation, retraction, abduction or hyperextension and elbow flexion and supination in terms of active joint range. Test tonal state by passive motion.

3. a) Abduction of arm with elbow extended
   b) flexion and elevation (180 degrees) of shoulder with elbow extended
   c) pronation and supination with the arm held in the "yard" or "reach" positions.

Introduction

As part of the evaluation of the hemiplegic patient the physical therapist must assess the motor function of the upper extremity. The results of this assessment give a base line guide upon which to plan a treatment program and as well can be referred to at a later date to determine if progress is being made.

This mini package is designed to give you practice in evaluating the different stages of recovery of motor function of the shoulder and elbow areas.

Objectives

The student will be able to evaluate shoulder and elbow motor function in another student who is simulating a hemiplegic patient.

Sub-Objectives

- perform the motor tests on the patient to evaluate recovery stages 1 to 6
- judge the performance of the patient on the motor tests for the stages 1 to 6
- record the observations in terms of active joint range for stages 1 to 6.

Activities

I. We will first look at testing for motor recovery stages I and II according to Brunnstrom.

1. To test for stages I and II, seat the patient and try to elicit movement in the affected upper extremity by:-
   - asking the patient to move the arm, i.e., shrug the shoulders, lift the arm sideways, lift the arm, bend or straighten the elbow.
   - working maximally the unaffected arm (i.e. biceps) to elicit an associated reaction on the affected side.
   - move the affected arm and ask the patient to hold a position.
2. Observe the patient's response and make judgments as follows:-
   - if no movement can be initiated in the affected arm and the limb feels heavy and offers no resistance to passive movement, grade the patient STAGE I.

   Record, i.e.,

1. NO MOVEMENT INITIATED OR ELICITED true

- if the basic limb synergies or some of their components are appearing with or without actual joint movement and some spasticity is developing, grade the patient STAGE II.

Record, i.e.,

2. SYNERGIES OR COMPONENTS FIRST APPEARING.	
	Spasticity developing slight increase
FLEXOR SYNERGY	active movement in biceps
EXTENSOR SYNERGY	can adduct shoulder

To make sure you understand the preceeding procedures:-

1. List the three steps you go through to determine if the patient is in stage I or II.

2. What results do you expect for a patient in stage I?

3. What results do you expect for a patient in stage II?

Re-read your answers and decide if they agree with the following:-

1. - ask for voluntary movement
   - resist the unaffected arm
   - position the affected arm and ask the patient to hold the position.
2. Stage I - no movement elicited, tone decreased.
3. Stage II - some synergic components appearing with or without joint movement - spasticity developing.

II. We will now look at testing for recovery stage III. In this stage the synergies or some of their components can be initiated voluntarily and demonstrate joint movement. Spasticity is marked.

1. With the patient seated, move the affected arm passively to determine the tonal state of the muscles. Particularly look for increased tone in the elbow flexors, the wrist and finger flexors, pectoralis major and the forearm pronators.

2. Assess the voluntary movement in the flexor synergy by asking the patient to try and reach up and scratch behind your ear. You demonstrate the required movement and let the patient do it with the unaffected arm first. Allow him several trials.

3. Observe the voluntary motion in the shoulder girdle, shoulder, elbow and forearm. Record in terms of active joint ranges, i.e., 0 - 1/4 - 1/2 - 3/4 full range
zero incomplete complete range
obtuse - 90 degrees - acute range (elbow)

SYNERGIES OR COMPONENTS INITIATED VOLUNTARILY. Spasticity marked true

FLEXOR SYNERGY		Active Joint Range		Remarks
Shoulder girdle	Elevation	full	range	
	Retraction	full	range	
Shoulder joint	Hyperextension Abduction	3/4	range	
	Ext. rotation			
Elbow	Flexion	90°		
Forearm	Supination	1/2	range	

4. Assess the voluntary movement of the extensor synergy by holding the affected arm in the full flexor synergic position and ask the patient to push down and across to touch to opposite knee. Try the movement first on the unaffected arm and allow the patient several trials.

5. Observe the voluntary motion in shoulder, elbow and forearm. Record in terms of active joint range as for the flexor synergy.

EXTENSOR SYNERGY		Active Joint Range		Remarks
Shoulder	Pectoralis major	full	range	~~turns trunk to~~
Elbow	Extension	1/2	range	affected side
Forearm	Pronation	partial	range	

To make sure you understnad the above procedure, answer the following questions.

1. How do you test muscle tone in the upper extremity?

2. What commands do you give the patient to evaluate voluntary movement in: -

   Flexor synergy

   Extensor synergy

3. How do you record your observations?

Check your answers and decide if they agree: -

1. Move arm passively at all joints.
2. "Try to reach your hand up and scratch behind your ear." "Push your hand down and across to touch the opposite knee."
3. In terms of active joint range.

III. We will now look at testing recovery stage IV. In this stage some movement combinations that deviate from the basic synergic patterns are possible and spacticity begins to decrease.

Seat the patient and demonstrate each movement.

1. Ask the patient to reach behind his back and touch his buttock. This movement a) utilizes a modified flexor and then a modified extensor synergy
   b) necessitates the performance of the downward rotations of the scapula, latisimus dorsi and teres major. These muscles are not part of either synergy
   c) demands that pectoralis major must be inhibited for successful completion.

   Observe the patient's response in terms of amount of active movement attained. Add any other remarks to clarify the movement patterns.

Record the results, i.e.,

MOVEMENTS DEVIATING FROM BASIC SYNERGIES Spasticity decreasing	Hand to sacral region	full	slow to perform

2. Ask the patient to lift the arm to a forward horizontal position.

   This movement if performed accurately shows that the strong linkage between pectoralis major and triceps is decreasing. If the patient pulls the arm into increased adduction the extensor synergy is dominating. If the patient flexes the elbow or abducts the shoulder as he tries to perform the movement, the flexor synergy is dominating.

Observe the patient's performance in terms of joint range and note the accuracy of the movement.

Record the results, i.e.,

Raise arm forw. horiz.	90°	No deviations in direction.

3. Ask the patient to flex both elbows and hold in close to his body and then to pronate and supinate the forearms.

   If the affected shoulder tends to abduct on supination of the forearm the flexor synergy is dominating.

   Observe the patient's performance in terms of range (not speed) and note the shoulder movements.

   Record the results, i.e.,

Pron.-supin. elbow at 90°	partial	range	NO SHOULDER MOVEMENTS

To test your understanding of this section answer the questions:

1. What movements do you ask the patient to perform to test Stage IV?

2. How do you make judgment to record?

Check your answers with the following: -

1. Reach affected hand behind buttock, left arm to "reach" position, pronate and supinate forearm with the elbow held in flexion.
2. Active joint range - description to explain deviations.

IV. We will now look at testing recovery stages V and VI. In stage V there is relative independence of the basic limb synergies and spasticity continues to decline. More difficult and varied movements combinations can be performed as well as individual joint movements. In stage VI movement combinations are near normal and spasticity is essentially absent.

Seat the patient and demonstrate each movement.

1. Ask the patient to raise the arm laterally while keeping the elbow straight and the forearm pronated.

This movement can only be performed properly when the basic limb synergies have lost their influence since: -

a) it combines two components of the flexor synergy (shoulder retraction and abduction) with two components of the extensor synergy (elbow extension and pronation)

b) pectoralis major must be completely dissociated from triceps.

Observe the patient's response in terms of active joint range and note any deviations, i.e., elbow flexion.

Record the results, i.e.,

RELATIVE IN-DEPENDENCE OF BASIC SYNERGIES Spasticity waning	Raise arm side.-horiz.	90°	elbow tends to slightly bend can hold stright if prompted

2. Ask the patient to keep the elbow straight and lift the arm over the head. The ability to perform this movement correctly denotes good voluntary control of serratus anterior as well as loss of synergic dominance.

   Observe the patient's performance in terms of active joint range and elbow control.

   Record the results, i.e.,

Raise arm over head	135°

3. Ask the patient to hold his arms in the forward or sideways horizontal position and to alternately pronate and supinate the forearm. No effect is made to control the rotation at the shoulder joint, however the elbows must remain extended.

   During the supination phase two components of the flexor synergy (shoulder external rotation and forearm supination) are added to a basic flexed position. If triceps can maintain a straight elbow the patient is very advanced in recovery.

   Observe the patient's performance in terms of active joint range, speed and ability to control the elbow.

   Record the results, i.e.,

Pron.-supin. elbow extended	full range	No flexion of elbow

4. To assess stage VI.
   Ask the patient to perform mainly rapid movement combinations, i.e.,
   - clap hands over head
   - clap hands behind back
   - touch body part to command

   Observe the performance in terms of ability to do movements almost as well as on the good side.

   Record the results, i.e.,

MOVEMENT COORDINATION NEAR NORMAL. Spasticity minimal	close to normal performance

To make sure you understand how to test for stage V and VI answer the following questions: -

1. What movements do you ask the patient to perform to test stage V?

2. Give three (3) examples of movement that could test for stage VI.

3. How do you judge stage VI?

Your answers should agree with the following:-

1. - arm abducted 90 degrees
   - arm in elevation - elbow straight
   - pronation and supination with shoulder in 90 degree flexion or 90 degree abduction.

2. - clap hands over head
   - clap hands behind back
   - touch body parts to command

3. Compare to normal side in terms of range, speed and fluidity of movement.

V. We will now look at the Speed Tests which give information concerning spasticity of the flexor and extensor muscles of the elbow and are applicable to stages IV, V, and VI. Both arms are tested for purposes of comparison.

   Seat the patient and place the hand of the limb to be tested in the lap with the fist closed.

1. Testing flexion range and control: - Start with the unaffected arm and position the forearm halfway between pronation and supination so that when the hand touches the chin, the chin fits into the open space between the thumb and the index finger. Ask the patient to touch his chin and bring his hand back to the starting position as fast as he can. Use a stop watch and count the number of full strokes (back and forth movements) completed in five seconds. Record the results.

   Repeat test on affected side. If the speed is very slow as when spasticity marked count half strokes and note. Record the results, i.e.,

SPEED TESTS for classes IV, V, VI.		Strokes per 5 sec.
Hand from lap to chin	Normal	10
	Affected	3

2. Testing extensor range and control: - Start with the unaffected arm and position the forearm in pronation. Ask the patient to touch his opposite knee with his fist and bring his hand back to the starting position as fast as he can. Count the full strokes completed in 5 seconds.

   Record the results.

   Repeat the test on the affected side again counting half strokes if necessary.

   Record the results, i.e.,

Hand from lap to opposite knee	Normal	12
	Affected	3

To make sure you understand these tests answer the following questions: -

1. What movements do you ask the patient to perform for the speed tests?

2. For which stages do you use these tests?

3. What do <u>speed tests</u> evaluate?

Your answers should agree with the following:-

1. - hand from lap to chin and back
   - hand from lap to opposite knee and back
2. IV, V, VI

3. range - control - spasticity.

Post-Test

Now it is time for you to simulate being a hemiplegic patient. Decide what motor deficit you wish to exhibit in the upper extremity and role play this for your partner. Make sure she performs all the necessary tests according to the stage of recovery you have chosen and that she records her evaluation in the form provided here. Check her judgments of your responses.

1. NO MOVEMENT INITIATED OR ELICITED _____

2. SYNERGIES OR COMPONENTS FIRST APPEARING. Spasticity developing _____

   Flexor synergy _____

   Extensor synergy _____

3. SYNERGIES OR COMPONENTS INITIATED VOLUNTARILY. Spasticity marked _____

FLEXOR SYNERGY	Active Joint Range		Remarks
Shoulder girdle	Elevation		
	Retraction		
	Hyperextension		
Shoulder joint	Abduction		
	Ext. rotation		
Elbow	Flexion		
Forearm			
EXTENSOR SYNERGY			
Shoulder	Pectoralis major		
Elbow	Extension		
Forearm	Pronation		
4. MOVEMENT DEVIATING FROM BASIC SYNERGIES Spasticity decreasing	Hand to sacral region		
	Raise arm forw.-horiz.		
	Pron.-supin. elbow at 90°		
5. REL. IN-DEPENDENCE OF BASIC SYNERGIES Spasticity waning	Raise arm side-horiz.		
	Raise arm over head		
	Pron.-supin. elbow extended		
6. MOVEMENT COORDINATION NEAR NORMAL Spasticity minimal			

Change roles and repeat the previous procedure.

Mini Package III

Evaluation of the Wrist and Hand

Pre-Test

1. What does Brunnstrom ask the patient to do to evaluate wrist function?

2. List six (6) grasp and prehension activities she asks the patient to perform to evaluate hand function.

3. What other movement in the hand does she evaluate?

Answers to Pre-Test

1. - stabilize the wrist during grasp with
     a) elbow extended
     b) elbow flexed
   - flex and extend the wrist with the fist closed and
     a) the elbow extended
     b) the elbow flexed
   - circumduct the wrist.

2. - mass grasp
   - hook grasp
   - palmer prehension
   - spherical grasp
   - mass extension
   - lateral prehension
   - cylindrical grasp

3. individual finger and thumb movements.

If you did not get the correct answers or if you feel you could not evaluate hand function on a hemiplegic patient continue through this mini package. Otherwise proceed to mini package IV.

Introduction

The return of hand function may or may not parallel the return of function in the other areas of the upper extremity. Brunnstrom has therefore approached the evaluation of the hand differently. The techniques employed assess functional abilities.

This learning package is designed to give you practice in evaluating the different stages of recovery of motor performance of the hand.

Objective

The student will be able to evaluate wrist and hand function in another student who is simulating a hemiplegic patient.

Sub-Objectives

- will evaluate wrist function
- will evaluate grasp and prehension abilities
- will evaluate individual finger and thumb movements.

Activities

I. We will first evaluate the wrist. In the normal individual, stabilization of the wrist during grasp is automatically carried out by the wrist extensors. In the hemiplegic patient however, this synergic action of the wrist extensors is often lacking. Particularly when the synergies are still dominant there is a tendency to flex the wrist when the elbow flexes.

To test wrist control perform the following manouvers with the patient seated.

1. Position the patients arm in front of him with the elbow in extension. Support the arm if necessary. Ask the patient to make a fist.

   Observe the movement at the wrist. Are the extensors stabilizing the wrist in slight extension?

   Record on the form, i.e.,

WRIST STABILIZATION for grasp.	1. Elbow extended	stabilized in slight extension.

2. Now bend the elbow to 90 degrees and support the arm if necessary. Ask the patient to make a fist. Observe the wrist extensors and wrist movement.

   Record on the form, i.e.,

WRIST STABILIZATION	2. Elbow flexed	wrist tends to flex - Min. stabilization.

3. Position the patient's arm in front of him with the elbow in extension, and the fist closed. Support the arm if necessary. Ask the patient to flex and extend the wrist while keeping the fist closed.

   Observe the response.

   Record on the form, i.e.,

WRIST FLEXION AND EXTENSION FIST CLOSED.	1. Elbow extended	fist stays closed

4. Now bend the elbow to 90 degrees and support the arm if necessary. Ask the patient to flex and extend the wrist while keeping the fist closed.

   Observe the responses.

   Record on the form, i.e.,

WRIST FLEXION AND EXTENSION FIST CLOSED	2. Elbow flexed	can't extend the wrist

5. Position the patient with the elbox flexed and the forearm stabilized in pronation. Ask the patient to circumduct the wrist. This activity requires a high degree of co-ordination and is indicative of advanced function return.

   Observe the patient's response.

   Record on the form, i.e.,

WRIST CIRCUMDUCTION	tends to use pronation and supination movement as well as wrist movements.

To determine if you understand the preceding section, answer the following questions.

1. What is the basic patient position for testing wrist function?

2. List 5 patient performances you test to evaluate wrist function.

Your answers should read as follows: -

1. sitting
2. ability to stabilize wrist during grasp with
   - elbow extended
   - elbow flexed

ability to maintain a fist while flexing and extending the wrist with
- elbow extended
- elbow flexed

ability to circumduct the wrist

II. We will now evaluate the patient's ability to open and close the hand, and to utilize various types of prehension. The prehension activities are tested in order of difficulty.

The patient is seated with his forearm supported in his lap.

1. Mass Grasp. Ask the patient to close the hand. Observe the response and record the number of fingers involved and the excursion of the movement. If the movement is strong evaluate with a dynamometer and compare to normal hand. i.e.,

MASS GRASP	all fingers full range	Dynamometer test	Normal 40 lb. Affected 5 lb.

2. Mass extension. Ask the patient to open the hand and extend the fingers. Differentiate between flexor release and active extension. Observe the response and record the number of fingers involved and the excursion of the movement, i.e.,

MASS EXTENSION	index and middle full range. ring and small fingers 1/2 range.

3. Hook grasp. Ask the patient to hook his fingers around the handle of a 2 pound handbag and lift the bag to a new position. Observe and record, i.e.,

HOOK GRASP (Handbag, 2 lb)	picks up bag easily

4. Lateral Prehension. Ask the patient to hold a card between the thumb and lateral side of the index finger. Observe ability and record, i.e.,

LATERAL PREHENSION (card)	Holds card and lets it go.

5. Palmer Prehension. Ask the patient to pick up and hold a pencil between the thumb and one or more finger ends. This movement necessitates true opposition. Ask the patient to release the pencil. Observe and record, i.e.,

PALMER PREHENSION (pencil)	difficulty in picking up - can hold and release

6. Cylindrical grasp. Ask the patient to pick up and hold, and put down a small glass. Observe and record, i.e.,

CYLINDRICAL GRASP (small jar) manages easily

7. Spherical grasp. Ask the patient to pick up, hold and release a ball. If he can do this, can he catch and throw a ball. Observe and record, i.e.,

SPHERICAL GRASP (ball) yes Catch no Throw not well

To make sure you understand the preceding section, answer the following questions.

What do you have the patient do to assess the following hand functions?

Mass grasp _____ Dynamometer test Normal _____ lb.
Affected _____ lb.

Mass extension _____

Hook grasp _____

Lateral prehension _____

Palmar prehension _____

Cylindrical grasp _____

Spherical grasp _____

Check your answers with the following: -

Mass Grasp make a fist Dynamometer test Normal measure lb.
Affected measure lb.

Mass extension extend fingers 1 or more

Hook grasp pick up handbag and move it

Lateral prehension hold card between thumb and index finger

Palmar prehension hold pencil between thumb and finger and release

Cylindrical grasp grasp, hold and release glass

Spherical grasp hold ball catch throw

III. We will now evaluate individual finger and thumb movements. These movements are tested last and if they are present, it indicates that a patient is well advanced toward recovery.

1. Individual Thumb Movements. Position the patient's arms in his lap with the ulnar side down. Teach on the unaffected side. Ask the patient to: -
   a) move the thumbs up and down (extension and flexion)
   b) move the thumbs side to side (abduction and adduction).

   Record your observations in terms of range and speed, i.e.,

INDIV. THUMB MOVEMENTS	1. Vertical movements	movement rapid - good range
ULNAR SIDE DOWN	2. Horizontal movements	movement rapid - good range

2. Individual Finger Movements. Position the patient's arms in his lap with the palms up. Teach on the unaffected side first. Ask the patient to -
   a) flex and extend the metacarpophalngeal joints
   b) abduct and adduct the metacarpophalangeal joints
   c) flex and extend the inter-phalangeal joints.

   Record your observations in terms of fingers, speed and range of motion, i.e.,

INDIVIDUAL FINGER MOVEMENTS	all movement present. full range - slower than unaffected side

3. Functional movements. Ask the patient to unbutton and button his shirt -
   a) using both hands
   b) using affected hand only.

   Ask for other skilled activities, i.e., snapping fingers

   Record your observations, i.e.,

BUTTON AND UNBUTTON SHIRT	Using both hands _____
	Using affected hand only _____
OTHER SKILLED ACTIVITIES	_____

To make sure you understand this section answer the following questions.

1. How do you assess individual thumb movements?

2. How do you assess individual finger movements?

3. What functional activities might you ask a patient to perform to assess hand ability?

Check your answers: -

1. Ask for flexion, extension, adduction and abduction of the thumb. Evaluate in terms of range and speed.
2. Ask for flexion, extension, adduction and abduction of the metacarpophalangeal joints, and flexion and extension of the inter-phalangeal joints. Evaluate in terms of range and speed.
3. Unbuttoning and buttoning a shirt. Snapping fingers.

Post-Test

Now it is time for you to simulate being a hemiplegic patient. Decide what motor deficit you wish to exhibit in the wrist and hand and role play this for your partner. Make sure she performs all the necessary tests and that she records her evaluation on the form provided. Check her judgments of your responses.

DIGITS

Mass grasp_____ Dynamometer test Normal _____ lb.
Affected _____ lb.

Mass extension _____

Hook grasp (handbag, 2 lb.) _____

Lateral prehension (card) _____

Palmar prehension (pencil) _____

Cylindrical grasp (small jar) _____

Spherical grasp (ball) _____ catch _____ throw _____

Indiv. thumb movements 1. Vertical movements _____
hands in lap.

ulnar side down 2. Horizontal movements _____

Individual finger movements _____

Button and unbutton shirt — Using both hands _____

Using affected hand only _____

Other skilled activities _____

Change roles and repeat the previous procedure.

Mini Package IV

Evaluation of the Trunk and Lower Extremity

Pre-Test

Regarding return of function of the lower limb, define the recovery stages in terms of what the patient should be able to do.

Stage I

II

III

IV

V

VI

Answers to Pre-Test

Stage I - No movement observed

II - Minimal voluntary movements

III - Hip - knee - ankle flexion in sitting and standing

IV - Knee flexion while weight bearing

V - Knee flexion beyond 90 degrees in sitting
isolated dorsiflexion

VI - Hip abduction in standing
inversion and eversion of ankle giving reciprocal hamstring action (in sitting)

If you did not answer the pre-test correctly and/or if you feel you need practice in evaluating the lower extremity of the hemiplegic patient, proceed through mini package IV. Otherwise proceed to the Attitudinal Test at the end of the package.

Introduction

Brunnstrum's evaluation of the trunk and lower extremity is not nearly as detailed as that for the upper extremity. The evaluation is strictly orientated toward the activities a patient must master to achieve safe sitting, standing and walking.

This mini package is designed to give you practice in evaluating the stages of recovery of the trunk and lower extremity.

Objectives

The student will be able to evaluate the trunk and lower extremity of another student who is simulating a hemiplegic patient

- evaluate trunk balance
- evaluate motor performance of the lower extremity.

Activities

I. We will first test the patient in the supine position since this is the easiest for the patient. In this position we can determine if the lower extremity is in Stage I (flaccidity) or Stage II (minimal voluntary movements).

1. Position the affected leg in mid-position so that the hip and knee are partially bent and the sole of the foot rest on the bed.

   Ask the patient to bend the hip and knee up toward the chest while turning the foot up.

   Record the response in terms of active components and range of motion.

   If no movement is present grade Stage I. If some voluntary movements are present grade Stage II, i.e.,

FLEXOR SYNERGY	hip and knee flexion present minimal range - no dorsiflexion (Stage II)

2. Position the affected leg as previously and ask the patient to push the leg down the bed (straighten the knee) and point the foot.

   Record the response in terms of active components and range.

   If no movement is present, grade Stage I. If some voluntary movement is present, grade Stage II, i.e.,

EXTENSOR SYNERGY	can straighten leg and point foot. STAGE II

3. Position the patient in supine and ask the patient to push the legs apart and pull them back together. Record the response, i.e.,

HIP: Abduction	no active movement	Adduction	pulls leg in strongly

To make sure you understand these tests answer the following: -

1. State the starting position to test flexion and extension synergy for Stages I and II.

2. What do you ask the patient to do?

   - flexor synergy

   - extensor synergy

3. How do you test adduction and abduction?

Your answers should agree with the following: -

1. 1/2 crook lying (affected leg)
2. flexor synergy - bend the hip and knee and dorsiflex the foot.
   extension synergy - straighten the hip and knee and plantiflex the foot.
3. supine lie abduct and adduct legs.

II. We will now test the patient in the sitting position.

1. Observe the patient's sitting position. Is he straight or does he list to one side? Apply moderate resistance to the trunk muscles (in all directions) and determine how strongly he can hold his position.

   Record your observations, i.e.,

TRUNK BALANCE (no back support)	lists to affected side. very stable

2. Ask the patient to dorsiflex the ankle and lift the foot off the floor. Ability to perform is Stage III.

   Record your observations, i.e.,

HIP-KNEE-ANKLE FLEXION	can do full range slowly

3. Ask the patient to slide the foot forward and back (small range). Since this requires knee extension activity in a basically flexed position, this shows that the synergies are breaking up. Grade Stage IV.

   Record your observations, i.e.,

KNEE-FLEX.-EXT. SMALL RANGE	can do slowly - Stage IV

4. Ask the patient to slide the foot back so that the knee bends more than 90 degrees. Grade Stage IV (late).

   Record your observations, i.e.,

KNEE FLEXION BEYOND 90°	can't go beyond 90 degrees

5. Ask the patient to pull the foot up (dorsiflex) without lifting the knee. Grade Stage IV (late).

   Record your observations, i.e.,

ANKLE, ISOLATED DORSIFLEXION	full range movement. Stage IV

6. Ask the patient to turn the foot out (eversion) and turn the foot in (inversion). Palpate under the knee to evaluate reciprocal action of the inner and outer hamstring muscles. The reciprocal action indicates a high degree of restoration of function of the neuro-muscular system. Grade Stage VI

   Record your observations, i.e.,

RECIPROCAL HAMSTRING ACTION	cannot perform inversion and eversion No reciprocal action

To make sure you understand these tests answer the following: -

1. How do you test the brunk balance?

2. In the sitting position what should the patient be able to do for Stage IV?

Your answers should read as follows: -

1. sit the patient - observe position
   apply resistance to judge stability.
2. small range knee flexion and extension
   flexion beyond 90 degrees
   isolated dorsiflexion.

III. We will now test the patient in the standing position. Have the patient standing in parallel bars for safety reasons.

1. Check the following: -
   a) can he stand with bar support?
   b) can he stand without support?
   c) can he stand on unaffected leg? How long?
   d) standing on double scales how much weight is taken through each leg?

Record your observations, i.e.,

STANDING

WITH o.k. WITHOUT o.k. SUPPORT
BALANCE, NORMAL LIMB 8 SEC.
DOUBLE SCALE a) R.side b) L.side
READING 60 lbs 100 lbs

2. Ask the patient to bend the hip and knee and dorsiflex the ankle. This movement is essential for walking. Grade Stage III.

   Record your observations, i.e.,

HIP-KNEE-ANKLE FLEXION does easily

3. Ask the patient to keep weight on both legs and to bend both knees slightly and then straighten them. Grade Stage IV.

   Record your observations, i.e.,

KNEE-FLEX. -EXT.SMALL RANGE tends to take weight off leg to get knee to bend.

4. Ask the patient to flex the affected knee while keeping the hip in extension. Since this requires knee flexor activity in a basically extended position: It is graded Stage V.

   Record your observations, i.e.,

KNEE FLEXION. HIP EXTENDED flexes knee about 30 degrees

5. Ask the patient to turn the foot up (dorsiflex) without moving the knee. This requires dorsiflexion in a basically extended position and is graded Stage V.

   Record your observations, i.e.,

ANKLE, ISOLATED DORSIFLEXION knee tends to flex when dorsiflexing

6. Ask the patient to keep the knee straight and to lift the leg to the side (beyond the range obtained by elevation of the pelvis). This requires hip abduction in a basically extended position. Grade Stage VI.

   Record your observations, i.e.,

HIP ABDUCTION KNEE EXTENDED knee tends to flex

To make sure you understand these tests answer the following: -

1. In the standing position what are the tests for the following stages?

   Stage III

   IV

   V

   VI

Check your answers with these below.

1. Stage III - hip-knee and ankle flexion

   IV - knee flexion while weight bearing

   V - knee flexion with hip extension isolated ankle dorsiflexion

   VI - hip abduction - knee extended

Post-Test

Now it is time for you to simulate being a hemiplegic patient. Describe what motor deficit you wish to exhibit in the lower extremity, and role play this for your partner. Make sure that she performs all the necessary tests for the stage you have chosen and that she records her evaluation in the form provided. Check her judgments of your responses.

TRUNK AND LOWER LIMB

SUPINE

Passive motion sense Hip _____ Knee _____

Ankle _____ Big toe _____

Flexor synergy _____

Extensor synergy _____

Hip: abduction _____ adduction _____

SITTING ON CHAIR	STANDING
Trunk balance (no back support)	With ____ Without ____ support
Sole sensation Correct ____	Balance normal limb ____ sec.
(no. of answers) Incorrect ____	Double scale (a) (b) reading+
Hip-knee-ankle flexion	Hip-knee-ankle flexion
Knee flex.-ext. sm. range	Knee flex.-ext. sm. range
Knee flexion beyond 90°	Knee flexion Hip extended
Ankle, isolated dorsiflexion	Ankle, isolated dorsiflexion
Reciprocal hamstring action*	Hip abduction knee extended

Change roles and repeat the previous procedure.

APPENDIX D

STUDENT EVALUATION OF

THE SELF INSTRUCTIONAL PACKAGE

ATTITUDINAL TEST

1. Do you feel the material in this Instructional Package improved your ability to assess a simulated hemiplegic patient?

   Yes _____ No _____

2. Do you now feel more confident about your ability to assess a real hemiplegic patient?

   Yes _____ No _____

3. Do you feel the material in this package was relevant to your training?

   Yes _____ No _____

4. Please indicate the following (based on a continum)

   "I found this package to be " --

Stimulating						Boring
Too difficult						Too easy
Fun						Dull
Helpful						Useless
Just Right						Too long

5. Write any comments you would like to make about this package in the space below:

_____

_____

_____

_____

_____

APPENDIX E

BRUNNSTROM EVALUATION FORM

FOR A HEMIPLEGIC PATIENT

McGill University
School of Physical and Occupational Therapy

Chart 1

HEMIPLEGIA--CLASSIFICATION AND PROGRESS RECORD (p.1)

Upper Limb---Test Sitting

Name_____ Age___ Date of onset_____ Side affected ____

Date

Passive motion sense, shoulder _____ elbow_____

pron.-supin. _____ wrist Flex.-ext._____

1. NO MOVEMENT INITIATED OR ELICITED _____
2. SYNERGIES OR COMPONENTS FIRST APPEARING. Spasticity developing _____
   Flexor synergy _____
   Extensor synergy _____
3. SYNERGIES OR COMPONENTS INITIATED VOLUNTARILY. Spasticity marked _____

FLEXOR SYNERGY		Active Joint Range		Remarks
Shoulder girdle	Elevation			
	Retraction			
	Hyperextension			
Shoulder joint	Abduction			
	Ext. rotation			
Elbow	Flexion			
Forearm				
EXTENSOR SYNERGY				
Shoulder	Pectoralis major			
Elbow	Extension			
Forearm	Pronation			
4. MOVEMENT DEVIATING FROM BASIC SYNERGIES	Hand to sacral region			
	Raise arm forw.-horiz.			
Spasticity decreasing	Pron.-supin. elbow at 90°			
5. REL. INDEPENDENCE OF BASIC SYNERGIES	Raise arm side-horiz.			
	Raise arm over head			
Spasticity waning	Pron.-supin. elbow extended			
6. MOVEMENT NORMAL	COORDINATION NEAR Spasticity minimal			

HEMIPLEGIA---CLASSIFICATION AND PROGRESS RECORD (p.2)

Upper limb -- Test Sitting (Continued)

Name _____

Date

SPEED TESTS For Classes 4, 5, 6		Strokes per 5 sec.	
Hand from lap to chin	Normal		
	Affected		
Hand from lap to opposite knee	Normal		
	Affected		

Passive motion sense, digits _____

Fingertip recognition _____

Wrist stabilization 1. Elbow extended _____
2. Elbow flexed _____

Wrist flexion and extension fist closed 1. Elbow extended _____
2. Elbow flexed _____

Wrist circumduction _____

DIGITS

Mass grasp _____ Dynamometer test Normal _____ lb.
Affected _____ lb.

Mass extension _____

Hook grasp (handbag, 2 lb.) _____

Lateral prehension (card) _____

Palmar prehension (pencil) _____

Cylindrical grasp (small jar) _____

Spherical grasp (ball) _____ catch _____ throw _____

Indiv. thumb movements hands in lap. 1. Vertical movements _____

ulnar side down 2. Horizontal movements _____

Individual finger movements _____

Button and unbutton shirt Using both hands _____

Using affected hand only _____

Other skilled activities _____

HEMIPLEGIA---CLASSIFICATION AND PROGRESS RECORD (p.3)

Trunk and Lower Limb

Name_____ Evaluation date _____

SUPINE

Passive motion sense: Hip_____ Knee _____

Ankle_____ Big toe_____

Flexor synergy_____

Extensor synergy_____

Hip: abduction _____ adduction _____

SITTING ON CHAIR	STANDING
Trunk balance (no back support)	With_____ Without_____ support
	Balance normal limb sec.
Sole sensation (no. of answers) Correct_____ Incorrect_____	Double scale reading+ (a) (b)
Hip-knee-ankle flexion	Hip-knee-ankle flexion
Knee flex.-ext. sm. range	Knee flex.-ext. sm. range
Knee flexion beyond 90°	Knee flexion Hip extended
Ankle, isolated dorsiflexion	Ankle, isolated dorsiflexion
Reciprocal hamstring action*	Hip abduction knee extended

AMBULATION Evaluation date_____

Brace?_____ Cane?_____ In parallel bars_____

Supported _____ Escorted_____ Alone_____

Arm in sling_____ Arm swings loosely _____ Elbow held flexed _____

Arm swings near normal _____

GAIT ANALYSIS Evaluation date _____

Hip: Swing phase

Stiff (Pelvic motion)_____

Moderately stiff_____

Free, near normal_____

Exagg. flexion _____

Circumduction _____

External rotation _____

Knee: Swing phase

Stiff_____

Moderately stiff_____

Exagg. flexion_____

Near normal_____

Ankle: Swing phase

Inversion_____

Toes drag_____

"Whip"_____

Near normal_____

Walking cadence: Steps/min._____

Hip: Stance phase

Trendelenburg_____

Trunk forward_____

Abduction_____

Steady, near normal _____

Knee: Stance phase

Hyperextension_____

Stable in sl. flex._____

Steady, near normal_____

Ankle: Stance phase

Inversion, early stance_____

Inversion throughout _____

Eversion_____

Entire sole down_____

Toes first_____

Heel-toe, near normal_____

* Inward and outward rotation at knee with inversion-eversion at ankle

+ Recorded as normal/affected: (a) preferred stance; (b) weight shift on aff. limb

APPENDIX F

STUDENT QUESTIONNAIRE

ON THE METHOD OF EVALUATING

THE BRUNNSTROM COURSE

BRUNNSTROM EXAMINATION

EVALUATION FORM

Group_____

1. Do you feel that the method of evaluating Brunnstrom was valid? (Tested what was taught)

_____ Yes _____ No _____ Partially

2. If Yes - why?

3. If No - why?

4. Did you like that method of being evaluated?

_____ Yes _____ No

5. What was the most difficult aspect of the test?

6. Did working on "the teacher" add to your anxiety?

_____ No _____ Yes, a little

_____ Yes, a lot

7. Have you any suggestions for improving this method?

APPENDIX G

INTRODUCTION TO THE

BRUNNSTROM AUDIO-VISUAL TAPE PRESENTATION

THE BRUNNSTROM EVALUATION OF THE HEMIPLEGIC PATIENT

Miss Signe Brunnstrom, a physical therapist, spent many years studying, clinically observing and working with hemiplegic patients. The results of these years of work have been set forth in a book:

Movement Therapy in Hemiplegia

Miss Brunnstrom advocates a neurophysiological approach to the evaluation and treatment of this type of patient. Her observations on large numbers of patients led her to believe that an almost stereotyped sequence of events takes place following a cerebral vascular accident. While no two hemiplegic patients are identical there are reflex factors in their motor behaviour which are similar from patient to patient.

The most well known of these common elements is a synergy.

- Can be defined as a group of muscles which:

1) work together as a bound unit
2) are of a primitive and automatic nature
3) are present on a spinal cord level.

In the Upper Extremity

Flexor Synergy - predominates - consists of: -

- Retraction and/or elevation of the Shoulder girdle
- Shoulder abduction and lateral rotation or hyperextension
- Elbow - flexion - supination
- Wrist and finger flexion

The Extensor Synergy - latent - consists of: -

- Protraction and depression of the Shoulder girdle
- Shoulder abduction and internal rotation
- Elbow - extension and pronation
- Wrist - extension
- Finger - flexion

In the Lower Extremity

Flexor Synergy - early but not predominant

- Hip: flexion, abduction, lateral rotation
- Knee: flexion to 90°
- Ankle: dorsiflexion and inversion
- Toes: extension

Extensor Synergy - predominates

- Hip: extension, abduction, internal rotation
- Knee: extension
- Ankle: plantiflexion and inversion
- Toes: flexion

Miss Brunnstrom feels that all hemiplegic patients demonstrate these synergic motor patterns and the extent to which they are present gives an indication of the approximate extent of damage and recovery in the C.N.S.

In her evaluation she uses these spastic synergic patterns to define the stages of recovery.

Before we go on to the Evaluation Procedures let us review the Stages of Recovery:

Stage 1: The flaccidity immediately following the cerebral vascular accident. No voluntary or reflexive activity is present in either involved limbs. Associated reactions cannot be elicited.

Stage 2: The basic movement synergies or some of their components (elbow flexion, knee extension) may be elicited reflexly as associated reactions. Minimal voluntary motion may be present. Spasticity, first seen as resistance to passive stretch, begins to develop.

Stage 3: Spacticity becomes more marked. The basic movement synergies may be performed voluntarily, although full range of all components may be lacking.

Stage 4: Movements which deviate from the basic synergies can be accomplished on a volitional basis. Spasticity begins to decline.

Stage 5: The basic synergies lose their dominance over volitional behaviour and the patient becomes increasingly more adept at performing movement combinations which differ greatly from the synergies. Spasticity continues to decrease.

Stage 6: Spasticity is essentially absent. Hence, isolated muscle actions can be performed freely.
Restoration of normal motor function is complete.

You must remember with reference to these Synergies:

1) Recovery may be arrested at any stage - dependent upon the severity of insult to the C.N.S.
2) A stage of recovery is never skipped, but a patient may proceed so quickly through a stage that it is not observed.
3) If full recovery is achieved the synergies may re-appear under stress.

The Evaluation you are about to see is not truly typical as we have a simulated patient who during the next hour will pass through all the stages of recovery to demonstrate how they are evaluated.

The organization of the Evaluation is not typical either. Usually you would not request the patient change positions so frequently and therefore would perform the evaluation procedures in a different order.

However, today we will perform the sensory examination and move on to assess the motor performance.

APPENDIX H

SLIDES USED FOR TEACHING PURPOSES

WITHIN THE

BRUNNSTROM TAPE

PHYSICAL & OCCUPATIONAL THERAPY

McGill University

THE BRUNNSTROM EVALUATION of the HEMIPLEGIC PATIENT

WITH

BARBARA BEATTY
SHARON DAUPHINEE

STAGES OF RECOVERY
of the
HEMIPLEGIC PATIENT

RECOVERY STAGE ONE
- No Voluntary Movement
- Muscle Tone Decreased

RECOVERY STAGE TWO
- Components of Basic Limb Synergies Appearing
- Muscle Tone Increasing

RECOVERY STAGE THREE
- Some Voluntary Control of Basic Limb Synergies
- Spasticity Present

RECOVERY STAGE FOUR
- Voluntary Control of Movement Combinations
- Spasticity Decreasing

RECOVERY STAGE FIVE
- Independence of Basic Synergies
- Spasticity Decreasing

RECOVERY STAGE SIX
- Isolated Joint Movements
- Muscle Tone Near Normal

SENSORY TESTING
of the
UPPER EXTREMITY

SENSORY TESTING
of the
LOWER EXTREMITY

MOTOR TESTING
of the
UPPER EXTREMITY

MOTOR TESTING
of the
LOWER EXTREMITY

GAIT ANALYSIS
of the
HEMIPLEGIC PATIENT

APPENDIX I

SIMULATED HEMIPLEGIC PROFILES PRESENTED TO STUDENTS IN THE TEST SITUATION

McGill University
School of Physical and Occupational Therapy

Chart 1

HEMIPLEGIA--CLASSIFICATION AND PROGRESS RECORD (p.1)

Upper Limb---Test Sitting

Name _____ Age ___ Date of onset _____ Side affected Right

Date

Passive motion sense, shoulder present (1) elbow present (2)
pron.-supin. present, slow to respond (3) wrist Flex.-ext. absent (4)

1. NO MOVEMENT INITIATED OR ELICITED _____
2. SYNERGIES OR COMPONENTS FIRST APPEARING. Spasticity developing _____
   Flexor synergy _____
   Extensor synergy _____
3. SYNERGIES OR COMPONENTS INITIATED VOLUNTARILY. Spasticity marked ✓ (5)

FLEXOR SYNERGY		Active Joint Range		Remarks
Shoulder girdle	Elevation	3/4 - full range	(6)	
	Retraction	full range	(7)	
	Hyperextension	full range	(8)	
Shoulder joint	Abduction	0 range	(9)	
	Ext. rotation	0 range	(10)	
Elbow	Flexion	acute angle	(11)	
Forearm		0 range	(12)	
EXTENSOR SYNERGY				
Shoulder	Pectoralis major	full range	(13)	
Elbow	Extension	3/4 range	(14)	
Forearm	Pronation	held in pronation	(15)	
4. MOVEMENT DEVIATING FROM BASIC SYNERGIES Spasticity decreasing	Hand to sacral region			
	Raise arm forw.-horiz.			
	Pron.-supin. elbow at 90°			
5. REL. INDEPENDENCE OF BASIC SYNERGIES Spasticity waning	Raise arm side-horiz.			
	Raise arm over head			
	Pron.-supin. elbow extended			
6. MOVEMENT COORDINATION NEAR NORMAL Spasticity minimal				

HEMIPLEGIA---CLASSIFICATION AND PROGRESS RECORD (p.2)

Upper limb -- Test Sitting (Continued)

Name _____

Date

SPEED TESTS For Classes 4, 5, 6

		Strokes per 5 sec.	
Hand from lap to chin	Normal		
	Affected		
Hand from lap to opposite knee	Normal		
	Affected		

Passive motion sense, digits absent (16)

Fingertip recognition Inconsistent - absent (17)

Wrist stabilization 1. Elbow extended No extensor activity (18)
2. Elbow flexed _____

Wrist flexion and extension fist closed 1. Elbow extended No extensor activity - flexes only (19)
2. Elbow flexed _____

Wrist circumduction _____

DIGITS

Mass grasp present (20) Dynamometer test Normal Number (21) lb.
Affected Number (22) lb.

Mass extension absent (23)

Hook grasp (handbag, 2 lb.) can hold (24)

Lateral prehension (card) _____

Palmar prehension (pencil) _____

Cylindrical grasp (small jar) _____

Spherical grasp (ball) _____ catch _____ throw _____

Indiv. thumb movements hands in lap. 1. Vertical movements _____

ulnar side down 2. Horizontal movements _____

Individual finger movements _____

Button and unbutton shirt Using both hands _____

Using affected hand only _____

Other skilled activities _____

HEMIPLEGIA---CLASSIFICATION AND PROGRESS RECORD (p.3)

Trunk and Lower Limb

Name _____ Evaluation date _____

SUPINE

Passive motion sense: Hip present (25) Knee present (26)
Ankle absent (27) Big toe absent (28)

Flexor synergy all components present (29)

Extensor synergy all components present (30)

Hip: abduction absent (31) adduction present (32)

SITTING ON CHAIR			STANDING		
Trunk balance (no back support)	lists to affected side	(33)	With ____ Without ____ support		(40)
Sole sensation (no. of answers)	Correct number	(34)	Balance normal limb	(a)	sec. (b)
	Incorrect number	(35)	Double scale reading+		
Hip-knee-ankle flexion	present-active	(36)	Hip-knee-ankle flexion	present	(41)
Knee flex.-ext. sm. range	present	(37)	Knee flex.-ext. sm. range	present	(42)
Knee flexion beyond 90°	cannot do	(38)	Knee flexion Hip extended	cannot do	(43)
Ankle, isolated dorsiflexion	cannot do	(39)	Ankle, isolated dorsiflexion		
Reciprocal hamstring action*			Hip abduction knee extended		

AMBULATION Evaluation date _____

Brace? _____ Cane? _____ In parallel bars _____
Supported _____ Escorted _____ Alone _____
Arm in sling _____ Arm swings loosely _____ Elbow held flexed _____
Arm swings near normal _____

GAIT ANALYSIS Evaluation date _____

Hip: Swing phase
Stiff (Pelvic motion) _____
Moderately stiff _____
Free, near normal _____
Exagg. flexion _____
Circumduction _____
External rotation _____

Knee: Swing phase
Stiff _____
Moderately stiff _____
Exagg. flexion _____
Near normal _____

Ankle: Swing phase
Inversion _____
Toes drag _____
"Whip" _____
Near normal _____
Walking cadence: Steps/min. _____

Hip: Stance phase
Trendelenburg _____
Trunk forward _____
Abduction _____
Steady, near normal _____

Knee: Stance phase
Hyperextension _____
Stable in sl. flex. _____
Steady, near normal _____

Ankle: Stance phase
Inversion, early stance _____
Inversion throughout _____
Eversion _____
Entire sole down _____
Toes first _____
Heel-toe, near normal _____

* Inward and outward rotation at knee with inversion-eversion at ankle
\+ Recorded as normal/affected: (a) preferred stance; (b) weight shift on aff. limb

McGill University
School of Physical and Occupational Therapy

Chart 1

HEMIPLEGIA--CLASSIFICATION AND PROGRESS RECORD (p.1)

Upper Limb---Test Sitting

Name _____ Age ___ Date of onset _____ Side affected RIGHT

Date

Passive motion sense, shoulder present (1) elbow present (2)

pron.-supin. present (3) wrist Flex.-ext. present - slow (4)

1. NO MOVEMENT INITIATED OR ELICITED _____
2. SYNERGIES OR COMPONENTS FIRST APPEARING. Spasticity developing _____

   Flexor synergy _____

   Extensor synergy _____
3. SYNERGIES OR COMPONENTS INITIATED VOLUNTARILY. Spasticity marked moderate (5)

	FLEXOR SYNERGY	Active Joint Range	Remarks
Shoulder girdle	Elevation	3/4 - full range	(6)
	Retraction	1/4 - full range	(7)
	Hyperextension		
Shoulder joint	Abduction	full range	(8)
	Ext. rotation	3/4 - full range	(9)
Elbow	Flexion	acute angle	(10)
Forearm		almost full	3/4 - full (11)
	EXTENSOR SYNERGY		
Shoulder	Pectoralis major	full range	(12)
Elbow	Extension	3/4 range	(13)
Forearm	Pronation	3/4 - full range	(14)
4. MOVEMENT DEVIATING	Hand to sacral region	partial range	(15)
FROM BASIC	Raise arm forw.-horiz.	partial (16)	Slight shoulder abduction and elbow flexion (17)
SYNERGIES Spasticity decreasing	Pron.-supin. elbow at 90°	partial (18)	Shoulder abduction with supination (19)
5. REL. IN-DEPENDENCE OF BASIC SYNERGIES	Raise arm side-horiz.		
	Raise arm over head		
Spasticity waning	Pron.-supin. elbow extended		
6. MOVEMENT COORDINATION NEAR NORMAL	Spasticity minimal		

HEMIPLEGIA---CLASSIFICATION AND PROGRESS RECORD (p.2)

Upper limb -- Test Sitting (Continued)

Name _____

Date

SPEED TESTS For Classes 4, 5, 6

		Strokes per 5 sec.	
Hand from lap to chin	Normal		(20)
	Affected	Numbers	
Hand from lap to opposite knee	Normal		(21)
	Affected	~~Numbers~~	

Passive motion sense, digits present - slow (22)

Fingertip recognition present (23)

Wrist stabilization
1. Elbow extended no extensor activity (24)
2. Elbow flexed

Wrist flexion and extension fist closed
1. Elbow extended
2. Elbow flexed

Wrist circumduction

DIGITS

Mass grasp absent (25) Dynamometer test Normal _____ lb.
Affected _____ lb.

Mass extension absent (26)

Hook grasp (handbag, 2 lb.)

Lateral prehension (card)

Palmar prehension (pencil)

Cylindrical grasp (small jar)

Spherical grasp (ball) _____ catch _____ throw _____

Indiv. thumb movements hands in lap. ulnar side down
1. Vertical movements
2. Horizontal movements

Individual finger movements

Button and unbutton shirt
Using both hands
Using affected hand only

Other skilled activities

HEMIPLEGIA---CLASSIFICATION AND PROGRESS RECORD (p.3)

Trunk and Lower Limb

Name _____ Evaluation date _____

SUPINE

Passive motion sense	Hip present	(27)	Knee present		(28)
	Ankle present	(29)	Big toe present - slow		(30)
Flexor synergy present but no dorsiflexion					(31)
Extensor synergy present					(32)
Hip: abduction present		(33)	adduction present		(34)

SITTING ON CHAIR			STANDING			
Trunk balance (no back support)	good	(35)	With	Without	(40)	support
Balance			normal limb			sec.
Sole sensation (no. of answers)	Correct number	(36)	Double scale reading+	(a)	(b)	
	Incorrect number					
Hip-knee-ankle flexion	pres. - no dorsiflexion	(37)	Hip-knee-ankle flexion	pres. - no dorsi-flexion		(41)
Knee flex.-ext. sm. range	present	(38)	Knee flex.-ext. sm. range	present		(42)
Knee flexion beyond 90°	slight	(39)	Knee flexion Hip extended	cannot do		(43)
Ankle, isolated dorsiflexion			Ankle, isolated dorsiflexion			
Reciprocal hamstring action*			Hip abduction knee extended			

AMBULATION Evaluation date _____

Brace? _____ Cane? _____ In parallel bars _____
Supported _____ Escorted _____ Alone _____
Arm in sling _____ Arm swings loosely _____ Elbow held flexed _____
Arm swings near normal _____

GAIT ANALYSIS Evaluation date _____

Hip: Swing phase
Stiff (Pelvic motion) _____
Moderately stiff _____
Free, near normal _____
Exagg. flexion _____
Circumduction _____
External rotation _____

Knee: Swing phase
Stiff _____
Moderately stiff _____
Exagg. flexion _____
Near normal _____

Ankle: Swing phase
Inversion _____
Toes drag _____
"Whip" _____
Near normal _____
Walking cadence: Steps/min. _____

Hip: Stance phase
Trendelenburg _____
Trunk forward _____
Abduction _____
Steady, near normal _____

Knee: Stance phase
Hyperextension _____
Stable in sl. flex. _____
Steady, near normal _____

Ankle: Stance phase
Inversion, early stance _____
Inversion throughout _____
Eversion _____
Entire sole down _____
Toes first _____
Heel-toe, near normal _____

* Inward and outward rotation at knee with inversion-eversion at ankle
+ Recorded as normal/affected: (a) preferred stance; (b) weight shift on aff. limb

APPENDIX J

PRODUCTION COSTS

OF THE

AUDIO-VISUAL TAPE

AND THE

SELF INSTRUCTIONAL PACKAGE

COST OF PRODUCING THE AUDIO-VISUAL TAPE:

		TOTAL
Studio facilities - per hour $15.45 x 5 hours		$ 77.25
Labour for filming - per hour $6.45 x 5 hours x 4 staff		129.00
Labour for editing - per hour $9.25 x 4 hours x 2 staff		72.00
Materials -	Slides	4.50
	Master tape	45.00
	Cassette	37.80
	Audiotape	3.50
		$ 369.05
Professional Staff Time 24 hours at $6.25/hour		150.00
		$ 519.05

Estimated cost of a commercial venture (i.e. Champlain Productions)

Labour 8.6 x 278.25	$2,392.95
Materials	90.00
	$2,482.95

COST OF PRODUCING A SELF INSTRUCTIONAL PACKAGE:

Professional Staff Time - 80 hours at $6.25/hour	$ 500.00
Secretarial help	100.00
Materials	9.50
	$ 609.50