The Development of a Test for the Measurement of Drug Information Gained from Practical Experience by Undergraduate Students in Pharmacy

Henri R. Manasse
Loyola University Chicago

Follow this and additional works at: https://ecommons.luc.edu/luc_theses

Recommended Citation

This Thesis is brought to you for free and open access by the Theses and Dissertations at Loyola eCommons. It has been accepted for inclusion in Master's Theses by an authorized administrator of Loyola eCommons. For more information, please contact ecommons@luc.edu.

This work is licensed under a Creative Commons Attribution-Noncommercial-No Derivative Works 3.0 License. Copyright © 1972 Henri R. Manasse
THE DEVELOPMENT OF A TEST FOR THE MEASUREMENT OF
DRUG INFORMATION GAINED FROM PRACTICAL EXPERIENCE
BY UNDERGRADUATE STUDENTS IN PHARMACY

by

HENRI RICHARD MANASSE, JR.

B.S. in Pharmacy, University of Illinois at
the Medical Center, College of Pharmacy, 1968

A Thesis
Submitted to the Faculty of the Graduate School,
Loyola University of Chicago
in Partial Fulfillment of the Requirements
for the Degree of Master of Arts

Loyola University of Chicago

May, 1972
ACKNOWLEDGMENTS

I could never adequately single out all of those persons for acknowledgment who have helped and encouraged me during this research problem. However, I would be amiss if I did not express my appreciation openly to several persons for whose assistance I am grateful.

Firstly, the author wishes to thank Dr. Raynard J. Dooley for his guidance and assistance as major advisor and director of the thesis. Dr. Gerald L. Gutek's assistance is also appreciated in his capacity as a member of the thesis advisory board.

Guidance and encouragement to begin graduate studies were offered by my dear friends and colleagues, Dr. Daniel A. Nona and Dr. Robert G. Mrtek. Dr. August P. Lemberger, Dean of the College of Pharmacy at the University of Illinois offered much support to my studies and the research problem. To these persons, the author will always be grateful and appreciative.

The support provided by the United States Vitamin Pharmaceutical Company and the Sargent-Welch Scientific Company is greatly acknowledged.

The author is especially indebted to his wife, Arlynn, for her support, patience, understanding and love during this and every endeavor.
TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td></td>
</tr>
<tr>
<td>INTRODUCTION AND PURPOSE OF THE STUDY</td>
<td>1</td>
</tr>
<tr>
<td>Evaluation of Practice Experience</td>
<td>3</td>
</tr>
<tr>
<td>Purpose of this Study</td>
<td>4</td>
</tr>
<tr>
<td>II.</td>
<td></td>
</tr>
<tr>
<td>REVIEW OF THE RELATED LITERATURE</td>
<td>6</td>
</tr>
<tr>
<td>Experimental Studies in Practical Experience in Pharmacy</td>
<td>6</td>
</tr>
<tr>
<td>Technology and Test Administration</td>
<td>8</td>
</tr>
<tr>
<td>Intrinsic Programming and Testing</td>
<td>9</td>
</tr>
<tr>
<td>III.</td>
<td></td>
</tr>
<tr>
<td>TEST DEVELOPMENT</td>
<td>12</td>
</tr>
<tr>
<td>Stage I - Constructing the Test</td>
<td>12</td>
</tr>
<tr>
<td>Selection of Objectives for the Test</td>
<td>12</td>
</tr>
<tr>
<td>Distinctive and Unique Testing Areas</td>
<td>13</td>
</tr>
<tr>
<td>Generation of Test Items</td>
<td>15</td>
</tr>
<tr>
<td>Content Validity</td>
<td>16</td>
</tr>
<tr>
<td>Construct Validity</td>
<td>16</td>
</tr>
<tr>
<td>Stage II - Preliminary Tryout</td>
<td>20</td>
</tr>
<tr>
<td>Selecting Tryout Test Groups: Rationale for Four Groups</td>
<td>20</td>
</tr>
<tr>
<td>Reliability of the Tryout Test</td>
<td>21</td>
</tr>
<tr>
<td>IV.</td>
<td></td>
</tr>
<tr>
<td>ADAPTATION OF THE TEST ITEMS TO INTRINSIC PROGRAMMING</td>
<td>25</td>
</tr>
<tr>
<td>Stage I - Final Composite</td>
<td>25</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>PAGE</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Administration of the Test</td>
<td>29</td>
</tr>
<tr>
<td>Scoring of the Test</td>
<td>32</td>
</tr>
<tr>
<td>Score Interpretation</td>
<td>35</td>
</tr>
<tr>
<td>Stage II - Field Testing of the Instrument</td>
<td>36</td>
</tr>
<tr>
<td>Selection of the Test Groups</td>
<td>36</td>
</tr>
<tr>
<td>Description of Scores for Each Group</td>
<td>36</td>
</tr>
<tr>
<td>Analysis of Scores Obtained for Each Group</td>
<td>39</td>
</tr>
<tr>
<td>V. SUMMARY AND IMPLICATIONS</td>
<td>45</td>
</tr>
<tr>
<td>Summary</td>
<td>45</td>
</tr>
<tr>
<td>Implications</td>
<td>47</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>49</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>117</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>122</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Percentage Score Distribution and Group Means Obtained From Tryout Test Sample</td>
<td>18</td>
</tr>
<tr>
<td>II. One Factor Repeated Measures ANOVA of Tryout Test Data</td>
<td>19</td>
</tr>
<tr>
<td>III. Grouping of Scores for Discrimination and Difficulty Analysis</td>
<td>22</td>
</tr>
<tr>
<td>IV. Schematic of Qualitative Sequence</td>
<td>27</td>
</tr>
<tr>
<td>V. Schematic of Quantitative Sequence</td>
<td>28</td>
</tr>
<tr>
<td>VI. Program Design for A Test for the Measurement of Non-Prescription Drug Product Information</td>
<td>30</td>
</tr>
<tr>
<td>VII. Picture of Auto Tutor Mark 4</td>
<td>31</td>
</tr>
<tr>
<td>VIII. Scoring Chart for Machine Score Interpretation</td>
<td>34</td>
</tr>
<tr>
<td>IX. Distribution of Scores Obtained From Field Testing Program</td>
<td>38</td>
</tr>
<tr>
<td>X. Chi-Square Analysis for the Establishment of Significant Differences Between Classes based on the Number of Sequence Entered</td>
<td>41</td>
</tr>
<tr>
<td>XI. Kruskal-Wallis ANOVA of Scores Resultant from Field Testing Program</td>
<td>43</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION AND PURPOSE OF THE STUDY

Curiosity, initiative and capacity for observation are features found to be present in the human being at birth. These characteristics are necessary ingredients of an educational process in universal use. Learning in any field by observation or imitation of an experienced master provides a means by which the hereditary skill or cultural heritage of a society is transmitted.¹

Such learning by observation has characterized instruction in the pharmaceutical sciences in America for nearly two centuries. Apprenticeship or practical education, was initially viewed as a utilitarian mode of education easily fostered by frontier conditions and a lack of formal educational programs in the United States. In fact, even when the first College of Pharmacy opened its doors in the United States in 1821, the prime requisite for admission was a specified time-block of experience which was to have been gained in a pharmacy under the tutelage of a practitioner pharmacist.²

As formal curricular programs were developed for the education of pharmacists, practical experience requirements remained as a vital component and requirement. It is not completely strange that this vestigial requirement remained, for most of the pharmacy practitioners of the day felt that the
practice of pharmacy was an art which could at best only be
learned through practice in the daily handling and preparation
of remedies in common use. One pharmacist in describing his
educational experience while an apprentice wrote,

Between the calls of customers, we had the privilege of reading Cox's Dispensatory, Turner's Chemistry, Ure's Chemical Dictionary and once in a quarter, the welcome Journal of Pharmacy. It is not wondered that, after the labors of the day, one found it difficult to keep awake the long winter evenings.³

Furthermore, Professor Parrish wrote in The American Journal of Pharmacy,

The apprentice enjoyed a wholesome development of muscle through wielding the ponderous pestle, handling sieves and working the screwpress. He learned how to make pills by wholesale, to prepare great jars of extracts and cerates. To bottle castor oil, Turlington's balsam, and opodeldoc by the gross, and what he lacked in the number and variety of articles he dealt in, was made up by the greater extent of his operations and the completeness with which, in a single establishment, all the then known processes were practiced.⁴

An evolution of sorts has been experienced in pharmaceutical education and practice since these authors wrote the preceding testimonies. However, present day requirements for entrance into the practice of pharmacy are comprised of two requisites:

1) the completion of a five-year curricular program leading to a Bachelor of Science degree in pharmacy
2) the fulfillment of a prescribed time-block of practical experience.

Curricular programs differ widely in content and in scope throughout the seventy-four colleges of pharmacy in the United States and Puerto Rico although the primary objectives are the same; namely, preparing a competent pharmacy practitioner. Practical experience requirements however, show even a greater variety of requirements and are not entirely congruous in terms of stated objectives for this experience.5

It has been shown that the need for practical experience can not be eliminated.6 For, if the maturational development, the psychological adjustments and the acquisition of judgement skills in the competent practice of pharmacy can be acquired only through a practice component prior to licensure, then the need for this requirement is made explicitly clear. It can not be the responsibility of the academicians alone to impart these types of "educational" skills upon the student through collegiate instruction because such responsibility may be outside of their sphere of competency.

Evaluation of Practice Experience

With an established need and objective for the practice experience requirement, it is incumbent upon the College faculty or the licensing boards to evaluate whether or not those objectives have been met. Measurement of cognitive skills reflected from practice experiences should accompany further
measurement of a student's overall abilities to adapt those skills to decision-making or functional parameters. It also becomes important for evaluation to occur in terms of a student practitioner's ethical and professional behavior.

Subjective and objective measurement techniques need to be developed expressly for evaluation of the practice experience component of pharmaceutical education. The construction of testing instruments for the evaluation of a student's abilities in cognitive skill areas, in artistic adaptation, psychological adjustment and judgemental decision-making must become a reality. It should be noted emphatically that the creation and use of such instruments is a requirement that must be met prior to the manipulation and reconstruction of practical educational programs for pharmacists.

**Purpose of this Study**

Of the components identified as being part of the learning experience of the student in the practice environment, that portion of the experience which deals with non-prescription medications was singled out for the purpose of intense measurement. Since the pharmacy practitioner must interface with the community on a daily basis in the area of non-prescription drugs, it was felt that knowledge in this phase of practice must be examined in terms of a student's competency to provide information and proper advice to the self-medicating patient.
Thus, it became the purpose of this study to construct a test which could measure a student's performance in several categories of non-prescription medications. It was intended to construct an examination which could differentiate, both qualitatively and quantitatively, the amount of drug product information learned during the collegiate portion of the undergraduate program in pharmacy from similar information gained in pharmacy internship training. In this way, the examination could evaluate a student's knowledge concerning this specialized group of drugs during any phase of the academic or practical educational program.

A second purpose was the development of a new method of test administration. It was intended to adapt the examination to an intrinsically programmed, random access teaching machine. In this method, the testing experience would be individualized and the machine would permit random access to the test sequence based upon a student's performance.
CHAPTER II

REVIEW OF THE RELATED LITERATURE

Experimental Studies in Practical Experience in Pharmacy

To date, there have been few reports of experimental studies assessing the practice experience program. Manasse, et al., described an experimental program which included two recent graduates of a college of pharmacy who were exposed to a clinically centered practice experience. These authors conclude, after subjective analysis, that a structured clinical component should be included as part of the internship training.

Recent focus has been brought upon the establishment of demonstration projects involving the practice experience component. It has been suggested that such demonstration projects be constructed within the curricular programs of the colleges of pharmacy and that these projects be carefully evaluated. Lesshaft and Billups reported the formation of a clerkship which was a learning experience where the student acquires knowledge through working closely with patients. These authors suggest that this experience is not a contrived classroom case study course but rather a functional learning tool in which the student is a participating, decision-making member of the attending health care group. To establish such a learning practicum, the authors worked closely with community practitioners in estab-
lishing objectives for the experience and ultimately meeting those objectives by constructing assignments and responsibilities in the pharmacy. Review of a student's progress was observed in weekly seminar sessions.

Warner reports the establishment of a pilot pharmacy clerkship at the University of Southern California.11 In the design of the project, a model for the evaluation of the clerkship was included for which six evaluative instruments were developed. Through the use of these instruments, Warner concluded that the clerkship experience changed the attitudes of medical staff and pharmacy students, the experience provided increased proficiencies on the students' behalf in dealing with patients, the students became aware of their role on the health team and the students demonstrated a significant gain in their ability to apply pharmaceutical cognitive skills to the clinical situation.

Paris related a vigorous course of training for pharmacists' assistants in The Netherlands.12,13 He describes a practical experience without benefit of academic instruction which is designed to prepare an individual for a qualifying examination for licensure as a pharmacist's assistant. Various theoretical components of practice including Latin, practical chemistry, pharmaceutical mathematics, chemical synonyms, sources of drugs, prescription interpretation, drug action, and patient interaction are examined prior to licensure. It is assumed that
all of a student's knowledge in these various areas is gained through practice under the supervision of a master pharmacist.

Evaluation of practice experience has received greater attention in the professions of medicine and nursing.\textsuperscript{14-18} However, these evaluations did not emphasize knowledge and intellectual skills but rather, focused on a student's attitudinal and functional adaptability to the clinical encounter.

**Technology and Test Administration**

Technology has become increasingly a point of focus in terms of testing and test administration. This attention was drawn by Pressey, who in 1950, designed a teaching machine that could assess a student's response and immediately provide self-instruction for remedial purposes.\textsuperscript{19} In today's highly technology-oriented environment of course, the computer has taken over as a tool for testing.\textsuperscript{20,21}

Turnbull suggests that,

> The computer will supply a kind of mini-guidance or perhaps mini-placement within the minute to minute interactions of the student with the instructional program. It will also accumulate the responses over longer sequences and display the record for the information of the student, the teacher and the guidance counsellor at educational decision points.\textsuperscript{22}

It is also reviewed that a computer can administer a test and interrogate a potential applicant for admission to a vocational continuing education program.\textsuperscript{23}

Harless, et al., describes using a computer to present
clinical situations to medical students and allowing these students to make decisions concerning diagnosis and treatment. The computer mediates the student's responses and tells of the progress a student is making. The computer has further been shown to be useful in analyzing multiple-choice examinations in terms of validity and reliability and also evaluating a student's clinical performance.

Intrinsic Programming and Testing

Specific application of computer or machine testing procedures may be based on the concept of intrinsic programming. This concept has been thoroughly reviewed by Crowder, Walther and Crowder, and Holtz. These authors describe a model of stimulus-response learning which can be interrupted by remedial learning units. After a student masters the remedial work presented to him in a "branch" of the learning unit sequence, he is allowed to continue his learning experience.

This conceptual framework has been applied to several areas of evaluation. Mrtek and Mrtek suggest that intrinsic programming can be used as a tool of evaluating one's readiness to begin a pharmacy continuing education program. It is proposed that a practitioner can begin a programmed, self-study course and through the mediation of the program's decision structure, can review "forgotten" concepts and can learn new concepts thus providing him with continued education.

A similar concept has been developed by Cleary, et al.,
although the work considers utilizing the intrinsic program exclusively as a testing medium. Cleary describes a sequential system of branching which is used to direct a subject to items that are appropriate to his performance level. Cleary, et al., also points out that such a system of testing can provide immediate feedback to the examinee and also would individualize the testing process. One of the major advantages, as Cleary, et al., points out, is that such a testing procedure could significantly reduce overall test time and also reduce the amount of random guessing. These authors conceptualize a test model which would contain:

1) a routing section which contains the branching necessary to direct the subject to the appropriate items

2) a measurement section which contains a short test with item difficulties concentrated at the appropriate level for the subject.

Waters and Bayroff substantiate the theory outlined by Cleary, et al., by showing that the presentation of test items should be based on an examinee's past performance which allows the individual to take items which are progressively more appropriate to his level of ability. This would permit a more accurate measurement of an individual's ability. Hubbard describes the practical application of these theories to the Examinations of the National Board of Medical Examiners.

Smallwood provides a lengthy discourse on the adaptability
of the teaching machine to decision structuring for teaching and testing purposes. In his review, he provides the technical and mathematical design for the construction of such an instrument.

It is hoped that the results of this study can bring together some of the thoughts and procedures of other researchers as these relate to the evaluation of one component of the practice experience in pharmacy.
CHAPTER III
TEST DEVELOPMENT
STAGE I - CONSTRUCTING THE TEST

Selection of Objectives for the Test

The practical experience gained by students of pharmacy centers on a number of vital elements. Of these elements, it was felt that knowledge concerning non-prescription drugs could be most easily isolated for measurement. Knowledge and intellectual skills identified with the subject area of home remedies presented a component of practice in which all students gain exposure throughout the internship experience.

A student's ability to function knowledgeably and competently in dealing with the patient and non-prescription medications embraces a number of factors. These factors include
1) knowing the advantage of one brand over another
2) knowing the safe and proper use of these drugs
3) knowing the importance of safe storage of medications
4) understanding dose and dosage scheduling
5) knowing instructions for the proper use of medications and
6) having a familiarity of health accessory items (i.e., syringes and needles, bandages, supports, catheters and irrigation equipment).

By examining these factors, a "blueprint" for the design and development of a test was constructed. Criteria were
specified for learning outcomes in the lower level of the cognitive domain for two components of drug products used for self-medication.41

**Distinctive and Unique Testing Areas**

The first component, **qualitative** knowledge, was established for the purpose of seeking out a student's capability to identify:

a) unique brand or package designs (i.e., yellow and white box)

b) special logos (i.e., "Extra Strength Pain Reliever")

c) dosage forms (i.e., tablets, syrups, etc.)

d) manufacturers (i.e., Lilly, Upjohn, Glenbrook, etc.)

e) packaging peculiarities (i.e., cobalt glass bottles, metal cans, etc.)

f) special health related items (i.e., thermometer types, syringe types, etc.)

It was assumed that this component of knowledge was universal and did not depend on didactic instruction. This knowledge could be obtained strictly through exposure to particular products through direct use, mass media advertising or stocking shelves in a pharmacy. Thus, a housewife and mother who depends heavily on self-medication within her family group, may present herself to be quite astute in terms of **qualitative** knowledge.

However, a **quantitative** area of knowledge was also identified. It was within this field of knowledge that questions were designed relative to one's competency concerning:
a) product ingredients (i.e., single or multiple combination)

b) general dosage ranges (i.e., one tablet every four to six hours)

c) contraindications (i.e., do not take while operating machinery or driving an automobile)

d) toxicity (i.e., over-ingestion of drug products and resultant effects)

e) drug interactions (i.e., chemical, physical or biologic incompatibilities)

f) drug sources (i.e., natural or synthetic sources for the manufacture of specific drug products)

g) special instructions (i.e., do not take with milk or antacids)

Quantitative knowledge directed primarily at didactic instruction gained from academic work.

A series of questions which fielded both the qualitative and quantitative types of knowledge of non-prescription drugs were developed for eight categories or types of drugs and health-related products.

These consisted of the following:

I. Analgesics

II. Cough Preparations

III. Antacids

IV. Vitamins

V. Laxatives

VI. Diarrhea Remedies
VII. Cold Remedies

VIII. Health-Related Accessories

Generation of Test Items

Thus, with the separation of knowledge regarding non-prescription drugs into qualitative and quantitative components, it would be possible to construct an examination which could test a person's competency in terms of breadth and depth. A test participant could be examined for breadth by exposing him to questions dealing with a broad range of drug products. On the other hand, his depth of knowledge could be determined by exposing him to questions which deal specifically with a category of drugs.

Items were prepared for the development of a tryout test. It was not the purpose of this item pool to produce a "good" test per se, but rather to generate and produce well structured and functional items for the intrinsic Auto Tutor program. These items consisted of multiple-choice questions each containing four distractors. Of these, only one represented the correct answer. A total of sixty seven qualitative items and one hundred forty quantitative items were written. All items were based upon known scientific data and current literature sources as these related to non-prescription drug products. The tryout test is attached as Appendix A.

A tryout test was developed for the purpose of examining test function. Although all items were prepared carefully to
meet the test objectives, content requirements, style, etc., it was not known whether or not the test had the capability to actually discriminate between criterion groups.

**Content Validity**

Content validity has been described as the representativeness or sampling adequacy of the content - the substance, the matter, the topics - of a measuring instrument. Content validation is guided by the question: Is the substance or content of this measure representative of the content or the universe of content of the property being measured.\(^42\)

Content validity of the test was assured through the use of guidelines and principles of non-prescription medications as established by the American Pharmaceutical Association.\(^43\) It was assumed that that organization's publication, "Handbook of Non-Prescription Drugs" was representative of the body of knowledge in which a practitioner shows proficiency. Validity was established by constructing the test so that it would closely fit the defined areas of knowledge as outlined by the American Pharmaceutical Association. Product information supplied by the manufacturer on the drug packages as well as recommendations by professors at the College of Pharmacy were also used to supplement the defined knowledge skills.

**Construct Validity**

Cronbach describes construct validity to be an analysis of the meaning of test scores in terms of psychological concepts or constructs.\(^44\) This definition may be generalized in part, to
include "...hypothetical qualities which are assumed to exist in order to account for behavior in many different specific situations".\textsuperscript{45} The process of construct validation then, as Gronlund states, examines whether or not "...the constructs which are presumed to be reflected in the test scores actually do account for differences in test performance".\textsuperscript{46}

Quantification of construct validity was effected by administering the tryout test to a group of people representing a broad background of knowledge and skills concerning non-prescription medications. This criterion group consisted of forty individuals - ten lay persons, ten first professional year and ten fourth professional year students at the University of Illinois College of Pharmacy, and ten pharmacy practitioners. Table I provides the reader with the scores obtained from the administration of the test to the tryout sample on both the qualitative and quantitative portions of the test.

Several analysis were done to verify and conclude a number of constructs:

1) A spearman-Rho Correlation between quantitative and qualitative scores yielded a highly significant $r$ of .95. Thus, on a total group basis, it may be said that a person's knowledge about the qualitative features of non-prescription drug products is directly related to his quantitative knowledge of these same types of drugs.

2) A One Factor Repeated Measures Analysis of Variance (Table II) presented statistical evidence which allowed the conclusion that a) background (i.e., laity, student, pharmacy practitioner) affects total performance on the test,
Table I

Percentage Score Distribution and Group Means
Obtained from Tryout Test Sample, April, 1971

X = QUANTITATIVE
Y = QUALITATIVE

<table>
<thead>
<tr>
<th>LAY PERSONS</th>
<th>FRESHMAN STUDENTS</th>
<th>SENIOR STUDENTS</th>
<th>PRACTITIONERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Y</td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td>27.1</td>
<td>37.3</td>
<td>38.6</td>
<td>59.7</td>
</tr>
<tr>
<td>25.7</td>
<td>37.3</td>
<td>36.4</td>
<td>65.7</td>
</tr>
<tr>
<td>22.1</td>
<td>34.3</td>
<td>20.7</td>
<td>25.4</td>
</tr>
<tr>
<td>22.1</td>
<td>31.3</td>
<td>20.7</td>
<td>22.4</td>
</tr>
<tr>
<td>20.0</td>
<td>26.9</td>
<td>20.0</td>
<td>34.3</td>
</tr>
<tr>
<td>17.9</td>
<td>28.4</td>
<td>17.1</td>
<td>34.3</td>
</tr>
<tr>
<td>15.7</td>
<td>28.4</td>
<td>14.3</td>
<td>23.9</td>
</tr>
<tr>
<td>15.0</td>
<td>23.9</td>
<td>14.3</td>
<td>20.9</td>
</tr>
<tr>
<td>13.6</td>
<td>23.9</td>
<td>10.7</td>
<td>25.4</td>
</tr>
<tr>
<td>7.1</td>
<td>29.9</td>
<td>5.7</td>
<td>16.4</td>
</tr>
</tbody>
</table>

\[ \bar{x}_{X} = 18.63 \quad \bar{x}_{Y} = 30.16 \quad \bar{x}_{X} = 19.85 \quad \bar{x}_{Y} = 32.84 \quad \bar{x}_{X} = 66.13 \quad \bar{x}_{Y} = 72.7 \quad \bar{x}_{X} = 69.49 \quad \bar{x}_{Y} = 77.10 \]
Table II

One Factor Repeated Measures ANOVA of Tryout Test Data

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>ms</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>50,859.56</td>
<td>79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Subjects</td>
<td>47,758.13</td>
<td>39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Background</td>
<td>42,485.95</td>
<td>1</td>
<td>42,485.95</td>
<td>306.23*</td>
</tr>
<tr>
<td>Error$_b$</td>
<td>5,272.18</td>
<td>38</td>
<td>138.74</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td>3,101.43</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantitative/Qualitative</td>
<td>1,819.89</td>
<td>1</td>
<td>1,819.89</td>
<td>63.63*</td>
</tr>
<tr>
<td>Background x Quantitative/Qualitative</td>
<td>194.65</td>
<td>1</td>
<td>194.65</td>
<td>6.80**</td>
</tr>
<tr>
<td>Error$_w$</td>
<td>1,086.89</td>
<td>38</td>
<td>28.60</td>
<td></td>
</tr>
</tbody>
</table>

*Significant at the 5% level

**Significant at the 2.5% level
b) criterion group performance differed on the quantitative and qualitative forms and c) different performance on the two test forms is dependent on background.

This evidence is further substantiated by the fact that the resultant student "t" test value gathered from an analysis of each groups' scores on the two test forms, shows significant score differences at the .05 level.

STAGE II - PRELIMINARY TRYOUT

Selecting Tryout Test Groups: Rationale for Four Groups

In order to examine test function in terms of item internal consistency, a tryout test group was selected. A group representing a broad range of backgrounds with regard to knowledge concerning non-prescription drugs was selected to test the examination instrument. This group was a convenience sample comprising ten lay persons, ten first professional year and ten fourth professional year students at the University of Illinois College of Pharmacy, and ten pharmacy practitioners. These persons were felt to exhibit such a broad range of background knowledge that the discriminatory power of the test could be well proven from results obtained from the profile for each group. At the same time, a wide range of scores obtained from this varied sample would allow an accurate analysis of the reliability of the instrument. The tryout test was administered to the forty persons on a paper and pencil basis.
Reliability of the Tryout Test

After obtaining responses to each of the questions on the tryout test composite, item analysis was initiated. Such analysis provided a formalized procedure for determining, 1) the difficulty of each item, 2) the discriminating power of each item and 3) the effectiveness of the distractors. Item analysis also allowed the detection of technical flaws in the test form.

The scores obtained on the quantitative and qualitative test forms were arranged in order from the highest score to the lowest score. Table III illustrates the distribution of scores into two clearly discriminate groups. For example, it may be seen in Table III that the lowest average raw score obtained on the qualitative form for Grouping I is 45; whereas the highest qualitative form score for Grouping II is 40. Similarly, the lowest score on the quantitative form for Grouping I is 77 and the highest score on the quantitative form for Grouping II is 54. Based upon the lack of raw score overlap among these distributions, the two groupings were used for comparison in the item analysis procedure rather than the established upper twenty seven percent and lower twenty seven percent comparison.

Item difficulty indices and item discrimination indices were determined by established procedure for each item on the quantitative and qualitative forms of the test as follows:
Table III

Grouping of Scores for Discrimination and Difficulty Analysis

<table>
<thead>
<tr>
<th>GROUPING I</th>
<th>QUALITATIVE SET</th>
<th>QUANTITATIVE SET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacists</td>
<td>59 - 46</td>
<td>105 - 84</td>
</tr>
<tr>
<td>Graduating Seniors</td>
<td>54 - 44</td>
<td>108 - 77</td>
</tr>
<tr>
<td>N = 20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GROUPING II</th>
<th>QUALITATIVE SET</th>
<th>QUANTITATIVE SET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lay Persons</td>
<td>25 - 16</td>
<td>38 - 10</td>
</tr>
<tr>
<td>Freshman Students</td>
<td>40 - 11</td>
<td>54 - 8</td>
</tr>
<tr>
<td>N = 20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example: Test Item "X"

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>A</th>
<th>B**</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Criterion Group (20)</td>
<td>0</td>
<td>12</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Lower Criterion Group (20)</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

**Correct answer

DIFFICULTY INDEX

(Appropriate Item Index lies between .40 and .60)

16 correct responses divided by total number in upper and lower group (40) = .40

DISCRIMINATION INDEX

(Appropriate Item Index lies between .30 and 1.00)

Upper Group $\frac{12}{20} = .60$ Lower Group $\frac{4}{20} = .20$

$.60 - .20 = .40$

Parallel to these determinations, was the examination of the effectiveness of the distractors. Thus, in the evaluation of each item to be considered for the preparation of a final test form, only those items that exhibited proper distractor function, and fell within the difficulty index of .40 to .60 and discrimination index of .30 to 1.00 were retained. Of the one hundred forty quantitative items composed in the tryout test, one hundred twenty items met the above named criteria. Thirty two qualitative items selected within the same criteria were taken from the initial sixty seven qualitative items included in the tryout test.

The compilation of difficulty indices also allowed all of the items to be arranged in ascending order of difficulty for
the final test composite. Both the qualitative and quantitative
items were ranked in order of difficulty.

Mathematical proofs of reliability were also calculated
for both forms of the tryout test. Using the "Split-Half" or
"Odd-Even" method, Pearson-Product Moment Correlation of 0.93 for
the qualitative form and 0.96 for the quantitative form were cal-
culated.\textsuperscript{50} These correlations were transposed to represent the
reliability of each entire test form by using the Spearman-Brown
"Prophecy" formula.\textsuperscript{51} The qualitative form assumed a reliability
index of .96 while the quantitative form reliability index became
.98. It is quite probable that the unusually high indices of
reliability are due to 1) high degree of relationship between
the test item and the performance criteria and/or 2) homogeneity
of the test items.
CHAPTER IV

ADAPTATION OF THE TEST ITEMS TO INTRINSIC PROGRAMMING

Stage I - Final Composite

Items retained through the item analysis procedure were composed into a final form of the test. For each of the eight categories of drugs previously defined (see pages 14-15), four highly discriminatory qualitative items were selected. This selection was based upon the fact that test items which possess greatest discriminatory power maximize total test reliability and hence, test quality.\textsuperscript{52,53} It was also felt that the use of such items would contribute to greater reliability due to the fact that upon failing these items, an examinee would not be asked to perform on subsequent items, thus eliminating "guess" or "chance" performance. These qualitative questions were followed by fifteen quantitative questions. This structured arrangement of item types was then named "A Test for the Measurement of Non-Prescription Drug Product Information".

The final form of "A Test for the Measurement of Non-Prescription Drug Product Information" was adapted to the structural requirements of intrinsic programming. It was felt that upon placing the test items in a branched program sequence, a high degree of decision structuring could be built into the testing process. This procedure allowed the investigator to present each item of the test one at a time and, based upon the
test participant's response, permitted the investigator to make a decision concerning subsequent progress through the testing sequence.

Intrinsic programming as developed by Crowder is based upon a unique application of Skinner's Stimulus-Response Theory in programmed instruction. Crowder's program allows evaluation of the response and a sequel decision-making process based upon the response provided by the learner. The decision may be to

1) continue to a new stimulus
2) review the previous stimulus and provide a new response
3) review the previous sequence of stimuli and develop a new rationale for response

This type of decision-making has been structured into programmed learning theory and has been utilized extensively in automated self-instructional devices. This unique decision structuring has been applied rather limitedly to the field of testing.

It was decided that each examinee be exposed to questioning in a particular category of non-prescription drugs one at a time. Within each category, the subject would be exposed first to the qualitative sequence consisting of four questions (see Table IV). These items were of equal difficulty but highly discriminatory. If the subject provided greater than fifty percent correct responses, he would be allowed to continue to the quantitative sequence consisting of fifteen questions (see Table V). If the subject generated fifty percent or less correct responses,
he would not be exposed to the subsequent quantitative questions in that category of drugs but rather, he would be directed to the qualitative sequence of a new category of drugs. Quantitative questions were arranged in ascending order of difficulty. Table VI allows the reader to follow the decision-making sequence through a schematic representation of the entire program for one category of drugs. This same program schematic also represents the remaining seven categories of drugs.

Such structuring of the test allowed examination for depth and breadth of knowledge concerning non-prescription drugs in a systematic fashion. Sequential item presentation also allowed for a reduction of total test exposure and time for those examinees who did not adequately perform on each of the eight qualitative sequences. Thus, a test subject was exposed to the test in its entirety only if he successfully responded to the qualitative portions of the examination.

Administration of the Test

The examination was prepared and microfilmed for presentation on the Sargent-Welch Mark 4 Auto Tutor. This electronic computer (Table VII) is a random-access, individually-controlled teaching machine which has been designed exclusively to impart self-instruction through the use of an intrinsically-branched program. To the knowledge of the manufacturer, the machine had not previously been programmed for the sole purpose of testing.

Explicit instructions and directions preceded the actual
PROGRAM DESIGN FOR "A TEST FOR THE MEASUREMENT OF NON-PRESCRIPTION DRUG PRODUCT INFORMATION"®

TABLE VI
Mr. A's study and bedroom are occupied by him. The
only room in which all the rooms. The furniture visible
the sign are to be extinguished. Here is the end scene.

AutoTutor
mark 4

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE VII
test (see Appendix B), thus eliminating the need for pre-test proctoring. Uniform directions were provided to all persons exposed to the test, thereby eliminating misunderstanding and ultimate mistakes in the test procedure. The machine allowed the participant to progress at a self-established pace throughout the entire testing procedure. Since the participant's place in the test is determined by individualized response, the possibility of cheating is eliminated. A test subject processes his answer to a particular question only by pressing the button which corresponds to his selected response. Upon interpreting the button response, the machine directs the student to a following frame determined by electronically coded information located out of the viewing range of the microfilm projector. This procedure is followed until the examination is completed.

At the end of the examination the participant is automatically locked into a two frame loop and advised to call an instructor, who in turn, collects the answer sheets and prepares the machine for the next test subject.

**Scoring of the Test**

The test was programmed in such a fashion so that two types of scoring could be implemented. The students' responses on the quantitative sequences could be evaluated through the use of a multiple-choice type answer sheet which accompanied the test. By programming each of the quantitative questions in each category of drugs into a linear programming sequence, the
student recorded each answer on an answer sheet (Appendix C). In this scoring mode, the machine only projected the question on the screen of the Auto Tutor, and the student was instructed to record his response by marking the answer sheet in appropriate fashion. Only one button choice was programmed to be active. Depressing it after the student had recorded his response on paper automatically advanced the student to the next question. There was no way that a student could return to any frame of the exam after his decision to advance was made.

The programming also permitted the use of a machine score mode whereby the evaluation could automatically be presented on the screen. The student's place within the triangle (see Table VIII) was determined solely by the results of his responses. (It should be noted that a student received a score of zero automatically if he responded incorrectly to twelve consecutive items). At the end of the quantitative sequence of fifteen questions, the examinee would arrive at a score frame. The frame then, represented by a reference number, provided a coded index of correct responses. When arriving at this score frame, the student was asked to write the reference frame number on his answer sheet (Appendix D). This procedure was carried out for each of the categories of drugs to which the student was exposed. The "frame numbers" were transposed into scores, which, when totaled, reflected the students' total correct responses. Table VIII shows the frame numbers and their accompanying score for
### SCORING CHART FOR MACHINE SCORE INTERPRETATION

<table>
<thead>
<tr>
<th>Reference Frame I</th>
<th>Frame No.</th>
<th>121</th>
<th>134</th>
<th>147</th>
<th>160</th>
<th>161</th>
<th>162</th>
<th>163</th>
<th>164</th>
<th>165</th>
<th>166</th>
<th>167</th>
<th>168</th>
<th>169</th>
<th>170</th>
<th>171</th>
<th>172</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. Correct</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference Frame II</th>
<th>Frame No.</th>
<th>306</th>
<th>319</th>
<th>332</th>
<th>345</th>
<th>346</th>
<th>347</th>
<th>348</th>
<th>349</th>
<th>350</th>
<th>351</th>
<th>352</th>
<th>353</th>
<th>354</th>
<th>355</th>
<th>356</th>
<th>357</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. Correct</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference Frame III</th>
<th>Frame No.</th>
<th>491</th>
<th>504</th>
<th>517</th>
<th>530</th>
<th>531</th>
<th>532</th>
<th>533</th>
<th>534</th>
<th>535</th>
<th>536</th>
<th>537</th>
<th>538</th>
<th>539</th>
<th>540</th>
<th>541</th>
<th>542</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. Correct</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference Frame IV</th>
<th>Frame No.</th>
<th>676</th>
<th>689</th>
<th>702</th>
<th>715</th>
<th>716</th>
<th>717</th>
<th>718</th>
<th>719</th>
<th>720</th>
<th>721</th>
<th>722</th>
<th>723</th>
<th>724</th>
<th>725</th>
<th>726</th>
<th>727</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. Correct</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference Frame V</th>
<th>Frame No.</th>
<th>861</th>
<th>874</th>
<th>887</th>
<th>900</th>
<th>901</th>
<th>902</th>
<th>903</th>
<th>904</th>
<th>905</th>
<th>906</th>
<th>907</th>
<th>908</th>
<th>909</th>
<th>910</th>
<th>911</th>
<th>912</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. Correct</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference Frame VI</th>
<th>Frame No.</th>
<th>1046</th>
<th>1059</th>
<th>1072</th>
<th>1085</th>
<th>1086</th>
<th>1087</th>
<th>1088</th>
<th>1089</th>
<th>1090</th>
<th>1091</th>
<th>1092</th>
<th>1093</th>
<th>1094</th>
<th>1095</th>
<th>1096</th>
<th>1097</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. Correct</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference Frame VII</th>
<th>Frame No.</th>
<th>1231</th>
<th>1244</th>
<th>1257</th>
<th>1270</th>
<th>1271</th>
<th>1272</th>
<th>1273</th>
<th>1274</th>
<th>1275</th>
<th>1276</th>
<th>1277</th>
<th>1278</th>
<th>1279</th>
<th>1280</th>
<th>1281</th>
<th>1282</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. Correct</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference Frame VIII</th>
<th>Frame No.</th>
<th>1416</th>
<th>1429</th>
<th>1442</th>
<th>1455</th>
<th>1456</th>
<th>1457</th>
<th>1458</th>
<th>1459</th>
<th>1460</th>
<th>1461</th>
<th>1462</th>
<th>1463</th>
<th>1464</th>
<th>1465</th>
<th>1466</th>
<th>1467</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. Correct</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

**TABLE VIII**
each drug category. Although the machine scoring feature exhibited a great degree of accuracy and immediate evaluation, the student's actual response was ultimately lost. This disadvantage was overcome by allowing the responses to be recorded on an answer sheet.

Score Interpretation

Two direct indications of an examinee's progress became available through the testing procedure. By acknowledging the fact that a score for quantitative questions had been obtained (either through the machine or manual scoring modes), it was known that the test subject had successfully completed the qualitative sequence for a specific category of drugs. Such acknowledgments then, established the breadth score. The breadth score represents the number of quantitative sequences entered for any of the drug categories. The total possible number of categories a student could have entered was of course, eight.

A depth score was tabulated to comprise the total number of correct responses a student obtained in each of the quantitative sequences to which he was exposed. Since each category of drugs contained fifteen quantitative questions, the total possible score for eight categories was, one hundred twenty.

A third score, which was ultimately used for the statistical analysis of the test scores, embraces both the breadth and depth achieved by each subject. That score is the average score obtained for each section entered. Thus, if a subject obtains a
breadth score of seven, and a depth score of seventy, his average score per section is ten.

Stage II - Field Testing of the Instrument

Selection of Test Groups

A field testing program was carried out after the appropriate items had been prepared for administration on the Mark 4 Auto Tutor. It was the purpose of this program to examine the overall usefulness of the Auto Tutor as a testing device and also to generate score data on a variety of students attending the University of Illinois at the Medical Center, College of Pharmacy.

All students at the College of Pharmacy were notified of the planned testing program and its objectives. Student volunteers were solicited from the student body to take the self-paced, self-administered examination during the first two weeks of classes of the Fall Term, 1971. Fifty students from each of the four academic classes were selected for the testing program. These two hundred test subjects represented a broad range of backgrounds in terms of academic and practice experience.

Description of Scores Obtained for Each Group

Scores were compiled for all of the examinees. Both scoring methods were utilized by directing half of the students to the manual scoring mode and the other half of the students to the programmed scoring mode. In addition, to insure that the academic levels of students in all groups was uniform, the
academic grade point averages were compiled for each test subject. Such compilation showed that each group represented a distribution of similarly skilled students. Mean grade point averages of 3.42, 3.33, 3.48 and 3.48 (based on 5.0 = A) were calculated for freshmen, sophomores, juniors and seniors respectively. Table IX reveals the distribution of scores for each class obtained from the field testing program.

It may be seen in Table IX that as the students in the field test increased their academic standing at the College of Pharmacy, they gained greater access to the number of drug categories (breadth score). The depth score, or the number correct on the quantitative questions for each drug category also increased with academic year rankings. As might be expected, the percentage of correct responses made by the student was also dependent on his academic classification.

There are several interesting features contained in the descriptive statistics presented in Table IX.

Freshmen and sophomore students had no formal, didactic presentation on the subject of non-prescription drugs at the time this test was administered. Scores obtained by these "naïve" persons on both qualitative and quantitative terms was due either to a student's exposure to these drug products in the practice setting as part of an externship or because of the student's constant contact with these drug entities because he or his family were "heavy" self-medicators. Since it is improbable that a
Table IX

Distribution of Scores Obtained from Field Testing Program

<table>
<thead>
<tr>
<th>Group Classification</th>
<th>N</th>
<th>Breadth Score</th>
<th>Depth Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean Categories Entered (Total Possible) = 8</td>
<td>Mean Score (Total Possible) = 120</td>
</tr>
<tr>
<td>Freshmen</td>
<td>50</td>
<td>2.22</td>
<td>15.12</td>
</tr>
<tr>
<td>Sophomores</td>
<td>50</td>
<td>3.18</td>
<td>24.18</td>
</tr>
<tr>
<td>Juniors</td>
<td>50</td>
<td>4.80</td>
<td>46.82</td>
</tr>
<tr>
<td>Seniors</td>
<td>50</td>
<td>5.52</td>
<td>59.68</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean % of Total Categories Entered</td>
<td>Mean % Correct Out of Total Questions Exposed</td>
</tr>
<tr>
<td>Freshmen</td>
<td>27.75</td>
<td></td>
<td>45.04</td>
</tr>
<tr>
<td>Sophomores</td>
<td>39.75</td>
<td></td>
<td>50.69</td>
</tr>
<tr>
<td>Juniors</td>
<td>60.00</td>
<td></td>
<td>65.03</td>
</tr>
<tr>
<td>Seniors</td>
<td>69.00</td>
<td></td>
<td>72.07</td>
</tr>
</tbody>
</table>
student as a self-medicator would use drug products in each of the eight categories of drugs included in this test, it is reasonable to assume that the knowledge sought out by the test was gained exclusively by practice experience in a pharmacy.

Junior and senior students on the other hand had completed course work which specifically deals with non-prescription drugs as dosage forms. Course work in this area was general, in that these drugs were studied from the viewpoint of the physical dosage form system rather than pharmacologically active entities. However, these students had an opportunity to gain a considerable amount of practice experience during summer and winter intersessions and also during part-time employment in pharmacies concurrent with the academic terms. It is therefore not surprising that these students not only had a greater breadth knowledge of non-prescription drugs but also were able to obtain a greater percentage of correct answers to the questions to which they were exposed on the quantitative portions of the examination.

Analysis of Scores Obtained for Each Group

Scores obtained from the field test subjects in each academic classification category did not align themselves along a normal Gaussian distribution. The senior scores were bimodally distributed, while the junior, sophomore and freshmen scores assumed a skewness greatly to the left of the normal distributive pattern thereby precluding formal parametric statistical analysis based on the assumptions of normality. For this reason, non-
parametric analysis of the data was undertaken.

A chi-square analysis of k independent samples was effected to test the following Null Hypothesis ($H_0$).\(^{57}\) The number of sequences or categories of drugs entered by an examinee is independent (and therefore should be equal) of the academic standing that that person has achieved in the University of Illinois, College of Pharmacy. The computed value for $X^2$, with three degrees of freedom, reveals that this hypothesis can be rejected at the 0.1% level of significance, therefore allowing an overall relationship of academic standing to the number of sequences entered.

To confirm exactly where among these four independent groups this relationship existed, a single degree of freedom chi-square analysis was completed. This analysis sought to compare freshmen versus sophomores (A), juniors versus seniors (B), and upper versus lower classmen (C). An orthogonal comparison (part #2 Table X) was prepared to insure a non-biased model for analysis which was free from error in terms of group dependency, based on the comparisons that were made.\(^{58}\)

The following hypotheses were tested using the single degree of freedom analysis (see part #2 Table X):

1) The number of sequences entered by freshmen and sophomore students is not dependent upon the academic background. This hypothesis was rejected at the 1.0% level of significance.
Table X

Chi Square Analysis for the Establishment of Significant Differences between Classes Based on the Number of Sequences Entered

1) Number of Qualitative Sequences Entered (50 Students in each Class):

<table>
<thead>
<tr>
<th></th>
<th>FRESHMAN</th>
<th>SOPHOMORE</th>
<th>JUNIOR</th>
<th>SENIOR</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>obs.</td>
<td>111</td>
<td>159</td>
<td>240</td>
<td>276</td>
<td>786</td>
</tr>
<tr>
<td>expt.</td>
<td>196.5</td>
<td>196.5</td>
<td>196.5</td>
<td>196.5</td>
<td>786</td>
</tr>
</tbody>
</table>

\[
\chi^2 = \sum \frac{(O - E)^2}{E} \quad \text{or} \quad \frac{\sum O^2}{\sum o/n} - \sum O = 86.154 \quad p < .001
\]

2) Single Degree of Freedom \(\chi^2\) Analysis for Comparison of Groups:

<table>
<thead>
<tr>
<th>Orthogonal Comparison</th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman vs. Sophomore (A)</td>
<td>+1</td>
<td>-1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Junior vs. Senior (B)</td>
<td>0</td>
<td>0</td>
<td>+1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>Lower vs. Upper (C)</td>
<td>+1</td>
<td>+1</td>
<td>-1</td>
<td>-1</td>
<td>0</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\text{A x B} & \quad \text{Cross Products} \quad \left\{ \begin{array}{ccc}
0 & 0 & 0 \\
0 & 0 & -1 \\
+1 & -1 & 0
\end{array} \right. \\
\text{B x C} & \quad \text{Row by Row} \\
\text{A x C} & \quad \text{Row by Row}
\end{align*}
\]

<table>
<thead>
<tr>
<th></th>
<th>Freshman vs. Sophomore Total</th>
<th>Junior vs. Senior Total</th>
<th>Lower vs. Upper Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>111</td>
<td>240</td>
<td>270</td>
</tr>
<tr>
<td></td>
<td>159</td>
<td>276</td>
<td>516</td>
</tr>
<tr>
<td></td>
<td>270</td>
<td>516</td>
<td>786</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\chi^2 &= 278.53 - 270 = 8.53 \\
\chi^2 &= 518.51 - 516 = 2.51 \\
\chi^2 &= 862.99 - 786 = 76.99
\end{align*}
\]

\[
\begin{align*}
\text{P} & < .01 \\
\text{non-significant} & \\
\text{P} & << .001
\end{align*}
\]
2) The number of sequences entered by junior and senior students is not dependent upon academic background. This hypothesis was accepted.

3) The number of sequences entered by upper classmen and lower classmen is not dependent upon academic background. This hypothesis was rejected at the 0.1% level of significance.

The conclusions that were reached from this analysis procedure were:

1) that the number of sequences entered by a test subject is dependent upon his academic and experience background

2) that upper classmen enter a greater number of sequences than lower classmen due to differences in academic backgrounds

3) academic backgrounds of students classified as juniors and seniors does not have a significant effect upon the total sequences entered.

The same independent groupings were analyzed to test the significance of the difference for the average depth score per section (as described on page 34) achieved by the examinee was a function of that person's background. Again, non-parametric analysis was undertaken because of the lack of normality exhibited by the data. The Kruskal-Wallis One-Way Analysis of Variance (ANOVA) by Ranks was employed as the final analysis. Table XI illustrates overwhelmingly that the average depth score achieved by an examinee is a function of the academic classification to which he is assigned. Again, it should be noted that as a student's academic classification is advanced, it is generally safe to assume that his overall practical experience has also increased thus provid-
Table XI

Analysis of Scores Resultant from Testing Students at the University of Illinois, College of Pharmacy, October, 1971, Using Kruskal-Wallis One-Way Analysis of Variance

\[
H = \frac{12}{N(N+1)} \sum_{j=1}^{k} \frac{R_j^2}{n_j} - 3(N+1)
\]

\[N = E_n = 200 \quad n = \text{no. of ranks per class (50)}\]
\[k = \text{no. of classes (4)} \quad \therefore \text{df} = k-1 = 3 \quad R = \text{rank sum by class}\]

1) **DISPARITY AMONG ENTIRE GROUP PROVEN BY:**

   \[H = \frac{12}{(200)(201)} \sum \left( \frac{(2498)^2}{50} + \frac{(3471.5)^2}{50} + \frac{(6233)^2}{50} + \frac{(7828.5)^2}{50} \right) - 3(201)\]

   \[H = 104.04 \quad \therefore \text{OVERWHELMLY SIGNIFICANT}\]

2) **DISPARITY AMONG GROUPS PROVEN BY:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A) FRESHMEN versus SOPHOMORE</td>
<td>B) JUNIORS versus SENIORS</td>
</tr>
<tr>
<td>Rf = 2498</td>
<td>Rs = 3471.5</td>
</tr>
<tr>
<td>nF = 50</td>
<td>nS = 50</td>
</tr>
<tr>
<td>H = 131.64 \therefore \text{VERY SIGNIFICANT}</td>
<td>H = 2076.46 \therefore \text{VERY SIGNIFICANT}</td>
</tr>
</tbody>
</table>
ing him with the didactic and practical information necessary to gain increasing scores on the quantitative portion of "A Test for the Measurement of Non-Prescription Drug Information".
CHAPTER V

SUMMARY AND IMPLICATIONS

Summary

An instrument for the comprehensive measurement of knowledge about non-prescription drugs has been developed. This instrument can be used to describe qualitatively and quantitatively, the quantity of information a student has gained concerning drug products used for purposes of self-medication. The qualitative measurement deals specifically with the salient features of package design, dosage form characteristics and identification of related health accessories. The quantitative portions of the test seek to measure one's knowledge in the area of dosing instructions, drug contraindications, toxic results of over use, product ingredients and sources of drugs.

Items for the test had been tested on a group of persons representing a broad range of backgrounds. This tryout testing program allowed the investigator to establish constructs of validity as well as mathematical proofs of reliability through an item analysis procedure. Items selected to make a final composite of the test form adhered to previously established indices of difficulty, discrimination and distractor function.

These items were ordered into an intrinsically programmed testing sequence. This sequence was then adapted to a random-
access teaching machine which allowed the administration of the test on an individualized, self-paced basis. Two scoring mechanisms were designed into the program for the purpose of presenting final test scores.

A field test of "A Test for the Measurement of Non-Prescription Drug Product Information" was administered to two hundred students at the University of Illinois at the Medical Center, College of Pharmacy utilizing the Mark 4 Auto Tutor. The Auto Tutor presented the items of the test on a screen and mediated the responses provided by the student. In this way, the student's progress throughout the testing sequence was dependent upon the student's background and knowledge concerning non-prescription drugs.

An intrinsically programmed presentation of the test via the Mark 4 Auto Tutor presented a number of distinct advantages:

1) It allowed the student to take an examination entirely at his own pace.

2) The student was exposed only to questions which paralleled his performance level thus reducing random-guessing and decreasing test boredom.

3) A final score was made available to the student almost instantaneously thereby resulting in a rapid evaluation of his knowledge and areas of weaknesses.

4) Cheating on the test is minimized due to the individualized testing process. Since the student determines his own level of proficiency, it is unlikely that any student will be exposed to the same questions at the same time.
5) Test administration through a teaching machine like the Auto Tutor provides a uniform set of pre-test directions to all test participants and also provides a mechanism which insures maximum test security.

The scores obtained from the field test at the University of Illinois were analyzed through the use of several statistical techniques. The resultant analysis supported the constructs of validity that were initially established for the test; that is, that scores obtained on the test are a function of didactic and practical experience. Thus, the examination has demonstrated its ability to discriminate test subjects based upon that subject's previous academic or pharmacy practice-oriented background.

Implications

As is the case with any investigation of a research problem, it may be concluded that further investigations of the type described are in order. Evaluative instruments for the measurement of artistic adaptation in the pharmaceutical sciences must be developed in order to measure a student's skills for job performance and career adaptability.

"A Test for the Measurement of Non-Prescription Drug Product Information" offers one such instrument. Although the Auto Tutor test program needs further study, other investigators interested in developing evaluative studies of the pharmacy practice experience are admonished to utilize this test instrument. The instrument and its method of administration and scoring offer the investigator a number of advantages which are not inherent in
standard examination practices. Areas in which these advantages may be exhibited may be

1) utilizing this testing instrument and/or procedure in standard board examinations in pharmacy

2) using this instrument to provide practitioners with an instantaneous evaluation of their knowledge in the area of non-prescription drugs.

The results of the field testing program also show some interesting implications.

Greater emphasis should be placed upon introducing the subject of non-prescription drugs early in the student's academic and practical curriculum. Since the pharmacy practitioner interfaces daily with the lay-public in the area of non-prescription drugs, it is imperative that the student possesses substantive knowledge of this type as early as possible in his student practice years.

Knowledge about non-prescription drugs on a qualitative and quantitative basis should be fortified in the practice environment. The student should be able to utilize his intellectual capabilities in this area of drugs by working closely with the self-medicating patient in terms of selecting the drug product and providing the patient with the necessary instructions for proper and effective use.
APPENDIX A
April, 1971

The test you are about to take is part of a research project in education supported by the United States Vitamin Pharmaceutical Corporation.

* * * *

DO NOT OPEN EXAMINATION UNTIL EXAMINER ADVISES YOU TO BEGIN

* * * *
(1) Liquiprin is sold in

1. clear plastic vial
2. amber wide mouth bottle
3. plastic dropper bottle
4. plastic pint bottle

(2) The manufacturer of Bufferin is

1. Eli Lilly and Company
2. Glenbrook Labs
3. Bristol-Myers
4. Whitehall Laboratories
5. none of these

(3) Smith, Kline and French Labs manufacture

1. Cope
2. Ecotrin
3. Tempra
4. Stanback

(4) Upjohn's PAC Compound is displayed in

1. brown and white box
2. green and yellow plastic bottle
3. white black and grey box
4. red and white box
(1) The most frequent dosage form in which antitussives are prepared is

1. capsule
2. tablet
3. gum
4. syrup
5. none of these

(2) A trademark consisting of a spoon into which syrup is being poured is characteristic of

1. Coricidin Cough Formula
2. Romilar CF
3. Robitussin
4. Vicks Formula 44

(3) A cluster of grapes can be found on a package of

1. Fletcher's Children's Cough Control
2. Coldene
3. Dorcol
4. Rem
5. none of these

(4) Which cough syrup is a "Schedule V or Class X" narcotic

1. Cheracol-D
2. Endotussin NN
3. Cosadein
4. Robitussin DM
(1) A cobalt-blue glass bottle is used to package the liquid dosage form of

1. Maalox
2. Riopan
3. Titralac
4. Phillip's Milk of Magnesia
5. Mylanta

(2) BiSoDol Powder is packaged in

1. a green wide mouth glass bottle with yellow plastic cap
2. a yellow and blue metal box with a screw top
3. a clear plastic vial with a red label
4. none of these

(3) Aludrox, Amphojel and Phosphaljel are manufactured by

1. Rorer
2. Warner-Chilcott
3. Stuart
4. Riker
5. none of these

(4) A round cardboard box with a metal lid is used to package

1. Maalox #2 tablets
2. Syntrogel tablets
3. Tums
4. Requa's Charcoal Tablets
(1) Surbex, a high-potency vitamin manufactured by Abbott Laboratories can be identified by

1. the green and black capsules
2. the orange soft gelatine round capsules
3. the yellow and green capsules
4. the orange oblong coated tablets
5. the bright yellow oblong coated tablets

(2) The "Vi-Sol" line of vitamins, manufactured by Mead Johnson Labs is specifically designed for

1. teenagers
2. adults
3. infants and young children
4. geriatric patients

(3) "Filmtabs" is a trademarked coating process used on vitamin tablets manufactured by

1. Eli Lilly and Company
2. E. R. Squibb
3. Abbott Laboratories
4. Miles Laboratories
5. none of these

(4) Gevral, a vitamin preparation manufactured by Lederle Laboratories can easily be identified by its package because

1. the bright red plastic bottle is an evident trademark
2. the attractive "apothecary" jar appearance of the bottle cannot be mistaken
3. the brown and white package is distinctive of Lederle products
4. none of these
(1) "The Chocolate Laxative" is

1. NR Tablets
2. Dulcolax
3. Exlax
4. Carter's Pills
5. all of these

(2) The following suppository laxative products are available OTC

1. Metamucil
2. Ceo-Two
3. Doximate
4. Siblin
5. Cellothyl

(3) Dulcolax packages can easily be recognized by their distinctive

1. yellow and green color
2. blue and red color
3. green and white color
4. orange and brown color
5. none of these

(4) Feen A Mint is available in the following dosage form

1. chewing gum
2. mint flavored chewable tablets
3. syrup
4. capsules
5. none of these
(1) A plastic white bottle labeled with a black, white and gray label is probably

1. Kaopectate
2. KaoCon
3. Donnagel
4. Parepectolin
5. none of these

(2) The following products are Class X Narcotics

1. Quintess
2. Parepectolin
3. Pargel
4. Donnagel
5. none of these

(3) The following product should be stored in the refrigerator

1. Lytren
2. Quintess
3. Resion
4. Lactinex
5. none of these

(4) A can serves as the package for a quantity of

1. Bacid
2. Lytren
3. Paocin
4. Mul-Sed
(1) Coryban D capsules are colored similarly to capsules of

1. Achromycin V
2. Panalba
3. Lincocin
4. none of these

(2) The red and white package which indicates it contains a cold remedy is probably

1. Coryban-D
2. Coricidin
3. Cheracol
4. Hovahistine
5. none of these

(3) The package which illustrates a child and a speckled tablet is

1. Coricidin-D
2. Dristan
3. Coricidin
4. Coricidin Demilets
5. none of these

(4) The package with the logo "symptomatic relief of colds, hayfever, sinus congestion" contains the product known as

1. Nyquil
2. Cheracol
3. Dristan
4. none of these
STOP******STOP******STOP******STOP******

DO NOT GO ANY FURTHER!!!!

DO NOT TURN THE PAGE!!!!

YOU WILL BE INSTRUCTED TO CONTINUE ONLY UPON THE EXAMINER'S REQUEST
(1) The trademark seal found on Empirin Compound resembles

1. a fizzling tablet
2. a red, black and white triangle
3. a unicorn
4. red and white square

(2) The background color of the display box for a bottle of Anacin is

1. yellow
2. blue
3. brown
4. none of these

(3) Tylenol is available in the following dosage forms

1. syrup
2. tablets
3. concentrated liquid
4. all of these
5. 2 & 3

(4) The familiar slogan appearing on the Excedrin package states that this product

1. relieves everyday headaches fast
2. specifically recommended for children
3. is the extra-strength pain reliever
4. none of these
(1) The products categorized as analgesics are used for the relief of

   1. bronchitis
   2. pain
   3. psoriasis
   4. none of these

(2) Chemically, the majority of OTC analgesics are classed as

   1. salicylates
   2. para aminophenols
   3. pyrazolones
   4. all of these
   5. none of these

(3) The most popular dosage form for OTC analgesics is

   1. tablet
   2. parenteral
   3. suppository
   4. syrup

(4) The recommended adult dosage for minor pains using a five grain aspirin is

   1. two tablets every four hours
   2. one tablet twice a day (A.M. & P.M.)
   3. four tablets in the morning
   4. none of these

(5) A product such as Empirin Compound specifies that not more than what number of tablets should be taken daily?

   1. six
   2. one
   3. twelve
   4. three
(6) Analgesics are recommended for the following types of pain

1. headaches caused by tension
2. headaches caused by sinusitis
3. headaches caused by eye-strain
4. none of these
5. all of these

(7) Aspirin is not recommended for which one(s) of the following types of pain

1. severe cancer pain
2. smooth muscle spasm
3. toothache
4. 1 & 2
5. 1 & 3

(8) The antipyretic effect produced by aspirin is useful in

1. lowering blood pressure which causes headaches
2. relieving headaches caused by excessively dilated cerebral vessels
3. increasing blood flow in the extremities
4. increasing the pain threshold
5. lowering body temperature in cases of fever

(9) Aspirin and aspirin compounds that are available OTC are effective in relieving pain associated with

1. broken bones
2. rheumatoid arthritis
3. tonselectomy
4. appendicitis

(10) A method for administering an analgesic to an infant may be

1. by crushing a tablet and mixing it with water
2. by putting the tablet under the infant's tongue
3. by inserting a rectal suppository
4. none of these
(11) The use of analgesics available OTC is contraindicated in the following disease

1. congestive heart failure
2. cervical carcinoma
3. kidney dysfunction
4. otitis media

(12) Caffeine is a common ingredient found in OTC analgesic compound because

1. it prevents people from drinking coffee while they are taking these drugs
2. people usually need a slight stimulant when they have pain
3. the caffeine increases the analgesic potency of the analgesics
4. caffeine is an effective analgesic

(13) One of the side effects which may result from prolonged use of a product such as Alka-Seltzer is

1. agranulocytosis
2. tingling of the extremities
3. systemic alkalosis
4. headaches

(14) A common substitute recommended for patients who are allergic to aspirin is

1. acetaminophen
2. phenacetin
3. aminopyrine
4. none of these

(15) Products such as Tylenol, Tempra and Nebs contain as their principal ingredient

1. acetanilid
2. propoxyphene hydrochloride
3. acetylsalicylic acid
4. acetaminophen
(16) The recommended dosage for Liquiprin is

1. two tablets every four hours
2. 0.6cc every four hours
3. one teaspoonful every four hours
4. insert one rectally at bedtime

(17) New Improved Liquiprin has as its principal ingredient

1. acetaminophen
2. acetylsalicylic acid
3. salicylamide
4. phenacetin

(18) For maximum stability of the ingredients, analgesic products should be stored in

1. plastic vials with lid tightly closed
2. cellophane wrappers placed in a tightly sealed box
3. amber bottles in a cool, dry area
4. amber bottles in the bathroom medicine chest far out of the reach of children

(19) St. Joseph Asprin for children is

1. orange flavored
2. grape flavored
3. cherry flavored
4. lemon-lime flavored

(20) A.S.A. Enseals (Lilly) are

1. pink and grey capsules
2. white scored tablets
3. red enteric coated tablets
4. pink capsules
(21) An OTC analgesic product especially marketed for the relief of menstrual pain is

1. Trigesic
2. Midol
3. Ecotrin
4. Aspergum

(22) The following product contains a buffering agent in addition to an analgesic

1. Measurin
2. Sal-Fayne
3. Femicin
4. Ascriptin

(23) A common OTC combination product for analgesic effect usually contains

1. propoxyphene hydrochloride and aspirin
2. aspirin, caffeine and phenacetin
3. meperidine and promethazine
4. aspirin, methylcellulose and carbopol

(24) Stanback is available in the following dosage forms

1. capsules and tablets
2. tablets and powders
3. powders
4. syrup and tablets
5. none of these

(25) Methapyrilene Fumarate is contained in

1. Anacin
2. Excedrin
3. Cope
4. Tylenol
5. none of these
(1) Cheracol-D (Upjohn) is flavored with
   1. cherry
   2. orange
   3. licorice
   4. lemon

(2) A black and yellow label marks which OTC antitussive product
   1. Robitussin
   2. Histadyl EC
   3. Coryban-D
   4. Vick's Formula 44

(3) Trind cough syrup is manufactured by
   1. Abbott Laboratories
   2. Endo Laboratories
   3. Schering Corporation
   4. Mead Johnson and Company
   5. none of these

(4) Advertised as the "8 hour Cough Formula" is
   1. Naldetuss
   2. Thorexin
   3. Anahist
   4. Pertussin
   5. Vicks Cough Syrup
(1) Antitussives are indicated for

1. harsh throat
2. chronic bronchitis
3. mild non persistent cough
4. emphysema
5. none of these

(2) Antitussive activity is based on

1. suppression of cough reflex in the medulla
2. soothing effect on irritated bronchial tissue
3. central nervous system depression
4. none of these

(3) Which one of the following ingredients is used in the majority of antitussive products

1. phenylephrine hydrochloride
2. phenylpropanolamine hydrochloride
3. ammonium chloride
4. glycerclyl guaiacolate
5. none of these

(4) Codeine phosphate is an effective antitussive equal in potency to

1. acetylsalicylic acid
2. dextromethorphan hydrobromide
3. chlorpheniramine maleate
4. meperidine hydrochloride

(5) Most cough syrups usually contain

1. an antitussive agent
2. an antihistamine
3. an adrenergic agent
4. an expectorant agent
5. all of these
(6) The usual recommended dosage range for a cough syrup is

1. a tablespoonful at bedtime
2. one teaspoonful every three to four hours
3. two teaspoonfuls every six hours
4. one half teaspoonful every two hours

(7) The routine use of cough syrups at the recommended dose is contraindicated in conditions of

1. acute cough accompanied by bloody sputum
2. operating machinery or driving an automobile
3. hyperthyroidism
4. high blood pressure
5. I don't know

(8) Ammonium chloride, a common ingredient in cough syrups, is used for its

1. antihistaminic properties
2. antitussive properties
3. expectorant properties
4. sedative effect

(9) Robitussin PE contains a sympathomimetic agent which is

1. ephedrine hydrochloride
2. phenylpropanolamine hydrochloride
3. phenylephrine hydrochloride
4. epinephrine bitartrate
5. none of these

(10) Side effects associated with excessive use of cough syrups usually include

1. muscular aches
2. drowsiness
3. vomiting
4. ringing of the ears
The ingredients contained in cough syrups are especially contraindicated in diabetes because

1. the syrups used as vehicles are high in calories
2. antihistamines increase the cellular production of glucose
3. expectorants reduce the amount of available insulin
4. these ingredients block the production of insulin in the pancreas
5. none of these

The usual content of glycercyl guaiacolate per teaspoonful of cough syrup is

1. 55mg/5cc
2. 250mg/5cc
3. 100mg/5cc
4. 25mg/5cc

Which of the following plant extracts are sometimes found in cough syrups and are used as expectorants

1. squill
2. ipecac
3. eucalyptus
4. 2 & 3
5. all of these

Alcohol is frequently added to the vehicle because

1. it increases the activity of the ingredients found in the cough syrup
2. it is used as a solvent for drugs in the manufacturing process
3. it is used as a flavoring agent
4. none of these

Dextromethorphan is a synthetic chemical derived from

1. reserpine
2. morphine
3. menthol
4. chloroform
(16) Adrenergic agents are useful ingredients in cough syrups for alleviating the symptoms of

1. ear aches
2. sore throat
3. nasal congestion
4. all of these

(17) Phenyltoloxamine Citrate is contained in

1. Pertussin 8 Hour
2. Romilar CF
3. Naldetuss
4. Triaminicol

(18) Which one(s) of the following cough syrups are specifically recommended for use by children

1. Dorcol
2. St. Joseph's
3. Fletcher's
4. 1 & 2
5. all of these

(19) The initials DM as used in the name Robitussin DM stand for

1. an antitussive agent
2. an expectorant ingredient
3. an antihistamine ingredient
4. a narcotic ingredient
(1) Alka Seltzer may easily be identified by

1. its oblong narrow package
2. the green and yellow lettering on the package
3. the picture of the fizzling tablet on the package
4. all of these

(2) Pepto Bismol liquid is packaged and displayed in

1. a cobalt blue bottle with a black top
2. a green tinted plastic bottle
3. a clear glass bottle packaged in a white and red box
4. a triangular shaped bottle with a black cap
5. none of these

(3) A double-layered white and yellow tablet probably represents

1. Maalox #1
2. Titralac
3. DiGel
4. Tums
5. Rolaids

(4) Chewable antacid preparations are usually flavored with

1. cherry
2. peppermint
3. cinnamon
4. lemon-lime
5. plain flavor
(1) The use of antacids is indicated for

1. relieving hypermotility of smooth muscle in the small intestine
2. vomiting
3. neutralizing excess stomach acid
4. neutralizing the entire contents of the stomach
5. relieving pain associated with bowel obstruction

(2) Antacids are especially useful as conjunctive remedies in

1. hiatus hernia
2. angina pectoris
3. peptic ulcer
4. all of these

(3) The effectiveness of an antacid in bringing relief is dependent on its ability to

1. increase the pH of the stomach contents
2. decrease the pH of the stomach contents
3. neutralize excess stomach acid without changing the pH of the stomach contents
4. none of these

(4) One of the by-products of the chemical reaction occurring in the stomach after the ingestion of an antacid is

1. oxygen
2. carbon dioxide
3. carbon monoxide
4. carbon trioxide
5. all of these

(5) The relief of excess gas or "heartburn" can usually be obtained by a few doses of

1. calcium carbonate
2. magnesium trisilicate
3. sodium bicarbonate
4. activated charcoal
5. all of these
(6) One of the most recent therapeutic uses of antacids, such as Maalox liquid, is in the treatment of

1. gout
2. decubitis ulcer
3. pancreatitis
4. colonic carcinoma
5. none of these

(7) The recommended adult dosage range of liquid antacid preparation is

1. one teaspoonful between meals
2. two tablespoonfuls before meals
3. two tablespoonfuls after meals
4. half cup mixed with a half cup of milk three times a day

(8) Excessive use of certain antacids may result in

1. systemic alkalosis
2. hardening of the arteries
3. increased gastric motility
4. stomach-wall damage

(9) Antacids should not be coadministered with

1. soft gelatine capsules
2. film coated tablets
3. enteric coated tablets
4. hard gelatine capsules

(10) The use of antacids is contraindicated in patients suffering from

1. achlorhydria
2. insomnia
3. tinnitus
4. gastritis
(11) Liquid antacid preparations are generally

1. insoluble in water
2. soluble in water
3. soluble in fats
4. insoluble in fats
5. none of these

(12) Hydroxides, a common active ingredient in antacid preparations, are usually compounds containing

1. divalent and trivalent metals
2. inert gases
3. monovalent metals
4. all of these
5. none of these

(13) The carbonates usually contained in antacid preparations are compounds containing

1. divalent and trivalent metals
2. inert gases
3. monovalent metals
4. all of these
5. none of these

(14) Maalox contains as its principal ingredients

1. Sodium Hydroxide and Calcium Hydroxide
2. Carbonates of Aluminum and Magnesium
3. Hydroxides of Aluminum and Magnesium
4. Sodium Bicarbonate and Aluminum Hydroxide

(15) Patients who have been advised to decrease their dietary intake of sodium should be instructed not to use large amounts of

1. Alka-Seltzer
2. DiGel
3. Rolaids
4. none of these
5. all of these
(16) In addition to the antacids it contains, Mylanta also contains

1. belladonna alkaloids
2. propantheline hydrobromide
3. dihydroxyaluminumamino acetate
4. simethicone
5. polysorbate 80

(17) Gelusil-Lac is different from Gelusil in that it contains

1. belladonna alkaloids
2. a greater amount of calcium carbonate
3. high protein and low fat milk solids
4. vitamin and mineral nutrients
5. all of these

(18) Glycine is found as an active ingredient in tablets of

1. Rolaids
2. WinGel
3. Amitone
4. Tums
5. none of these

(19) The amino acid, glycine, \((\text{NH}_2\text{CH}_2\text{COOH})\) is thought to be an effective agent in conjunction with other antacids because

1. amino acids relieve stomach pains caused by ulcers
2. glycine is an effective coating agent
3. glycine may bind \(H^+\) and neutralize stomach acid

(20) The difference between Maalox #1 and Maalox #2 is

1. 0.4 Gm. combined hydroxides of aluminum and magnesium
2. 0.4 Gm. combined carbonates of sodium and calcium
3. 0.8 Gm. combined hydroxides of sodium and calcium
4. none of these
(1) "One-A-Day" is a trademarked name for an OTC

1. antacid
2. vitamin
3. antihistamine
4. deodorant

(2) Homicebrin, a multiple vitamin manufactured by Eli Lilly and Company can be recognized by

1. its vivid yellow coated tablets with the Lilly Marking
2. the yellowish emulsion designed for teaspoonful dosing
3. the oblong brown soft gelatine capsule with the Lilly Marking
4. a clear yellow liquid designed for teaspoonful dosing

(3) A bright yellow and white box probably is the outer container for a bottle of

1. Natalins
2. Myadec
3. Clusivol
4. Unicaps
5. none of these

(4) Aquasol A and Aquasol E are vitamin preparations manufactured by

1. Mead Johnson
2. Ayerst Laboratories
3. Abbott Laboratories
4. USV Pharmaceutical Corp.
5. none of these
(1) Vitamins are indicated for a number of therapeutic uses which may include

1. prevention and treatment of hemorrhage
2. prevention and treatment of night blindness
3. treatment of neuritis and polyneuritis
4. all of these
5. none of these

(2) Vitamin A can be made synthetically or obtained from which of the following natural sources

1. pork liver oils
2. fish liver oils
3. plant resins
4. beef by-products
5. none of these

(3) Vitamin A is to Vitamin C as

1. Vitamin C is to Vitamin B₁
2. Vitamin D is to Vitamin K
3. Vitamin B₆ is to Vitamin B₁₂
4. Vitamin D is to Vitamin B₂
5. none of these

(4) Vitamin B₁ is synonymous with

1. nicotinic acid
2. ascorbic acid
3. thiamin
4. niacin
5. riboflavin

(5) A vitamin used in the treatment of pernicious anemia is

1. riboflavin
2. tocopherol
3. cyanocobalamin
4. ergocalciferol
5. none of these
(6) Vitamin D is used in the treatment of

1. hypoparathyroidism  
2. lupus erythmatoses  
3. diabetes  
4. myocardial infarction  
5. none of these

(7) Vitamin K is used to antagonize the effect of

1. heparin  
2. sodium warfarin  
3. insulin  
4. none of these  
5. hydrocortisone

(8) The minimum adult daily requirement of thiamin is approximately

1. one to five milligrams  
2. fifteen to twenty-five milligrams  
3. one hundred milligrams  
4. fifty to seventy-five milligrams  
5. none of these

(9) L-Dopa may be antagonized by

1. Thiamine  
2. ascorbic acid  
3. pyridoxine  
4. rutin  
5. none of these

(10) The most effective route for the administration of Vitamin $B_{12}$ is

1. orally  
2. rectally  
3. topically  
4. parenteral  
5. none of these
(11) Patients with liver diseases may be deficient in the following vitamins

1. fat soluble vitamins
2. water soluble vitamins
3. both water soluble and fat soluble vitamins
4. I don't know

(12) Vitamin products in the pharmacy are most sensitive to

1. heat
2. light
3. moisture
4. all of these
5. none of these

(13) Folic acid is not found in OTC vitamins because it

1. reacts with other vitamins to render it inactive
2. was found too ineffective in combination with other vitamins
3. has a bitter taste which is difficult to mask
4. masks the symptoms of Vitamin B₁₂ deficiency
5. none of these

(14) Chronic toxic manifestations can occur after the excess ingestion of

1. Vitamin B₂
2. Vitamin C
3. Vitamin B₆
4. Vitamin A
5. none of these
(1) "Fleet" is a name commonly associated with

1. cough syrups
2. laxatives
3. analgesics
4. cold remedies
5. none of these

(2) Colace, a laxative product made by Mead Johnson Labs is available as

1. a red coated tablet
2. a yellow hard gelatin capsule
3. a dark brown liquid
4. a red liquid
5. all of these
6. I don't know

(3) The distinctive brown and white label can be found on a bottle of

1. Senokot
2. Cas-Evac
3. Kondremul
4. Gentlax
5. None of these

(4) Caroid and Bile Salts manufactured by Breon Labs also has, as part of the product name, the word

1. cascara
2. senna
3. phenolphthalein
4. psyllium
5. none of these
(1) The pharmacological activity of OTC laxative drug products usually occurs in

1. the stomach
2. the rectum
3. the duodenum
4. the colon
5. none of these

(2) Stimulant laxatives are thought to exert their action by

1. stimulating the anal canal to pass fecal material
2. activating the nerve plexus in the intestinal muscle and thereby causing a peristaltic wave
3. stimulating nerve cells in the mucosal lining of the stomach and thereby causing an elimination of food substances from the stomach
4. increasing the fluidity of the stool in the colon
5. none of these

(3) A good example of a stimulant laxative available OTC is

1. Ex-Lax
2. Metamucil
3. Cellothyl
4. Surfak
5. none of these

(4) Phenolphthalein is classified as a

1. bulk laxative
2. stimulant laxative
3. saline laxative
4. emollient laxative
5. none of these

(5) Castor oil, a commonly used cathartic is classified as a

1. stimulant laxative
2. emollient laxative
3. saline laxative
4. bulk laxative
(6) Bulk laxatives usually have as their active ingredients

1. anthraquinone
2. phenolphthalein
3. Danthron
4. natural gums
5. none of these

(7) The use of laxatives is especially contraindicated in

1. bleeding ulcers
2. appendicitis
3. severe hypertension
4. hernia
5. none of these

(8) Patients using Dulcolax tablets should be instructed to take the drug

1. after meals
2. at bedtime
3. before meals
4. after juice in the morning
5. none of these

(9) Emollient cathartics such as mineral oil can be potentially dangerous in that they may cause

1. electrolyte depletion
2. lipoid pneumonia
3. obstructed bowels
4. colitis
5. none of these

(10) Continued use of cathartics is contraindicated because

1. physiological dependence may occur
2. after use of cathartics, the bowel does not function properly
3. after use of cathartics absorption of food is impaired
4. rebound constipation may occur
5. none of these
A good example of a saline cathartic is

1. Phospho Soda
2. Sal Hepatica
3. Phillips Milk of Magnesia
4. 1 & 2
5. all of these

Saline cathartics are believed to cause laxation by

1. increasing the total nondigestible bulk of the colon and thereby causing excretion
2. osmotic effects which cause an increase in water volume in the intestine
3. 1 & 2
4. none of these

Fecal softeners are useful laxating agents especially in cases of

1. pregnancy
2. hernia
3. hypertension
4. all of these
5. none of these

Colace capsules contain as their primary ingredient

1. phenolphthalein
2. oxyphenisatin
3. podophyllin
4. dioctyl sodium sulfosuccinate
5. danthron
6. I don't know

Peri-Colace differs from Colace in that it also contains

1. casanthranol
2. cascara
3. danthron
4. none of these
(16) A product such as Peri-Colace is especially useful in cases where

1. a stool softening and stimulating effect is required
2. immediate laxation must be produced
3. danthron is contraindicated
4. none of these

(17) The usual adult dose of phenolphthalein to be taken for laxation is

1. 60-100 mg.
2. 250-500 mg.
3. 15-30 mg.
4. 1 gm.
5. none of these

(18) The administration of laxative products containing danthron may result in

1. hyperpnea
2. discolored feces
3. discolored urine
4. jaundice
5. all of the above
6. I don't know
(1) A pink plastic bottle probably contains

1. Kaopectate
2. KaoCon
3. Donnagel
4. Parepectolin
5. none of these

(2) Which one of the following products is pleasantly flavored with banana oil

1. Diamagma
2. Donnagel PG
3. Kaopectate
4. Donnagel
5. Pepto Bismal

(3) Bacid, a product available from USV Pharmaceutical Corporation, can easily be recognized by

1. the green suspension
2. the white mint flavored suspension
3. the orange capsules
4. the yellow powder
5. none of these

(4) Requa Corporation is a manufacturer of

1. charcoal tablets
2. pectin suspensions
3. kaolin suspensions
4. 2 & 3
5. none of these.
(1) The onset of the condition known as diarrhea may be attributed to

1. infectious origin
2. emotional distress
3. food poisoning
4. ulcerative colitis
5. all of these

(2) Physiologically, diarrhea can be potentially dangerous because

1. loss of electrolytes is evident
2. increased bowel movements can damage the anal sphincter
3. it is frequently a cause of hypertension
4. food stuffs can not be absorbed because of their rapid excretion
5. none of these

(3) When recommending the use of OTC diarrhea drug products, it is important to tell the patient

1. not to take excess amounts of these since they can cause toxic manifestations
2. not to take the products at bedtime because constipation can result
3. not to take the product for more than a few days if the cause of the diarrhea is unknown
4. to eat plenty of fruit
5. not to drink water
6. I don't know

(4) Most OTC diarrhea remedies contain as their active ingredients

1. kaolin
2. bismuth subsalicylate
3. magnesium hydroxide
4. bismuth aluminate
5. magnesium sulfate
6. I don't know
(5) Pectin, a very common ingredient in diarrhea remedies, is not found in the formulation of

1. Donnagel
2. Quintess
3. Pargel
4. KaoCon
5. none of these

(6) The usual adult dose of Donnagel is

1. 15 cc. every hour as needed
2. 30 cc. every four hours
3. 30 cc. daily
4. 30 cc. after every bowel movement
5. 5 cc. after every bowel movement
6. I don't know

(7) Pectin is chemically classified as a

1. conjugated ester
2. protein
3. alkaloid
4. carbohydrate
5. none of these

(8) Lytren, a product available from Mead Johnson, can be especially useful in cases of diarrhea because

1. it contains nutrients and ions which replenish the losses after diarrhea
2. it contains kaolin and pectin which absorb the excess fluids in the bowels
3. it contains tinture of opium which is useful in decreasing gastric motility
4. it contains paregoric which is useful in decreasing gastric motility
5. I don't know
(9) Restoring intestinal bacterial flora can be accomplished by recommending the following OTC products

1. Bacid
2. Lytren
3. KaoCon
4. Pargel
5. none of these

(10) Lactinex contains as its principle ingredient

1. hyoscyamine sulfate
2. activated attapulgite
3. alumina gel
4. uronic acid
5. none of these

(11) When recommending the use of a product such as Bacid, the pharmacist should always caution the patient

1. not to ingest this product while driving or operating machinery
2. not to ingest this product along with hot drinks such as coffee or tea
3. not to expose themselves to bright sunlight
4. not to engage in vigorous exercise
5. all of these

(12) Lactobacillus acidophilus is the principle ingredient of

1. Kalpec
2. Kaoresin
3. Bacid
4. Resion
5. Maltsupex
6. I don't know
(13) In addition to the ingredients found in Donnagel, the product Donnagel PG also contains

1. powdered opium
2. paregoric
3. codeine sulfate
4. tincture of opium
5. none of these

(14) NeoCultol, a diarrhea remedy available from USV Pharmaceutical Company, uses the following dosage form for administration

1. parenteral
2. mineral oil jelly
3. cherry flavored suspension
4. banana flavored emulsion
5. none of these

(15) NeoCultol is a useful agent in the treatment of diarrhea because it

1. has ingredients which are used for their coating effect
2. has ingredients which have adsorbent value
3. has ingredients which restore the bacteria levels in the intestinal flora
4. has ingredients which are useful detoxifying agents
5. none of these
(1) A bright red, white and blue package is the outer box for a bottle of

1. Dristan
2. Sinutabs
3. Contac
4. Allerest
5. none of these

(2) "The twelve hour action capsules" from those listed below are probably

1. Coryban-D
2. Coricidin-D
3. Sinutabs
4. Contac
5. none of these

(3) Large oblong yellow tablets probably represent the dosage form of

1. Triaminicin
2. Clistin-D
3. Pyroxate
4. Nistadyl
5. none of these

(4) The OTC cold remedy available from Upjohn Company, Pyroxate, can be identified by

1. the black and yellow capsule
2. the red candy coated tablet
3. the oblong yellow tablet
4. the two tone blue capsules
5. none of these
(1) The use of OTC Cold Remedies may be termed as

1. symptomatic treatment
2. curative treatment
3. restorative treatment
4. worthless
5. none of these

(2) A common adrenergic agent found in cold remedies is

1. chlorpheniramine maleate
2. phenylpropanolamine hydrochloride
3. pyrilamine maleate
4. aspirin
5. none of these

(3) Instructions accompanying an OTC cold remedy should include the following warning

1. do not take this product with alcoholic beverages
2. do not take this product while driving or operating machinery
3. do not take this product if you have hypertension
4. 1 & 2
5. all of these

(4) Diseases in which cold remedies are specifically contraindicated include

1. coronary thrombosis
2. hyperthyroidism
3. ulcerative colitis
4. tinea cruris
5. none of these

(5) Methpyrilamine Fumarate, an ingredient in Allerest is pharmacologically classified as a

1. antihistamine
2. analgesic
3. antibiotic
4. none of these
5. adrenergic
(6) In addition to the adrenergic and antihistaminic agents contained in Contac, that product also contains

1. aluminum hydroxide
2. ephedrine sulfate
3. phenindamine tartrate
4. belladonna alkaloids
5. none of these

(7) Contac is one of the cold remedies which is specifically contraindicated in cases of

1. seborrhea
2. hepatitis
3. glaucoma
4. nephritis
5. none of these

(8) Sinutabs are said to be useful in sinus headaches because they contain

1. acetaminophen and phenacetin
2. acetaminophen and caffeine
3. aspirin and phenacetin
4. salicylamide and caffeine
5. none of these

(9) The usual adult dose of phenylpropanolamine contained in OTC cold remedies is

1. 10 mg. - 20 mg.
2. 25 mg. - 50 mg.
3. 2 mg. - 5 mg.
4. 500 mg.
5. none of these

(10) When present in the formulation, OTC cold remedies contain the following amounts of chlorpheniramine maleate

1. 1 mg. - 4 mg.
2. 10 mg. - 25 mg.
3. not cleared for use in OTC products
4. 50 mg.
5. none of these
(11) Inhalants and nasal sprays may not always be effective decongestants because

1. they are topically inactive
2. the distribution of the drug is poor because of the thick mucous blanket in the naso-pharyngeal areas
3. the onset time is very long because these drugs are not absorbed in nasal tissues
4. the drugs are readily decomposed and rendered inactive
5. none of these

(12) Nasal congestion may easily be described as

1. mucosal membrane swelling
2. excess mucosal drainage
3. candidal infection
4. respiratory defect
5. none of these

(13) Overdosing of OTC cold remedies may cause

1. nervousness, restlessness
2. hyperthyroidism
3. cardiac arrest
4. diabetes
5. none of these

(14) Belladonna alkaloids are useful in the symptomatic relief of

1. runny nose
2. sinus headaches
3. respiratory congestion
4. sneezing
5. none of these

(15) Urinary retention and dryness of the mouth may occur after the administration of a cold remedy trademarked as

1. Histadyl
2. Contac
3. Dristan
4. Triaminicin
5. none of these
STOP******STOP******STOP******STOP******

DO NOT GO ANY FURTHER!!!!

DO NOT TURN THE PAGE!!!!

YOU WILL BE INSTRUCTED TO CONTINUE ONLY UPON THE EXAMINER'S REQUEST
(1) A lubricant which should not be recommended for use on natural rubber products should be

1. Vaseline
2. KY Jelly
3. Castor Oil
4. Acacia Mucilage
5. Water
6. I don't know

(2) The usual amount of liquid for a grade-school child's enema is

1. one half ounce
2. two ounces
3. three ounces
4. four ounces

(3) A rectal thermometer reading will usually differ from an oral thermometer reading on the same individual by

1. one degree higher (rectal)
2. two degrees higher (rectal)
3. one degree higher (oral)
4. two degrees higher (oral)
5. no measurable difference
6. I don't know

(4) When advising a patient about the cleansing of a fever thermometer, the patient should be told to wash the instrument in

1. a 25% solution of Zephiran
2. a warm soapy solution of water
3. a 5% solution of iodine
4. vigorously boiling water for 30 seconds
5. I don't know

(5) The use of a moist towel in conjunction with a heating pad is not usually recommended because

1. the heat from the pad is sufficient
2. there is danger from electrical shock
3. the effect of moist heat is questionable
4. steam may be produced and blister the skin
(6) It is usually recommended that feminine syringes be cleaned with

1. a 2% solution of benzalkonium chloride
2. a warm water bath containing a mild soap
3. a 0.5% solution of iodine
4. plain hot water

(7) The volumetric capacity of a combination bottle syringe is usually

1. one quart
2. three pints
3. two quarts
4. one pint

(8) A Birmingham Douche is used for

1. feminine hygiene
2. rectal cleansing
3. nasal flushing
4. all of these

(9) The use of a breast pump is recommended

1. to relieve the pain of breast engorgement
2. to begin the flow of milk prior to infant feeding
3. to circulate air through mammary tissues after infant feeding
4. to induce flow of lactating hormone to the breasts

(10) When recommending the use of a Hydrocollator, the patient must be advised

1. not to allow the pack to become too hot
2. that the pack should be boiled and then wrapped with a quantity of moist towels
3. to allow the pack to exert its own heat at room temperature
4. none of these
(11) A common household ingredient which, when properly diluted, may be used as a douching solution is

1. Baking Soda
2. Salt
3. Vinegar
4. Sugar
5. all of these

(12) The recommended dose of Massengill Powder for use in douching is

1. one heaping teaspoonful in a quart of warm water
2. one tablespoonful in a quart of warm water
3. one ounce in a quart of warm water
4. one heaping teaspoonful in a pint of warm water

(13) Too frequent use of douches may cause

1. irritation and damage to vaginal tissues
2. upset of the normal vaginal flora
3. probable change of the normal pH of the vagina
4. all of these
5. I don't know

(14) The choice of a proper lubricating agent for use on rubber products is important because

1. some lubricants have a foul odor
2. there may be a chemical reaction between the lubricant and the rubber
3. liquid lubricants are difficult to use and the patient should be advised of this
4. the use of lubricants is only indicated for certain products
5. none of these
APPENDIX B
A TEST FOR THE MEASUREMENT OF NON-PRESCRIPTION DRUG PRODUCT INFORMATION

by

Henri R. Manasse

and

Robert G. Mrtek, Ph.D

©1971, Henri R. Manasse and Robert G. Mrtek
University of Illinois College of Pharmacy
Chicago, Illinois

Please press Button "A" to continue.
The development of this instrument, which will be used for subsequent studies in educational research, has been granted under the support of the United States Vitamin Pharmaceutical Corporation, Tuckahoe, New York. The authors acknowledge the generosity of the USV Corporation in supporting the development of this study.

The authors also wish to recognize the assistance of many individuals, without whom, realization of this project would not have been possible. In particular, Dr. Raynard Dooley of Loyola University School of Education, and Marilyn Williams of Sargent-Welch Scientific Company of Skokie, Illinois have been generous with their time and technical assistance in this study. A note of appreciation is also extended to Marsha Mrtek for her perserverance in the preparation of the type-written manuscript.

September, 1971

H. R. M. R. G. M.

PLEASE PRESS BUTTON "A" TO CONTINUE
Just a note to acquaint you with the Mark IV AutoTutor...

The instrument on which you are about to take this exam is programmed to automatically administer, make decisions about, and score your progress during the test. You are to make the appropriate responses, as explained during the progression of test items by pushing a button. The only buttons you will need to be concerned with are:

- BUTTON "A"
- BUTTON "B"
- BUTTON "C"
- BUTTON "D"
- BUTTON "R"

IMPORTANT: Push only the button which most appropriately describes your answer... OR... Push only the button you have been asked to push

PUSH BUTTON "A" TO CONTINUE
So that your answers will be correctly tabulated, it is imperative that you follow directions very carefully as they relate to your answer sheet.

Be sure that you are familiar with which you are provided. It will specify exactly where to place appropriate marks OR which buttons to press at certain decision points,

PRESS BUTTON "A" TO CONTINUE
LET'S BEGIN!

The questions on this examination are individualized according to your ability and familiarity with each section of material. You must answer EACH question that is presented to you by making either a mark on your answer sheet and then pressing a button on the AutoTutor, or just by pressing a button. At no time will you be able to return to a question. Therefore you must be certain of your answer selection BEFORE pressing any button.

Follow the directions in each frame very carefully.

Is this the first time you are taking this test?

YES........ Press button "A"

NO ........ Press button "B"
THIS IS CONTROL POINT I. REFER TO YOUR EXAMINATION CARD AND PRESS THE APPROPRIATE BUTTON. **DO NOT PRESS ANY OTHER BUTTONS!**
PRESS THE BUTTON CORRESPONDING TO YOUR CHOICE.

Upjohn's PAC Compound is displayed in

[A] brown and white box
[B] green and yellow plastic bottle
[C] white, black and grey box
[D] red and white box
PRESS THE BUTTON CORRESPONDING TO YOUR CHOICE.

A common OTC combination product for analgesic effect usually contains

[A] propoxyphene hydrochloride and aspirin
[B] aspirin, caffeine and phenacetin
[C] meperidine and promethazine
[D] aspirin, methylcellulose and carbopol
A common OTC combination product for analgesic effect usually contains

[1] propoxyphene hydrochloride and aspirin
[2] aspirin, caffeine and phenacetin
[3] meperidine and promethazine
[4] aspirin, methylcellulose and carbopol
You are doing very well.

All answers have been correct thus far.

PRESS BUTTON "A" TO CONTINUE
A TEST FOR THE MEASUREMENT OF
NON-PRESCRIPTION DRUG PRODUCT INFORMATION

Division "B"

by

Henri R. Manasse and Robert G. Mrtek, Ph.D.
University of Illinois at the Medical Center, College of Pharmacy
Chicago, Illinois

Please provide the information as requested below:

Name ___________________________ Year of Graduation ________
Last First Middle
How much experience have you had in a pharmacy in terms of weeks? ______ weeks
Name of Pharmacy in which you have gained experience: ______________________

GENERAL DIRECTIONS FOR TAKING A TEST ON THE AUTOTUTOR

Certain general directions should be kept in mind while taking a test on the AutoTutor. READ these directions carefully before beginning the test. If you should have any questions be sure to seek the advice of an instructor.

GENERAL DIRECTIONS:

1. Follow all instructions presented by the AutoTutor and the accompanying answer sheet very carefully. Do exactly as the machine instructs.

2. Intermittently the AutoTutor will not visibly present any information but its motor will continue to run. This occurs in various parts of the test and will last approximately 15 to 20 seconds. Do not be alarmed. This is an intrinsic feature of this machine.

3. When the AutoTutor asks you to examine your answer sheet, do so. Note that there are two columns on the answer sheet. One column contains a list of Control Points and provides you with directions regarding the proper button to push. The other column represents the scoring mechanism used in this test.

4. Do not be concerned with spaces which may be left blank on your answer sheet. Just do as well as you can on all questions that are presented to you on the AutoTutor.

5. You ARE NOT limited by time requirements. Work as fast and as efficiently as possible.
Control Point 1 - Push Button
Question #1 - 1 2 3 4
Control Point 2 - Push Button B
Question #2 - 1 2 3 4
Control Point 3 - Push Button
Question #3 - 1 2 3 4
Control Point 4 - Push Button B
Question #4 - 1 2 3 4
Control Point 5 - Push Button
Question #5 - 1 2 3 4
Control Point 6 - Push Button B
Question #6 - 1 2 3 4
Control Point 7 - Push Button
Question #7 - 1 2 3 4
Control Point 8 - Push Button B
Question #8 - 1 2 3 4
Control Point 9 - Push Button
Question #9 - 1 2 3 4
Control Point 10 - Push Button B
Question #10 - 1 2 3 4
Control Point 11 - Push Button
Question #11 - 1 2 3 4
Control Point 12 - Push Button B
Question #12 - 1 2 3 4
Control Point 13 - Push Button
Question #13 - 1 2 3 4
Control Point 14 - Push Button B
Question #14 - 1 2 3 4
Control Point 15 - Push Button
Question #15 - 1 2 3 4
Control Point 16 - Push Button B
Question #16 - 1 2 3 4
Question #17 - 1 2 3 4
Question #18 - 1 2 3 4
Question #19 - 1 2 3 4
Question #20 - 1 2 3 4
Question #96 - 1 2 3 4
Question #97 - 1 2 3 4
Question #98 - 1 2 3 4
Question #99 - 1 2 3 4
Question #100 - 1 2 3 4
Question #101 - 1 2 3 4
Question #102 - 1 2 3 4
Question #103 - 1 2 3 4
Question #104 - 1 2 3 4
Question #105 - 1 2 3 4
Question #106 - 1 2 3 4
Question #107 - 1 2 3 4
Question #108 - 1 2 3 4
Question #109 - 1 2 3 4
Question #110 - 1 2 3 4
Question #111 - 1 2 3 4
Question #112 - 1 2 3 4
Question #113 - 1 2 3 4
Question #114 - 1 2 3 4
Question #115 - 1 2 3 4
Question #116 - 1 2 3 4
Question #117 - 1 2 3 4
Question #118 - 1 2 3 4
Question #119 - 1 2 3 4
Question #120 - 1 2 3 4
A TEST FOR THE MEASUREMENT OF NON-PRESCRIPTION DRUG PRODUCT INFORMATION

Division "A"

by

Henri R. Manasse and Robert G. Mrtek, Ph.D.

University of Illinois at the Medical Center, College of Pharmacy

Please provide the information as requested below:

Name_________________________________________Year of Graduation________

LAST FIRST MIDDLE

How much experience have you had in a pharmacy in terms of weeks?__weeks

Name of Pharmacy in which you have gained experience:__________________________

GENERAL DIRECTIONS FOR TAKING A TEST ON THE AUTOTUTOR

Certain general directions should be kept in mind while taking a test on the AutoTutor. READ these directions carefully before beginning the test. If you should have any questions be sure to seek the advice of an instructor.

GENERAL DIRECTIONS:

1. Follow all instructions presented by the AutoTutor and the accompanying answer sheet very carefully. Do exactly as the machine instructs.

2. Intermittently the AutoTutor will not visibly present any information but its motor will continue to run. This occurs in various parts of the test and will last approximately 15 to 20 seconds. Do not be alarmed. This is an intrinsic feature of this machine.

3. When the AutoTutor asks you to examine your answer sheet, do so. Note that there are two columns on the answer sheet. One column contains a list of Control Points and provides you with directions regarding the proper button to push. The other column represents the scoring mechanism used in this test.

4. Do not be concerned with spaces which may be left blank on your answer sheet. Just do as well as you can on all questions that are presented to you on the AutoTutor.

5. You ARE NOT limited by time requirements. Work as fast and as efficiently as possible.
Control Point 1 - Push Button ______
Record the Number Displayed on the Appropriate Reference Frame.

Control Point 2 - Push Button A

Control Point 3 - Push Button ______
Reference Frame I ______

Control Point 4 - Push Button A
Reference Frame II ______

Control Point 5 - Push Button ______
Reference Frame III ______

Control Point 6 - Push Button A
Reference Frame IV ______

Control Point 7 - Push Button ______
Reference Frame V ______

Control Point 8 - Push Button A
Reference Frame VI ______

Control Point 9 - Push Button ______
Reference Frame VII ______

Control Point 10 - Push Button A
Reference Frame VIII ______

Control Point 11 - Push Button ______

Control Point 12 - Push Button A

Control Point 13 - Push Button ______

Control Point 14 - Push Button A

Control Point 15 - Push Button ______

Control Point 16 - Push Button A
REFERENCES


4 Edward Parrish, "On the Relations of the Several Classes of Druggists and Pharmacists to the Colleges of Pharmacy," American Journal of Pharmacy, XLIII (November, 1871), 481.


29 Herman R. Holtz, A Short Course in Intrinsic Programming (Skokie: Welch Scientific Co., 1965).


35 Ibid.


46 Ibid. p. 109.

47 Gronlund, Constructing Achievement Tests, p. 85.


51Ibid., p. 392.


55Smallwood, A Decision Structure for Teaching Machines p. 3.


BIBLIOGRAPHY

BOOKS


PERIODICALS


Parrish, Edward. "On the Relations of the Several Classes of Druggists and Pharmacists to the College of Pharmacy." American Journal of Pharmacy, 43 (November, 1871), 481.


MIMEOGRAPHED DOCUMENTS


The thesis submitted by Henri R. Manasse, Jr. has been read and approved by the director of the thesis. Furthermore, the final copies have been examined by the director and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the thesis is now given final approval with reference to content and form.

The thesis is therefore accepted in partial fulfillment of the requirements for the degree of Master of Arts.

April 11, 1972
Date

Signature of Adviser