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A STUDY OF THE INFLUENCE OF TWO TEACHING METHODS
ON RETENTION OF PRINCIPLES AND CONCEPTS

by

MARVELU R. FISCHER

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Approved:

Anna Pearl Sherrick, R.N., Ed.D.
Head, Major Department

Rita M. Darragh
Chairman, Examining Committee

Donis D. Smith
Dean, Graduate Division

MONTANA STATE COLLEGE
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ABSTRACT

The study was an experiment to determine whether the method of instruction, informal lecture or programmed instruction, significantly differed in its influence on the retention of principles and concepts taught in a segment on N. 103, Introduction to Nursing, at Montana State College.

The purpose was to compare the retention of principles and concepts where the content of the material given was the same but two different methods of instruction were utilized.

The selection of the population was determined by a random sampling of the freshman nursing class at Montana State College. Statistical means showed that there was no significant difference between the control group (informal lecture) and the experimental group (programmed instruction) prior to instruction. Two tests for retention were given to each group.

The results showed that the methods of instruction employed did not differ significantly in their influence on the retention of principles and concepts. Programmed instruction, as utilized in this study, was as effective as the informal lecture methods.

A STUDY OF THE INFLUENCE OF TWO TEACHING METHODS ON RETENTION OF PRINCIPLES AND CONCEPTS

CHAPTER I

SELECTION OF THE PROBLEM

Introduction and Review of Literature

In the past twenty years, with the advance in scientific and technical information, education has become an increasingly complex and expensive process. This problem is no less true in nursing than any other area. As a result educators have been under increasing pressure to seek and utilize new and better ways of promoting effective learning for larger numbers of students at realistic levels of expenditure of time and money. One outgrowth of meeting the educational demands of modern society has been the development of programmed learning and the use of auto-instructional materials.

The programmed learning movement is based in part on certain principles of psychology derived from laboratory studies of human and animal learning. These principles serve to confirm the procedures and techniques used by nearly all renowned teachers of the past. Among the pioneers in the development of self-teaching devices and materials are B.F. Skinner and Sidney L. Pressey.

Prior to 1921, Sidney Pressey, a psychologist, developed a machine that could produce measurable amounts of learning in students, but he

received little support from either educators or psychologists.¹

In 1954, E. B. Skinner in his paper, "The Science of Learning and the Art of Teaching,"² described laboratory techniques that reliably produced modifications in the behavior of human experimental subjects. The characteristics and principles involved and their direct application to classroom teaching were set forth. Further, Skinner developed a machine which told the student immediately whether each response was correct or incorrect. This characteristic of reinforcement, also called knowledge of results or feedback, in programmed instruction is present regardless of the form of presentation. Behavior, is strengthened, or modified, depending upon the kind of consequences (reinforcement) the behavior produces.³

"Programmed instruction is a particularly useful tool in that it enables us to teach meaningful materials under conditions which are better controlled than is ordinarily possible."⁴ "In particular, programmed instruction may be used to eliminate or reduce the effects of the person of the experimenter, as a variable. They also eliminate

¹William A. Deterline, An Introduction to Programmed Instruction (Englewood Cliffs, N.J.: Prentice Hall, Inc., 1962), p.9.

²Ibid., p.9.

³Ibid., p. 11.

⁴Millicent Alter, "Retention as a Function of Length of Retention Interval, Intelligence, and Training Time," The Journal of Programmed Instruction, Vol. II, No. 2 (Summer, 1963), p. 7.

implicit communications between experimenter and subject during the experiment proper by making all communication explicit."⁵

Comparing the effectiveness of programmed instruction with "conventional" methods of teaching is difficult, but some research has been done in this area. One such study was completed at Hamilton College in French, German, and logic. Students taking partially programmed courses averaged about twenty percent higher on a standardized test of written French grammar and translation than students in a conventional course. In German, three class periods a week supplemented by twenty to thirty minute laboratory periods with programmed materials made possible an average gain of about twenty points on the standardized test over the averages made by students in the old course of five class periods and no laboratory. In logic, students as a class gained an average of ten points in the final examination over the previous class which had not participated in the program.⁶

At the University of California at Los Angeles, 186 freshmen engineering students studied elementary probability by a variety of teaching methods. These studies were conducted by Roe, Massey, Welton,

⁵James D. Baker, "Programmed Instruction as a Methodological Tool in Psychological Research," The Journal of Programmed Instruction, Vol. II, No. 1, (Spring, 1963), p. 23.

⁶Wilbur Schramm, Programmed Instruction (The Fund for the Advancement of Education, 1962), p. 47.

Gurshon, and Leeds in 1960.⁷

Oakes (1960) reported no significant difference between sections of an introductory psychology course taught by programmed instruction and by conventional methods. Glaser and Taber, 1961, reported results were significantly in favor of programmed presentation over traditional methods on immediate post-testing and six weeks later when pharmacy students in Pittsburgh were taught prescribed information about vitamins.⁸

Programmed instruction is still so new that research on it is young and fragmentary. The research available indicates that students do learn by this method. However, the study by Glaser and Taber is one of the very few that has attempted to measure retention in the lecture method as opposed to programmed instruction. According to Millicent Alter, "Although experimentation in programmed instruction is burgeoning, there are, as yet no published studies which utilize this form of instruction as a tool for studying the parameters of retention. Most of the programmed instructional studies which have been concerned with retention have measured at only two points in time, immediately and again after a single retention interval, the primary goal of such studies has generally been to investigate the constancy

⁷Ibid., p. 48.

⁸Ibid., p. 49.

of the retention between certain experimental treatments over time."⁹

A thorough examination of abstracts in Nursing Research, dating from 1953 to 1963 dealing with research studies done in nursing failed to reveal any published material relative to programmed instruction. Some research in programmed instruction in nursing is being done at the present time. One textbook has been published dealing with programmed instruction in teaching aseptic technique.

Since programmed learning does have such tremendous implications for the future of education and nursing education has done extremely little research on this approach to learning, the investigator felt examination and study was definitely warranted. Perhaps this is one way in which some of the following problems can be met: 1) existing teacher shortages, 2) ever-increasing numbers of students, 3) better recognition of an adaptation to individual differences in students, and 4) the need to cover ever-expanding bodies of knowledge.

The Problem

The problem examined in this study was: Does the method of instruction utilized, informal lecture or programmed instruction, significantly differ in its influence on the retention of principles and concepts

⁹Millicent Alter, "Retention as a Function of Length of Retention Interval, Intelligence, and Training Time," The Journal of Programmed Instruction, Vol. II, No. 2, (Summer, 1963), p. 7.

taught in a segment of N. 103, Introduction to Nursing, at Montana State College?

The Purpose

The purpose of this study was to compare retention of principles and concepts where the content of the material given was the same but two different methods of instruction were employed.

Methodology

The experimental method was utilized in this study. Two groups of freshman nursing students at Montana State College were selected by random sampling. The Mann Whitney U Test was applied to ensure there was no significant difference between the groups prior to instruction. A pretest was also given to determine that neither group had significant knowledge of the material to be taught. The control group was taught by the usual informal lecture method. The experimental group was given the same course material in the form of a programmed textbook. Two tests post instruction were given, one at an interval of two weeks and the other four months later, to determine if there was a significant difference in the levels of retention of the two groups.

Null Hypothesis

There is no significant difference in the amount of retention of principles and concepts between the two groups, control (informal lecture) and experimental (programmed instruction).

Alternative Hypothesis

The experimental group (programmed instruction) will show a higher level of retention of principles and concepts.

Limitations of the Study

The study was limited by the length of time devoted to the two methods since only one small segment of the entire course was utilized. Other limiting factors included: 1) inability to test for retention more than twice or at a later period than four months after the content was given; 2) exchange of material between the two groups of students, experimental and control; 3) unwillingness of students to participate in the experimental group.

Definitions

Terms as used in the study were defined as follows:

Retention - "...the amount of material correctly remembered."¹⁰

Recall Test - "...in which one merely calls words to mind freely."¹¹

Principle - "Science Principle: a statement of a generally accepted fact or a fundamental truth which can be used as a guide to action.

¹⁰Clifford T. Morgan, Introduction to Psychology (New York: McGraw Hill, 1961), p. 687.

¹¹Horace B. English and Ava Champney English, A Comprehensive Dictionary of Psychological and Psychoanalytical Terms (New York: Longmans, Green and Co., 1958), p. 548

Nursing Principle: a statement of the application of science principles useful in nursing."¹²

Concept - "Science Concept: a statement of a generalization based on specific facts.

Nursing Concept: a statement of a generalization based on nursing principles."¹³

Informal Lecture Method - "Conversational presentation interspersed with comments, questions, and brief discussions."¹⁴

Programmed Instruction - "...the kind of learning experience in which a 'program' takes the place of a tutor for the student, and leads through a set of specified behaviors designed and sequenced to make it more probable that he will behave in a given desired way in the future - in other words, that he will learn what the program is designed to teach him. It is usually a series of items, questions, or statements to each of which, in order the student is asked to make a response. His response may be to fill in a word left blank, to answer a question, to select one of a series of multiple-choice answers, to indicate agreement or disagreement, or to solve a problem and record the answer.

¹²Normark and Rohweder, Science Principles Applied to Nursing (Philadelphia: J.B. Lippincott Co., 1959), p. 3.

¹³Ibid., p. 3.

¹⁴J. G. Umstattd, Instructional Procedures at the College Level (Austin: University of Texas Press, 1947), p. 35.

As soon as he has responded to the item, he is permitted to see the correct response so that he can tell immediately whether his response has been the right one."¹⁵

Programmed Book - "A special book in which the subject matter to be learned has been arranged into a series of sequential steps leading from familiar concepts to new materials. The student generally is asked to construct a response as opposed to choice."¹⁶

Skinner Method - A method "which presents a set of programmed materials. At each step the subject must construct an answer and evaluate its correctness with a model answer before proceeding further in the program."¹⁷

Mann Whitney U Test - a non-parametric statistical test for uncorrelated data, used with independently drawn random samples, the size of which need not be the same. It is used in the study to determine that the two groups, experimental and control, come from the same population."¹⁸

¹⁵Wilbur Schramm, Programmed Instruction Today and Tomorrow (The Fund for the Advancement of Education, November, 1962), p. 1, 2.

¹⁶Wendell I. Smith, J. William Moore, Programmed Learning (Princeton, New Jersey: D. Van Nostrand Company, 1962), p. 236.

¹⁷Ibid., p. 236.

¹⁸N. M. Downie, R. W. Heath, Basic Statistical Methods (New York: Harper and Row, 1959), pp. 208-215.

Remainder of the Study

Chapter II presents in more detail the methodology of the study and sources of data.

Chapter III contains the analysis and treatment of findings.

The fourth chapter contains the summary, conclusions, and recommendations for further study.

CHAPTER II

METHODOLOGY OF THE STUDY

Selection of the Sample

The population of the study was selected from the freshman nursing class enrolled in Nursing 103, Introduction to Nursing, at Montana State College.

Three factors were considered in the selection of the population:

- 1) high school grade point average,
- 2) college placement examination scores on the Ohio Psychological test,
- 3) fall quarter grade point averages.

Twenty-seven students were not included in the sample due to a lack of scores in one or more of the above areas. Of the remaining number of students, thirty were randomly selected for the control group and thirty-five for the experimental group. The Mann Whitney U test was statistically applied to each of the three factors listed above to insure that there was no significant difference between the two groups.¹

(For data see Appendix B.)

A z score of $-.14$ was obtained for the fall quarter grade point averages. On a one tailed test, a z score of 2.33 indicates a signi-

¹The Mann Whitney U Test.

Steps: 1. All the scores are ranked in one composite distribution in an increasing order of size. The lowest score receives a rank of one.

ficant difference in the groups at the 1% point. It was accepted that there was no significant difference between the two groups and that they came from the same population.

Because there were a number of ties in scores on the other two factors, high school grade point averages and the Ohio Psychological Test, another variation of the Mann Whitney U test was applied.²

2. The two columns of scores are summed.

3. U, is found by the following formula

$$U_1 = N_1 N_2 + \frac{N_1(N_1 + 1)}{2} - R_X$$

4. The $\bar{z}$ ratio is computed by the following:

$$\bar{z} = \frac{U_1 - \frac{N_1 N_2}{2}}{\sqrt{\frac{N_1 N_2 (N_1 + N_2 + 1)}{12}}}$$

$$\sqrt{\frac{N_1 N_2 (N_1 + N_2 + 1)}{12}}$$

R. W. Heath and N. M. Downie, Basic Statistical Methods (New York and Evanston: Harper and Row Publishers 1959), p. 213-214.

²The Mann Whitney U Test with a Number of ties.

Steps: 1.-3. See footnote 1, pp. 12-13.

5. The number of ties are determined and the following formula is applied to each tie:

$$T = \frac{t_3 - t}{12}$$

The $\bar{z}$ score for high school grade point averages was $-.77$. A $\bar{z}$ score of $-.55$ was obtained for the Ohio Psychological Test. Again, there was no significant difference between the groups at the 1% point. It was accepted on the basis of the three factors tested that the groups came from the same population.

Procedure

Several objectives were chosen from the course outline for the development of instructional content. They were: 1) to relate the symptom of pain to defense mechanisms of the body, 2) to understand the normal physiology of Pain, 3) to use descriptive terms in reporting pain. Principles and concepts were taken from anatomy, physiology, and nursing in accordance with the objectives.

These principles and concepts were used for instruction of the control and experimental groups. (See Appendix A.)

-
- b. The $\bar{z}$ ratio is computed using the formula:

$$\bar{z} = U - \frac{N_1 N_2}{2}$$

$$\sqrt{\frac{N_1 N_2}{N(N-1)} - \frac{N_3 - N}{12}} - T$$

S. Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw - Hill, 1956), p. 124.

A pretest was given to the two groups to ensure there was no difference in knowledge of the subject matter. (See Appendix B.) Twenty-five students in the control group and thirty-three in the experimental group were present. The Mann Whitney U test was applied with a resultant $\bar{z}$ score of -1.16. It was accepted that at the 1% point there was no significant difference between the groups in knowledge of subject material prior to instruction.

The instructional content was used as a guide for the development of the principles and concepts to be taught in the programmed textbook. The textbook was structured according to the Skinner method with a series of small units called frames. Each frame consisted of a short sentence which introduced or reinforced a principle or concept. A word or phrase (stimulus) to be filled in by the student was omitted from each sentence. The correct answer (reinforcement) appeared in the right hand column of the book.

A directional booklet on the use of the programmed textbook was given to the students in the experimental group. (See Appendix A.)

The students were instructed to cover the correct answer with a sheet of paper, read each sentence carefully one at a time, fill in the appropriate answer, check it with the given correct response and continue on to the next frame. Each frame was built upon preceding knowledge so that in order to continue in the textbook, preceding material had to be learned.

The programmed textbooks were given to the experimental group during a regular class period. The programmed textbook given the experimental group is shown in Appendix A. Students in the control group were given informal lectures covering the instructional content. Following the one-hour class period, experimental group students were permitted to take the programmed textbooks with them. The books were returned after one week. Also, if they so desired, these students could take notes from the textbook. Students were asked not to exchange materials or notes between the two groups.

Approximately two weeks following the instruction of the two groups, a test for retention of the material was given. Four months following the initial test for retention, the same test was re-administered. (See Appendix B.)

The interval of four months was chosen because students until this time were expected to have no reinforcement of the material given in other courses.

CHAPTER III

ANALYSIS AND INTERPRETATION OF DATA

A test was designed to measure retention of principles and concepts developed in the subject matter presented to the nursing students.

(Appendix B.) The first test for retention was given two weeks following instruction of the experimental and control groups. Due to absences on the testing date the original sample of thirty students in the control group and thirty-five students in the experimental group was reduced to twenty-one students in the control group and twenty-four students in the experimental group. The Mann Whitney U test was applied to the test scores. (See p. 12, footnote 2. Test scores are given in Tables I and II.) A $\bar{z}$ score of $-.07$ was obtained. Since a $\bar{z}$ score of 2.33 on a one tailed test indicates a significant difference at the 1% point, the null hypothesis stating there was no significant difference between the two groups in retention of principles and concepts was accepted.

The second test for retention was given four months after the initial test. Twenty-two students in the control group and twenty-seven students in the experimental group participated. The Mann Whitney U test was applied to test scores. The $\bar{z}$ score was $-.64$. Again, the null hypothesis was accepted at the 1% point and alternative hypothesis was rejected.

The data from the two tests for retention revealed that the two

different methods employed, programmed instruction and the informal lecture, did not significantly differ in their influence on the retention of principles and concepts.

The individual test items were divided into three categories according to the type of knowledge for which they tested. Questions one through twenty-one were recall questions, questions twenty-two through twenty-six, recognition, and questions twenty-eight through thirty-two, application.

The mean achievement of the two groups on each level of knowledge was determined on the two tests for retention. The results were as follows:

	Recall	Recognition	Application
Possible N	26	5	5
Means of control group on 1st test for retention	15.7	2.6	2.7
Means of control group on 2nd test for retention	13.0	2.3	2.2
Means of experimental group on 1st test for retention	16.4	2.8	2.1
Means of experimental group on 2nd test for retention	12.2	2.95	2.4

The mean achievement of the experimental group in the first test for retention was 1.3 higher in the recall questions, .2 higher on

recognition, and .6 higher on application questions than the control group. On the second test for retention the mean achievement of the experimental group was .8 lower on recall questions, .65 higher on recognition questions, and .2 higher on application questions.

The mean achievement of the control group declined 2.7 on recall questions on the second test for retention. The experimental group declined 4.2.

On recognition questions, the control group declined .3 while the experimental group increased .15.

The control group declined .5 on application questions on the second test whereas the experimental group gained .3.

It appeared that the mean achievement of the experimental group was slightly higher on most levels of knowledge on the two tests. While the mean achievement of the control group declined less on the recall questions on the second test for retention, the mean achievement of the experimental group was slightly higher on recognition and application questions.

The informal lecture method appeared to be more useful in the retention of recall or factual material over a period of time. Programmed instruction appeared to be more applicable for the retention of principles and concepts over a period of time.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The problem investigated in the study was: Do the methods of instruction utilized, i.e., informal lecture or programmed instruction, significantly differ in their influence on the retention of principles and concepts taught in N 103, Introduction to Nursing at Montana State College?

The purpose of the paper was to compare retention of principles and concepts where the content of the material given was the same but two different methods of instruction were employed.

It was hypothesized there would be no difference in the levels of retention between the groups taught by the two methods.

The experimental method was employed to investigate the problem. The population was selected by random sampling from the freshman nursing class at Montana State College. Thirty students were selected for the control group (informal lecture) and thirty-five for the experimental group (programmed instruction). Several objectives in the subject of pain were chosen from the nursing course outline. A programmed textbook was developed to meet these objectives and given to the experimental group. The same content was given the control group by the informal lecture method.

Statistical means showed there was no significant difference between the groups prior to instruction.

A pretest revealed no significant difference in knowledge of principles and concepts of the material taught. The size of the sample on the pretest was reduced to thirty-three in the experimental group and twenty-seven in the control group.

Two weeks after instruction a test for retention given to twenty students in the control group and twenty-four in the experimental revealed no significant difference between the groups.

Four months later the same test again revealed no significant difference between the groups in the retention of principles and concepts. The size of the sample was twenty-two in the control group and twenty-seven in the experimental.

The informal lecture method appeared to be more useful in the retention of factual material over a period of time whereas programmed instruction seemed to be more applicable for the retention of principles and concepts over a period of time.

Conclusions

It was concluded that:

1. The method of instruction, informal lecture or programmed instruction, did not influence the retention of principles and concepts taught in N 103, Introduction to Nursing.
2. Programmed instruction as employed in this course was as effective as the informal lecture method in teaching principles and concepts.

Recommendations

Recommendations for areas of investigation are:

1. Programmed material should be developed for a larger unit of instruction.
2. A more detailed analysis should be made of amount of loss of retention from the first to the second test.
3. Testing intervals should be over longer periods of time.

APPENDIX

APPENDIX A

INSTRUCTIONAL MATERIAL

Instructional Content

Objective: To relate the symptom of pain to defense mechanisms of the body.

Pain is a disagreeable sensation elicited by a potentially harmful stimulus. Its purpose is mainly protective, warning of impending danger or early tissue damage. Its importance may be stressed by the following example. A patient whose legs are without sensation as the result of a spinal injury won't feel the pain of an overheated hot water bottle so a severe burn results. Pain accompanies tissue destruction as a result of disease, physical agents, and chemical irritants.¹

Reaction to Pain

There is a marked uniformity among people in the perception of pain but individual responses to pain vary widely. Age, sex, background, and circumstances under which the pain is perceived affect responses to pain.

The same person may react differently in different situations depending upon what is at stake, the degree of anxiety present, the state of health, and distractions present. For example, a woman may suffer the pain of childbirth gladly but would be less willing to tolerate a gall-bladder attack.

Distractions make a vast difference in reaction to pain. Concentration upon an event causing pain increases its perceived intensity. Tolerance to pain is also influenced by how much the patient knows or believes it will affect his life's goals. Fatigue, anger, boredom, and apprehension decrease one's ability to tolerate pain. It is also less tolerable when there is less distractive activity such as at night or in the early morning.²

Young people may fear pain because it is an unfamiliar experience and may respond to it by crying. Older persons may know what to expect

¹Dorothy Smith and Claudia Gips, Care of the Adult Patient (Philadelphia: J. B. Lippincott Co., 1963), p. 117.

²Kathleen N. Shafer, Janet R. Sawyer, Audrey M. McCluskey and Edna L. Beck, Medical Surgical Nursing (St. Louis: C. V. Mosby Co., 1961), p. 78.

and may be quiet and withdrawn while experiencing pain.

Some cultural groups have a tendency to hide obvious expression while others display reactions readily.

Pain is a subjective, private experience. The pain felt is based upon reason, knowledge and experience. Therefore, the nurse should beware of judging the severity of a patient's pain.³

Objective: To understand the normal physiology of pain.

The sensation of pain is initiated by the stimulation of pain receptors called nociceptors (Latin *noceo* - to injure). Nociceptors are located over the entire body surface in the skin and mucosa and in the viscera. The superficial concentration of nociceptors varies. For example, the back of the hand has more receptors than the thigh. There are few receptors in the viscera.

The more receptors, the more precisely the source of pain can be localized. The location of pain on the body surface can be more precisely determined than pain in the chest caused by an abnormal condition.

Any type of stimulus, if adequate in intensity, stimulates nociceptors in the skin and mucosa. Visceral nociceptors are stimulated only by marked changes in pressure and by certain chemicals. For example, cellular oxygen deficiency leads to the formation or accumulation of chemicals that stimulate nociceptors in the heart.

Sensory impulses of pain reach the cerebral cortex where consciousness and interpretation of pain takes place by way of a three-neuron relay.⁴

a) Sensory neuron I conducts the sensation of pain from receptors in the skin, mucosa, muscles, tendons, and viscera to the spinal cord or brainstem. Receptors are the origin of the dendrite. The dendrite extends from the receptors to spinal ganglia located outside the cord on the posterior roots of the spinal nerves and is located in the spinal nerve and its branches. Dendrites are nerve cell processes that transmit impulse toward the cell body.

The cell body is located in the spinal ganglion (a cluster of nerve cell bodies outside the central nervous system) on the posterior root or spinal nerves.

The axon, like the dendrite, is a nerve cell process. It carries

³Dorothy Smith and Claudia Gips, Op. Cit., pp. 118, 119.

⁴Ibid., pp. 132-133.

impulses away from the cell body from the posterior root of the spinal nerve to the posterior gray column of the cord.

b) Sensory neuron II relays the stimulus or sensation of pain from the posterior gray column of the cord up the lateral spinothalamic tract to the thalamus. The dendrite and cell body are located in the posterior gray column. The axon desuccates (crosses in the form of an X) and ascends in the lateral spinothalamic tract that terminates in the thalamus.

c) Sensory neuron III relays the stimulus via the thalamocortical tract in the internal capsule to the post-central gyrus in the parietal lobe of the cerebral cortex.

The thalamus produces conscious recognition of the sensation of pain and acts as part of the alerting mechanism. The perception and interpretation of pain takes place in the cerebral cortex.

There are two types of pain fibers: 1) large myelinated fibers which carry "fast" pain described as sharp or pricking. An example of this is the immediate sharp pain sensation when there is a blow on the skin. 2) Smaller non-myelinated fibers carry "slow" pain described as lingering or burning. After the sharp pain described above there is a slow, dull, burning pain.⁵

Myelinated fibers convey impulses more quickly than non-myelinated fibers. The types of pain are: 1) superficial pain which arises from stimulation of the skin receptors, 2) deep pain which results from stimulation of receptors in the viscera, and 3) referred pain. This type is the misinterpretation of pain by the cerebrum to a surface area instead of to the regions where the stimulated receptors are found. This occurs only as the result of pain receptors located in the deep structures such as the skeletal muscle and viscera. Pain origination in the viscera and other deep structures is interpreted as coming from the skin area whose sensory fibers enter the same segment of the spinal cord as the sensory fibers from the deep structure.⁶

The perception of pain may be altered at many points by abnormal conditions. For example, if local nerve endings have been damaged by a severe burn, the patient will not respond to painful stimuli. Tumors in the spinal cord may prevent the transmission of impulses. Inflammatory processes of the cerebral cortex influence the perception

⁵Kathleen N. Shafer, Janet R. Sawyer, Audrey M. McCluskey and Edna L. Beck, Medical Surgical Nursing (St. Louis: C. V. Mosby Co., 1961), 2nd Ed., p.76.

⁶Dorothy Smith and Claudia Gips, Care of the Adult Patient (Philadelphia: J. B. Lippincott Co., 1963), p. 118.

of pain as does age, anesthesia, and analgesia.⁷

Objective: To use descriptive terms in reporting pain.

The patient in pain who doesn't complain may show discomfort by other means. He may curl up in bed, assume an abnormal posture as kneeling or may toss about. The pulse is often elevated and he may perspire. The facial expressions should be observed. The patient may look tense; the muscles will be taut; teeth are clenched, the eyes are fixed, and the face has a drawn expression.

The following should be reported in describing pain: 1) its nature--sharp, dull, burning, aching, knifelike, squeezing, deep, pulsating, gnawing, pressing; 2) the intensity--mild, moderate, severe; 3) the location--lower left abdomen, inner aspect of the mid-thigh, entire left chest; 4) the onset--sudden, slowly building up to present intensity, first occurrence; 5) the duration--intermittent, returning at 5 or 6 minute intervals and lasting 30 seconds, brief, lasting 15 minutes; 6) its spread--radiates down the left arm; 7) the relation to circumstance--before or following eating, when patient moves fast; 8) the control--relieved by elevation of limb, stops when still. Changes in pain must be reported. Pain may be relieved or intensified by a change in the course of the disease.⁸

⁷Ibid., p. 119.

⁸Ibid., pp. 100-121.

DIRECTIONAL BOOKLET FOR PROGRAMMED INSTRUCTION

This booklet is designed to acquaint you with the technique of programmed instruction. To learn by this method, it is essential that you follow the directions carefully.

Take a piece of paper or cardboard and cover the words appearing to the right of each sentence or frame. These words are the answers to the blank spaces in each sentence. Read each sentence or frame carefully. You are to supply the missing word or phrase. Clues to the blank spaces are found either in the sentence itself or the preceding frames. If you are unable to fill in the blank, do not uncover the answer appearing to the right. Go back to the preceding frames. You have not covered the material adequately. Repeat, do not uncover the answers to the right if you cannot supply the missing word(s). When you have the answer to the blank uncover only the word in the right hand column that corresponds with that sentence. If you are correct, go on to the next frame.

SAMPLE: When you have the correct answer for the blank in the sentence, you are to _____. go on to the next frame

1. Suppose that three students, Jane, Betty, and Sue take a test. Jane gets a score of 16 points, Betty a score of 12 points, and Sue a score of 5 points. The sum of these original or raw scores, $16 + 12 + 5 = \underline{\hspace{1cm}}$. 33
2. The average, or arithmetic mean, is found by dividing the sum (in this case 33) by the number of scores (or students). In this case, divide by _____. 3
3. $\frac{33}{3} = 11$, so 11 is the average. The average is also called the _____. (Arithmetic) mean
4. The mean was found by dividing the sum of the raw scores by the number of _____. Scores (or Students)
5. To repeat, the mean was found by dividing the _____ by the _____. Sum of the raw scores number of scores

6. The raw scores of the three students differ or deviate from the mean. Jane's score of 16 deviates from the mean by 5, since $16 - 11 = \underline{\hspace{2cm}}$. 5
7. Betty's score of 12 deviates from the mean, 11, by how much $\underline{\hspace{2cm}}$? 6
8. And in the opposite direction from the mean, Sue's score of 5 deviates from the mean by how much $\underline{\hspace{2cm}}$? 4
9. If you sum the deviations 5, 1, and 6, and divide by the number of students, 3, you get the AVERAGE DEVIATION. $\frac{5 + 1 + 6}{3} = \underline{\hspace{2cm}}$.
10. The average deviation, which in this case is 4, is an expression of the spread of scores, or the variability of scores. The average deviation indicates how far, on the average, the scores are from what measure? $\underline{\hspace{2cm}}$. The Mean

Frames one through ten were taken from An Explanation of Standard Scores For People Who Really Don't Want to Know a Great Deal About Them and Who Are Frightened by Statistics Books. Programs by NLN Test Services. National League for Nursing, 1- Columbus Circle, New York 19, New York.

A PROGRAMMED TEXTBOOK ON THE PRINCIPLES OF
ANATOMY AND PHYSIOLOGY RELATION TO PAIN

1. Pain is a disagreeable sensation caused by a harmful stimulus. A pin prick on the finger may be considered a _____ which will cause the sensation of _____.
stimulus, pain
2. The function of a warning system is protection. When something acts as a warning system against danger, we say it serves to _____ us.
protect
3. The purpose of pain, then, is to protect and it acts as a _____ against impending danger.
warning system
4. Another term for a warning system is defense mechanism. Such warning systems serving to protect the body are also called _____.
defense mechanisms
5. Therefore, another defense mechanism of the body is _____.
pain
6. A patient who has no sensation in his legs due to a spinal injury will not feel _____.
pain
7. If an overheated hot water bottle is placed against his leg, he will not _____ it.
feel
8. A burn will result because the patient felt no _____ and there was no _____ against impending danger.
pain
warning system
9. Without his knowing it, the patient will be _____.
burned
10. Pain usually accompanies destruction of the body cells or tissue. Tissue destruction may be caused by a _____ such as cancer.
disease

11. Another causative agent of tissue destruction may be a physical agent such as an explosion causing extensive _____.
burns
12. A burn caused by chemicals such as sulfuric acid is an example of tissue destruction caused by a _____ irritant.
chemical
13. Pain then, accompanies tissue destruction as a result of _____, _____, and _____.
disease, physical agents, chemical irritants
14. There is a marked uniformity among people in the perception of pain but individual responses vary widely. A pin prick will be _____ by most people but the manner in which the response is made varies according to the _____.
perceived, (felt) individual
15. The same person may react differently to _____ in different situations.
pain
16. A woman may gladly bear the pain of childbirth but would _____ be willing to tolerate the pain of a gallbladder attack.
not
17. What is at stake in various situations makes her response to pain _____ in the two situations.
different
18. A person who is very anxious will not tolerate pain as well as the person who is calmer. Reaction to pain, here, differs according to the degree of _____.
anxiety
19. Weak, debilitated people may not be able to stand pain as well as the person who is calmer. Reaction to pain then, may vary depending on the state of _____.
health
20. Concentration upon an event causing pain increases its perceived intensity whereas if a person is distracted, the intensity of pain seems to be _____.
less

21. The difference in tolerance is due to _____.
distractions
22. Less distractive activity as in the early morning or evening _____ tolerance to pain.
decreases
23. Generally, then, it can be said that the same person may react differently to pain depending upon what is at stake, the degree of _____ present, the state of _____, and _____.
anxiety
health
distractions
24. Fatigue, anger, boredom, and apprehension also _____ one's ability to tolerate pain.
decrease
25. African natives will not display their reaction to pain but will _____ it.
hide
26. Spaniards will not hide their emotions but may openly _____ them.
display
27. These people are of different cultural groups so it may be said that reaction to pain varies among different _____.
cultural
groups
28. Children may cry because they are afraid of pain whereas an older person who has experienced it may be withdrawn and express little reaction. Another factor in reaction to pain is _____.
age.
29. Two other factors in reaction to pain are _____ and _____ background.
age
cultural
30. Pain is not an objective experience but is a private, _____ experience.
subjective
31. Therefore, it is important that the nurse not judge the severity of a _____ pain.
(person's)
patient's
32. Earlier, we said that pain is caused or initiated by a harmful _____.
stimulus

33. Pain receptors are called nociceptors (Latin-Noci, to injure). The stimulus arouses pain receptors in the skin and mucosa called _____.
nociceptors
34. The nociceptors are located over the entire body surface in the epidermis, also called the _____.
skin
35. More nociceptors are located in body organs, another term for which is _____.
viscera
36. A stimulus will initiate pain by stimulation of these _____ in the skin and viscera.
nociceptors
37. If there are more nociceptors in one area such as in the hand, as there are in another area of the body surface such as in the thigh, we may say the superficial concentration of receptors is different or _____.
varies
38. Unlike the skin which has many receptors, the viscera have _____.
few
39. The more receptors there are, the more there are to arouse or _____.
stimulate
40. If there are more receptors to be stimulated, the more exact will be the area on _____ of the pain.
location
41. Since there are more nociceptors in the skin than in the viscera, it is easier to determine the _____ location of pain on the body surface than in, for example, the chest.
exact
42. Any type of stimulus is adequate in intensity, _____ receptors in the skin and mucosa.
stimulates
43. On the other hand, only marked changes in pressure and certain chemicals can stimulate nociceptors in the _____.
viscera

44. Cellular oxygen deficiency leads the accumulation of chemicals that stimulate _____ in the heart. nociceptors
45. Therefore, to arouse the sensation of pain on the body surface or in the viscera requires different types of _____. stimuli
46. A three-neuron relay transmits sensory impulses of pain to the cerebral cortex. The sensation of pain resulting from a pin prick will reach the cerebral cortex via the _____. three-neuron relay
47. The origin of a dendrite which is a nerve cell process, lies in the receptors. In this instance, the origin of the dendrite would be _____. nociceptors
48. The dendrite extends to spinal ganglia located outside the cord on the posterior roots of spinal nerves. The impulse of the pin prick travels from _____ along the dendrite to the _____. nociceptors
spinal ganglia
49. Dendrites, then, transmit impulses toward the cell body located in the spinal ganglia. The spinal ganglia is located outside the _____ on the posterior roots of the spinal nerves. spinal cord
50. An axon, like the dendrite, is a nerve cell process. Unlike the dendrite which carries impulses _____ the cell body, it carries them _____ from the cell body. toward
away
51. The axon carries impulses to the posterior gray column of the cord from the cell body located in the _____. spinal ganglia
52. We have just described Sensory Neuron I of the three-neuron relay; it carries impulses from _____ in the skin,

- mucosa, muscles, tendons, and viscera to end of axon, or the posterior gray column of the _____.
53. A stimulus will activate nociceptors in the _____, _____, _____, _____, and _____.
 nociceptors
 spinal cord
54. The impulse is transmitted from the nociceptors along that nerve cell process which carries impulses toward the cell body. It is called a _____.
 dendrite
55. The cell body is located in the _____.
 spinal ganglia
56. From the cell body located outside the spinal cord, the impulse of the pin prick is carried away from the posterior roots of the spinal nerves to the posterior gray column of the cord via an _____.
 axon
57. Sensory Neuron II now takes over. The impulse of the pin prick is now where? _____.
58. The dendrite and cell body of Sensory Neuron II are located here. The impulse of the pin prick then goes up the lateral spinothalamic tract and ends in the thalamus via the process carrying impulses away from the cell body. It is the _____.
 axon
59. Again, the impulse of the pin prick has traveled from the posterior gray column of the cord up the _____ to the _____.
 lateral spinothalamic tract,
 thalamus
60. The thalamus produces conscious recognition of the sensation of pain and acts as part of the alerting system. When the impulse of the pin prick reaches the thalamus, the person _____ the sensation of pain.
 recognizes
61. Sensory Neuron II extends from _____ to the _____.
 posterior gray
 column of cord,
 thalamus

62. The last part of the neuron relay, Sensory Neuron III, relays the impulse from the thalamus via the thalamocortical tract to the parietal lobe of the cerebral cortex. The impulse of the pin prick has reached its destination when it comes to the _____. cerebral cortex
63. We said the person is aware of or recognizes the sensation of pain when the impulse reaches the _____. thalamus
64. Now, the impulse is interpreted and perceived as pain in the termination of the impulse in the _____. cerebral cortex
65. Let us review the route of the pin prick impulse. It is picked up by nociceptors, in the ____, ____, ____, ____, and _____. skin, mucosa, muscles, tendons, viscera
66. It travels to the end of the Sensory Neuron I located in the _____. posterior gray column of cord
67. Sensory Neuron II then carries the impulse to the _____. thalamus
68. It is here that the person first _____ the sensation of pain. recognizes
69. Sensory Neuron III then carries the impulse to the _____. cerebral cortex
70. At this terminal point, the individual _____ and _____ the sensation of pain. perceives interprets
71. Large myelinated fibers carry "fast" pain described as sharp or pricking. Sharp pain experienced when there is a blow in the shin is carried by _____ fibers. large myelinated
72. Small non-myelinated fibers carry "slow" pain described as lingering

- or burning. The lingering pain after the initial blow on the shin is carried by _____ fibers.
73. Myelinated fibers convey impulses more _____ than non-myelinated fibers.
74. The two types of fibers transmitting pain are _____ and _____.
75. Superficial pain arises from stimulation of receptors on a superficial areas. An example of this would be stimulation of receptors in the _____.
76. A blow on the hand would result in _____ pain.
77. On the other hand, deep pain arises from stimulation of receptors located in deeper structures such as in the _____.
78. Pain in the chest may be termed _____ pain.
79. Sometimes, pain may be misinterpreted as to source by the cerebrum. This is called referred pain. Referred pain occurs as the result of _____ by the cerebrum.
80. Surface pain occurring as the result of stimulation of pain receptors located in deep structures is known as _____ pain.
81. In referred pain, if the sensory fibers of the deep structures and those of the skin enter the spinal cord at the same segment, the source may be _____.
82. The three types of pain are _____, _____, and _____.
83. The type of pain, with the exception of referred pain is dependent on the _____ stimulated.

small
non-myelinated

quickly

myelinated
non-myelinated

skin

superficial

viscera

deep

misinterpre-
tation

referred

misinterpreted

superficial,
deep, referred

source (area)

84. Abnormal conditions may alter the perception of pain. If local nerve endings have been damaged by a severe burn, the patient will not _____ the pain, and hence not respond to the painful stimuli. perceive (feel)
85. A tumor in the spinal cord may block the transmission of _____. impulses
86. Inflammatory processes of the cerebral cortex influence the perception of pain. This occurs because it is in the cerebral cortex that _____ and _____ of pain take place. perception, interpretation
87. Examples of abnormal conditions altering the perception of pain are _____, _____, and _____. severe burns, tumors, inflammatory processes
88. Reaction to pain takes place through a reflex arc, causing withdrawal. This simply means when a person touched a hot iron, for example, he _____ from the stimulus. withdraws
89. Impulses from the stimulus are conducted over the shortest nerve pathways to the spinal cord, and back to the local muscles causing _____. withdrawal
90. The impulse from a burn on the finger travels over _____ pathways, to the _____, and back to _____. nerve, spinal cord, local muscles
91. Reporting pain requires close observations by the nurse. If a patient doesn't complain of pain, the nurse must _____ his actions. observe
92. Severe pain in the abdomen may cause the patient to curl up or assume abnormal positions as kneeling. He does this because this relieves the tenseness of the muscles, causing them to _____ somewhat and alleviate _____. relax, pain

93. He may frown or grimace when in pain so it is important to note _____ expressions. facial
94. Part of the alarm reaction is the appearance of an elevated pulse and diaphoreses. The nurse must then observe the _____ rate and watch for _____. pulse
diaphoresis
95. Teeth may be clenched and the eyes fixed as when a person glares or _____. stares
96. All these examples again point to the fact that reaction to pain varies according to the _____. individual
97. When reporting pain, certain things should be noted. Among them is the nature of the pain. For example, if the pain is sharp, or the opposite, _____, it is reported as such. dull
98. If the patient says the pain is there all the time but is not sharp you may chart it as an _____ pain. aching
99. If the patient describes pain as throbbing or beating as the pulsating of the blood, you would describe it as _____. pulsating
100. If the pain is such that it feels like a stabbing sensation as one would perceive by a knife, it may be termed _____ like. knife
101. Again, these are terms used to describe the _____ of the pain. nature
102. Another observation to make is how intense the pain is or its _____. intensity
103. Usually, we classify this as mild, _____, or severe. moderate

104. Location of pain is important in charting. If the patient points to the lower right side of his abdomen when asked where the pain is, you would chart it as occurring in the _____ abdomen. lower right
105. If he states it is all over the left side of his chest, you would record it as appearing over the entire _____ of the chest. left side
106. Again, it is important to chart the exact _____ of the pain. location
107. The onset of pain is important. If suddenly the pain was experienced you could say the onset was _____. sudden
108. If it was not so rapid or sudden in onset but taking a much longer time building up to its present intensity, you could say it was _____ in onset. slow
109. Perhaps the patient never experienced the pain before. Then you would chart it as the _____ occurrence of the pain. first
110. When reporting pain, remember to relate its _____. onset
111. Duration, or how long the pain _____ should be charted. lasts
112. Intermittent is a term to use if the pain comes and goes at _____. intervals
113. If a patient states the pain lasted 15 minutes, you would chart 15 minutes for the _____ of the pain. duration
114. Report, also, the spread of the pain. When the patient complains the pain goes down his arm, you would describe the spread as radiation _____. down the arm.

115. We have just cited two more observations in reporting, the _____ of pain and the _____. duration, spread
116. The relationship of pain to circumstance is reported. The patient said every time he eats, he experiences pain. You would chart it as occurring following _____. eating
117. The patient doesn't experience pain until he moves his foot. You chart the pain as occurring when he _____. moves his foot
118. How the pain is controlled is noted. If the pain occurs only when the foot is moved, it is controlled by lying _____. still
119. Medications are given for pain. The control is then due to _____. medication
120. Two other considerations in reporting pain which we have just described are _____ and _____. control, relation to circumstances
121. Changes must be reported. If the pain was dull, then became sharp, it _____. changed
122. A change in the course of the disease may cause a _____ in the intensity of pain. change
123. Summarizing, when charting, the following observations are made: _____, onset, _____, spread, relation to _____, and _____. nature, intensity duration, circumstances, control

APPENDIX B

TESTS

Pretest Sample and Key

MONTANA STATE COLLEGE School of Nursing

N 103 Foundations in Nursing

Name _____

Date _____

I. COMPLETION: Fill in the blank spaces with the correct word(s).

1. The sensation of pain is elicited by (a, an) _____. stimulus
2. Another term for pain receptors is _____. nociceptors
3. Through the reflex arc, when confronted with a painful stimulus, the person _____. withdraws
4. Sensory impulses of pain travel to the cerebrum via nerve pathways called a _____. three sensory neuron relay
5. Four observations to be made when charting pain are the: _____, _____, _____, and _____.
location or control, intensity or nature, duration or onset, circumstances or spread

II. MULTIPLE CHOICE: In the blank to the right of the question, place the letter of the most correct response.

1. Pain receptors in the viscera are stimulated by: _____ c
a) any type of stimulus
b) a stimulus severe in intensity
c) changes in pressure and chemicals
d) changes in cellular O₂

2. Conscious recognition of the sensation of pain takes place in the:

- a) cerebral cortex
- b) lateral spinothalamic tract
- c) hypothalamus
- d) thalamus

d

3. If twenty people are sharply pricked on the finger with a pin, their perception of the pain will:

- a) vary according to each individual
- b) be markedly uniform
- c) vary according to the situation in which the stimulation takes place
- d) be uniform if they are of the same cultural group

b

4. The location of pain is more exactly determined on the body surface than in the abdominal cavity.

This is true because:

- a) pain receptors are more easily stimulated on the body surface
- b) pain receptors in the viscera are less sensitive to most types of stimuli
- c) there is a greater concentration of pain receptors in the viscera
- d) there is a greater concentration of pain receptors in the skin

d

5. Interpretation and the perception of pain occurs in the:

- a) cerebral cortex
- b) spinal cord
- c) hypothalamus
- d) thalamus

a

6. Penetrating is a term which may be used to describe:

- a) the nature of pain
- b) the intensity of pain
- c) the spread of pain

a

7. Misinterpretation of pain as to location by the cerebrum results in:

- a) superficial pain
- b) referred pain
- c) deep pain

b

8. Changes in pain must be reported because: c
- a) the doctor always wants to know how the patient is progressing
 - b) it means that the patient is getting better
 - c) it is indicative of a change in the course of the disease
9. The primary function of pain is to: b
- a) react to a stimulus
 - b) protect
 - c) accompany tissue destruction
10. "Fast" pain is carried by: a
- a) myelinated fibers
 - b) non-myelinated fibers
 - c) nerve pathways
 - d) dendrites

Test for Retention and KeyMONTANA STATE COLLEGE
School of Nursing

N 103 Foundations in Nursing

Name _____

Date _____

COMPLETION: Place the missing word(s) in the blank provided at the right.

1. Since pain acts as warning system against danger, it is considered another _____ of the body. defense mechanism
2. Pain accompanies destruction of _____. tissue
3. Another term for pain receptors is _____. nociceptors
4. Pain receptors are located in the _____, _____, and _____. skin, mucosa, viscera
5. The impulses of pain reach the cerebral cortex via a network of nerve pathways called the _____. 3-sensory neuron relay
6. Sharp pain experienced after a cut on the finger is transmitted by _____ fibers. myelinated
7. The lingering pain experienced after the initial incision is carried by _____ fibers. non-myelinated
8. Pain receptors in the deep structures are stimulated by _____ and _____. change in pressure chemicals
9. The dendrite of Sensory Neuron I has its origin in the _____. nociceptors
10. Through the reflex arc, when confronted with a stimulus, the person _____. withdraws

TRUE OR FALSE: If the statement is correct, place T in the blank at the right; if false, place F.

11. Any type of stimulus is sufficient to elicit the sensation of pain in the skin and mucosa.
12. The same person will react in the same manner to the stimulus of pain.
13. Through observation, the nurse may judge the severity of a patient's pain.
14. Superficial concentration of pain receptors is the same over the body.
15. Referred pain results when sensory fibers of both the skin and deep structures enter the spinal cord at the same segment.

TFFFT

PLACE THE LETTER OF THE APPROPRIATE WORD (A or B) which best completes the statement, in the space provided to the right.

A = Decreases

B = Increases

16. Tolerance to pain ___ by the presence of anxiety.
17. Distracting a patient's attention from a painful procedure ___ his tolerance to it.
18. Good health ___ tolerance to pain.
19. Tolerance to pain ___ with fatigue.
20. Age, when comparing the reaction of a child and an adult to pain, ___ tolerance.
21. Trace the path of an impulse of pain.

ABBAB

Sensory Neuron I

Origin: nociceptors

Termination: spinal cord

Sensory Neuron II

Origin: spinal cord

Termination: thalamus

Sensory Neuron III

Origin: thalamus

Termination: cerebral cortex

MULTIPLE CHOICE: Place the letter of the best answer in the column at the right.

22. Whether pain is deep or superficial is dependent upon: c
a) the nature of the stimulus
b) the concentration of pain receptors
c) the area stimulated
23. Conscious recognition of the sensation of pain takes place in the: d
a) cerebral cortex
b) lateral spinothalamic tract
c) hypothalamus
d) thalamus
24. The primary function of pain is to: b
a) react to a stimulus
b) protect
c) accompany tissue destruction
25. Interpretation and perception of pain occurs in the: a
a) cerebral cortex
b) spinal cord
c) hypothalamus
d) thalamus
26. If twenty people are sharply pricked on the finger with a pin, their recognition of pain will: b
a) vary according to each individual
b) be markedly uniform
c) vary according to the situation in which the stimulation takes place
d) be uniform if they are of the same cultural group

Mr. X was admitted to the hospital with the following complaints: nausea, vomiting, pain in the abdomen. When questioned the patient stated pain began approximately one hour after eating dinner. It had begun as a dull ache in the right upper quadrant. The pain now occurred at brief intervals and was judged by the nurse as severe. Hot wet packs were applied to the abdomen and Demerol 100 mg was given. After approximately one hour, Mr. X appeared to be resting.

The following questions refer to the above case. Place the letter of the appropriate answer in the blank at the right.

27. The location of Mr. X's pain may be described as: _____

- a) over the entire abdomen
- b) beginning in the right upper quadrant and extending across the abdomen
- c) radiating from the right upper quadrant to the left upper quadrant of the abdomen

This question was omitted when correcting the test due to typographical omission of essential material.

28. The nature of the pain may be described as: _____

- a) dull, aching
- b) radiating
- c) penetrating
- d) none of these

29. Control of pain was accomplished by: _____

- a) admission to the hospital
- b) Demeral 100 mg
- c) hot wet packs to the abdomen
- d) b and c
- e) all of the above
- f) none of the above

30. The intensity of pain may be described as: _____

- a) mild
- b) moderate
- c) severe
- d) none of the above

31. Onset, in this instance, was: _____

- a) slow
- b) sudden
- c) the first occurrence
- d) none of the above

32. Term(s) used to describe the duration of pain would be: _____

- a) one hour
- b) two hours
- c) intermittent
- d) until control measures were given

TABLE I

CONTROL GROUP

The High School and Fall Quarter Grade Point Averages, the Ohio Psychological Test Reported in Stanines and the Raw Scores of the Control Group on the Pretest, First Test for Retention, and the Second Test for Retention

Student Code	High School Grade Point Average	Fall Quarter Grade Point Average	Ohio Psycho- logical Test	Pretests Scores	First Test For Reten- tion	Second Test For Reten- tion
a	2.2	2.29	5	10	27	18
b	2.6	2.34	6	7		24
c	2.2	2.12	6			27
d	2.5	2.27	6			13
e	2.6	1.82	6	7	25	21
f	3.1	2.51	6	11	22	22
g	3.3	2.41	3	4	20	17
h	3.6	1.94	5	7	28	24
i	2.8	1.76	5	8	29	23
j	2.6	1.82	5	7		
k	1.6	1.59	5	8	12	
l	2.3	2.06	5			17
m	2.8	2.35	8			20
n	2.2	1.53	5	6	21	
o	2.3	1.88	5	11	23	24
p	3.2	2.47	4	10	21	13
q	2.7	2.33	5	12	32	23
r	2.3	2.18	6	7	28	23
s	2.3	1.82	4	11	20	18
t	3.2	3.00	7	6	32	17
u	2.7	2.01	4	11	27	23
v	3.3	2.59	3	11	24	
w	2.3	1.65	4	9		
x	2.7	2.18	8	7	30	23
y	2.6	.71	3	8		
z	1.9	1.29	4			
aa	3.6	2.35	9.	8	32	24
bb	2.7	1.94	3	7	18	13
cc	3.4	2.97	6	6	30	
dd	3.2	2.47	8	10	30	28

TABLE II

EXPERIMENTAL GROUP

The High School and Fall Quarter Grade Point Averages, the Ohio Psychological Test Reported in Stanines, and the Raw Scores of the Experimental Group on the Pretest, First Test for Retention and Second Test for Retention

Student Code	High School Grade Point Average	Fall Quarter Grade Point Average	Ohio Psycho- logical Test	Pretest Scores	First Test For Reten- tion	Second Test For Reten- tion
1	2.4	2.12	5	4	22	21
2	2.6	2.00	7	8		20
3	2.3	1.54	4	3	16	
4	2.4	2.53	8			20
5	2.7	2.29	7	11	27	17
6	2.3	2.06	4	7	23	17
7	3.5	2.53	8	9	31	26
8	2.1	2.41	2	8		
9	3.3	2.18	5	8	27	24
10	3.0	1.82	7	10	23	
11	2.6	1.76	4	8	30	18
12	2.2	2.50	4	8	24	
13	3.2	2.06	5	7	30	
14	3.1	2.00	4	6	22	19
15	2.4	2.41	6	6	26	12
16	2.8	3.00	4			18
17	2.5	2.31	6	11		22
18	1.9	1.71	3	4	21	14
19	3.9	2.59	7	10	32	24
20	2.1	1.88	3	6		
21	2.6	2.12	7	7	24	
22	2.7	1.94	5	7	23	22
23	3.1	2.47	6	7	16	24
24	2.7	2.76	6	7	19	18
25	2.4	1.35	6	11	30	14
26	3.4	2.82	6	11	32	24
27	2.2	2.12	4	7	24	22
28	3.7	3.24	4	9	28	22

Student Code	High School Grade Point Average	Fall Quarter Grade Point Average	Ohio Psycho- logical Test	Pretest Scores	First Test For Reten- tion	Second Test For Reten- tion
29	2.7	1.94	6	9	31	26
30	2.3	1.59	2	6		18
31	2.7	1.75	4	6		24
32	1.9	1.59	1	7	25	16
33	2.2	1.29	5			19
34	1.3	1.53	5	7		
35	2.0	1.12	4	9		13

LITERATURE CITED

LITERATURE CITED

Books

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