INFORMATION TO USERS

This dissertation was produced from a microfilm copy of the original document. While the most advanced technological means to photograph and reproduce this document have been used, the quality is heavily dependent upon the quality of the original submitted.

The following explanation of techniques is provided to help you understand markings or patterns which may appear on this reproduction.

1. The sign or "target" for pages apparently lacking from the document photographed is "Missing Page(s)". If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting thru an image and duplicating adjacent pages to insure you complete continuity.

2. When an image on the film is obliterated with a large round black mark, it is an indication that the photographer suspected that the copy may have moved during exposure and thus cause a blurred image. You will find a good image of the page in the adjacent frame.

3. When a map, drawing or chart, etc., was part of the material being photographed the photographer followed a definite method in "sectioning" the material. It is customary to begin photoing at the upper left hand corner of a large sheet and to continue photoing from left to right in equal sections with a small overlap. If necessary, sectioning is continued again — beginning below the first row and continuing on until complete.

4. The majority of users indicate that the textual content is of greatest value, however, a somewhat higher quality reproduction could be made from "photographs" if essential to the understanding of the dissertation. Silver prints of "photographs" may be ordered at additional charge by writing the Order Department, giving the catalog number, title, author and specific pages you wish reproduced.

University Microfilms
300 North Zeeb Road
Ann Arbor, Michigan 48106
A Xerox Education Company
SWANSON, Richard Alan, 1942-
THE DEVELOPMENT AND EVALUATION OF AN INSTRUCTIONAL UNIT IN CONSUMER MATHEMATICS FOR SECONDARY SCHOOL LOW ACHIEVERS.
The Ohio State University, Ph.D., 1972
Education, curriculum development

University Microfilms, A XEROX Company, Ann Arbor, Michigan
THE DEVELOPMENT AND EVALUATION OF AN INSTRUCTIONAL UNIT IN
CONSUMER MATHEMATICS FOR SECONDARY SCHOOL LOW ACHIEVERS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of the Ohio State University

By

Richard Alan Swanson, B.S., M.A.

* * * * *

The Ohio State University
1972

Approved by

Advisor
College of Education
PLEASE NOTE:

Some pages may have indistinct print.

Filmed as received.

University Microfilms, A Xerox Education Company
ACKNOWLEDGMENTS

The author wishes to break with traditional form and acknowledge first the unceasing support of his wife, Patricia. Without the love and encouragement which was provided, the investigation reported here would never have been conducted.

To his major advisor, Professor Harold Trimble, go heartfelt thanks for the guidance and assistance provided over the years.

To Professor Sidney Eboch and Professor Alan Osborne must go many thanks for their continued direction throughout the doctoral program.

Special gratitude must be extended to the teachers and administrators of the Columbus Public Schools and the officials of the insurance industry for their cooperation. Particular thanks must go to Earl Tharp, Russell Miller, and Robert Bailey.

For typing the final draft, Jean Farnsworth has earned the lasting appreciation of the author.
October 11, 1942 ........ Born - Brooklyn, New York

1964 ..................... B.S., Illinois Institute of Technology, Chicago, Illinois


1969 ..................... Teaching Associate, Department of Mathematics, The Ohio State University, Columbus, Ohio

1970-1972 ............. Research Associate, Educational Resources Information Center, Clearinghouse for Science and Mathematics Education, The Ohio State University, Columbus, Ohio

1971-1972 ............. Teaching Associate, Department of Science and Mathematics Education, The Ohio State University, Columbus, Ohio

FIELDS OF STUDY

Major Field: Mathematics Education

Studies in Mathematics Education. Professors Harold C. Trimble and Alan R. Osborne

Studies in Educational Development. Professor Sidney C. Eboch
TABLE OF CONTENTS

ACKNOWLEDGMENTS ............................................. ii
VITA .................................................................. iii
LIST OF TABLES ................................................... vii

Chapter

I. INTRODUCTION AND BACKGROUND ................. 1

   Description of the Problem
   Historical View of the Low Achiever in Mathematics
      The Expression "Low Achiever"
      The Low Achiever and Learning
      Methodology
      Content
   Purpose of this Study
      Preliminary Description
      Purposes
   Specific Objectives
      Conjectures
      Objectives
   Overview
   Definitions for the Study
   Assumptions
   Limitations
   Delimitations

II. REVIEW OF RELATED LITERATURE ................. 13

   Characteristics of the Low Achiever
   The Low Achiever in Mathematics
      Reported Characteristics
      Conferences
      Recommendations and Programs
      Research: Elementary
      Research: Junior High School
      Research: Senior High School
      Research: College

iv
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some Effects of Audiovisual Techniques on Learning</td>
<td></td>
</tr>
<tr>
<td>A General View</td>
<td></td>
</tr>
<tr>
<td>Visual Learning</td>
<td></td>
</tr>
<tr>
<td>Research and Surveys</td>
<td></td>
</tr>
<tr>
<td>Applications of Audiovisual Techniques to Mathematics</td>
<td></td>
</tr>
<tr>
<td>History</td>
<td></td>
</tr>
<tr>
<td>Research: Films and Filmstrips</td>
<td></td>
</tr>
<tr>
<td>Research: Slides and the Overhead Projector</td>
<td></td>
</tr>
<tr>
<td>Research: Multiple Applications</td>
<td></td>
</tr>
<tr>
<td>Other References</td>
<td></td>
</tr>
<tr>
<td>The Teaching of Consumer Mathematics</td>
<td></td>
</tr>
<tr>
<td>History</td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td></td>
</tr>
<tr>
<td>Instructional Materials Guides</td>
<td></td>
</tr>
<tr>
<td>Insurance and Media</td>
<td></td>
</tr>
<tr>
<td>Implications of this Literature for this Study</td>
<td></td>
</tr>
<tr>
<td>III. INSTRUCTIONAL MATERIALS DEVELOPMENT</td>
<td>61</td>
</tr>
<tr>
<td>Content of the Insurance Unit</td>
<td></td>
</tr>
<tr>
<td>Production of the Slides</td>
<td></td>
</tr>
<tr>
<td>Production of the Worksheets</td>
<td></td>
</tr>
<tr>
<td>Development of the Evaluation Instruments</td>
<td></td>
</tr>
<tr>
<td>Objective Tests</td>
<td></td>
</tr>
<tr>
<td>Questions</td>
<td></td>
</tr>
<tr>
<td>The Post-Test</td>
<td></td>
</tr>
<tr>
<td>The Retention Test</td>
<td></td>
</tr>
<tr>
<td>The Teacher Questionnaire</td>
<td></td>
</tr>
<tr>
<td>IV. RESEARCH DESIGN, PROCEDURES AND POPULATION</td>
<td>78</td>
</tr>
<tr>
<td>Experimental Design</td>
<td></td>
</tr>
<tr>
<td>Experimental Hypotheses</td>
<td></td>
</tr>
<tr>
<td>Pilot Study</td>
<td></td>
</tr>
<tr>
<td>Modifications Which Resulted from the Pilot Study</td>
<td></td>
</tr>
<tr>
<td>Contact and Selection Procedures</td>
<td></td>
</tr>
<tr>
<td>Population: Schools and Teachers</td>
<td></td>
</tr>
<tr>
<td>Logistics of the Experiment</td>
<td></td>
</tr>
<tr>
<td>V. ANALYSIS OF DATA</td>
<td>103</td>
</tr>
<tr>
<td>Selected Characteristics of the Student Population</td>
<td></td>
</tr>
<tr>
<td>Reactions of the Participating Teachers</td>
<td></td>
</tr>
<tr>
<td>Changes in the Students and Teachers as Reported by the Teachers</td>
<td></td>
</tr>
<tr>
<td>Statistical Analysis</td>
<td></td>
</tr>
</tbody>
</table>
# VI. CONCLUSIONS AND RECOMMENDATIONS

## Summary
- Conclusions
- Discussion
- Recommendations for Program Revision
- Recommendations for Further Research

## APPENDIX

<table>
<thead>
<tr>
<th>Appendix Item</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Description of the Course &quot;High School Mathematics&quot;</td>
<td>136</td>
</tr>
<tr>
<td>B. Insurance Unit Outline</td>
<td>138</td>
</tr>
<tr>
<td>C. Classification of the Slides into Basic Categories</td>
<td>148</td>
</tr>
<tr>
<td>D. Insurance Script</td>
<td>150</td>
</tr>
<tr>
<td>E. Insurance Vocabulary</td>
<td>161</td>
</tr>
<tr>
<td>F. Fire Insurance Worksheet</td>
<td>164</td>
</tr>
<tr>
<td>G. Sample Application: Automobile Insurance</td>
<td>166</td>
</tr>
<tr>
<td>H. Automobile Insurance Rates</td>
<td>168</td>
</tr>
<tr>
<td>I. Life Insurance Worksheet and Annual Premiums</td>
<td>173</td>
</tr>
<tr>
<td>J. Answer Key for Worksheets</td>
<td>176</td>
</tr>
<tr>
<td>K. Post-Test Used in the Pilot Study</td>
<td>178</td>
</tr>
<tr>
<td>L. Summary of Test Statistics for the Pilot Study</td>
<td>188</td>
</tr>
<tr>
<td>M. Post-Test Used in the Investigation</td>
<td>190</td>
</tr>
<tr>
<td>N. Summary of Test Statistics for the Post-Test</td>
<td>197</td>
</tr>
<tr>
<td>O. Retention Test</td>
<td>199</td>
</tr>
<tr>
<td>P. Teacher Questionnaire</td>
<td>201</td>
</tr>
<tr>
<td>Q. Responses Entered on the Teacher Questionnaire</td>
<td>206</td>
</tr>
<tr>
<td>R. Letter of Approval from the Assistant Superintendent for Special Services</td>
<td>216</td>
</tr>
<tr>
<td>S. Introductory Handout for the Teachers of Applied Mathematics</td>
<td>218</td>
</tr>
<tr>
<td>T. Response Percentages of the Participating Teachers to the List of Insurance Concepts and Principles</td>
<td>222</td>
</tr>
<tr>
<td>U. Class Means of the Arithmetic Computation, Post-Test, and Retention Test Achievement Measures</td>
<td>224</td>
</tr>
<tr>
<td>V. Formulas for F-ratio and t-tests</td>
<td>226</td>
</tr>
<tr>
<td>W. Test Items Included in the Sub-tests</td>
<td>229</td>
</tr>
<tr>
<td>X. Letter from the Director of Information of the Ohio Insurance Institute</td>
<td>231</td>
</tr>
</tbody>
</table>

## BIBLIOGRAPHY

- 233
<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Approximate Number of Commercial Audiovisual Materials in Selected Mathematical Areas</td>
<td>57</td>
</tr>
<tr>
<td>2. Comparison of Order of Contact, Order of Participation, and Group Assignment for the High Schools</td>
<td>91</td>
</tr>
<tr>
<td>4. Number of Applied Mathematics Classes and Teachers in Each School</td>
<td>95</td>
</tr>
<tr>
<td>5. Identification Code for the Classes and the Participating Teachers</td>
<td>96</td>
</tr>
<tr>
<td>6. Selected Characteristics of the Participating Teachers</td>
<td>97</td>
</tr>
<tr>
<td>7. Comparison of Class Enrollment and Class Attendance</td>
<td>105</td>
</tr>
<tr>
<td>8. Review of Changes as Reported by the Participating Teachers</td>
<td>111</td>
</tr>
<tr>
<td>9. Means and Variances of the Arithmetic Computation Measures</td>
<td>114</td>
</tr>
<tr>
<td>10. Means and Variances of the Post-test and Sub-test A</td>
<td>116</td>
</tr>
<tr>
<td>11. Means and Variances of the Sub-test B and the Sub-test C</td>
<td>116</td>
</tr>
<tr>
<td>12. Means and Variances of the Sub-test D and the Sub-test E</td>
<td>116</td>
</tr>
<tr>
<td>13. Means and Variances of the Sub-test F and the Retention Test</td>
<td>117</td>
</tr>
<tr>
<td>14. Means and Variances of the Retention Sub-test</td>
<td>117</td>
</tr>
<tr>
<td>15. F-ratio Values and Significance Levels for Homogeneity of Variance Tests</td>
<td>118</td>
</tr>
<tr>
<td>16. T-Test Values and Significance Levels for Comparison of Test Means</td>
<td>120</td>
</tr>
<tr>
<td>17. Group Enrollment and Attendance for Tests</td>
<td>125</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION AND BACKGROUND

Description of the Problem

The problem described by this report involves the development, trial and evaluation of an instructional unit on insurance used by classes of secondary school low achievers in the Columbus Public Schools during the 1971-1972 school year.

The distinguishing characteristic of the instructional unit was the influence of the classroom use of photographic slides which illustrated the principles being taught. The use of these slides was intended to serve both as a motivational device for these students and as an aid to their learning and remembering the content of the instruction.

Historical View of the Low Achiever in Mathematics

The Expression "Low Achiever"

Mathematics educators have always admitted that there were students who had difficulties in learning mathematics. Depending upon the era under consideration and the characteristics of the students involved, these students were given the description of dull, below average, slow, low ability, low achiever or underachiever. Although these descriptions do not characterize the same learning difficulty, they have been applied by some educators
and writers to any student who has fallen far behind the majority of his class in achievement.

A search of the educational literature for information regarding this type of student could not be restricted to just situations involving "low achievers." It was necessary to also search the literature for situations which involved students described by the other terms. When the basis for using such a term was found to be a measure of achievement definitely below that of a student's age group, the details of the particular situation were included as a part of the literature review. The resulting literature review provided the basis for a comprehensive description of what was known about the low achiever in the classroom. This description of the low achiever will be given in Chapter II.

The Low Achiever and Learning

When education belonged to the "privileged few," there was not a problem of dealing with the low achiever. The evolution of compulsory public education for the masses introduced a problem which to this day has not been resolved: What do you do with the low achievers in the classroom?

Alternatives to this question have been discussed in educational literature by many authors. Surveys of these alternatives reported by Travers, LeDuc and Runion (156) and Fitzgerald (48) revealed a variety of recommendations and descriptions of successful experimental programs. A few of the outstanding characteristics of the programs were: a) variety within the class period, b) language matched to the students' ability, c) a laboratory approach with
audiovisual and manipulative materials, and d) adaptation of instructional content to form a course which seemed more realistic to the students.

When these low achievers were observed in the classroom, it was relatively easy to describe their learning characteristics. They had trouble with vocabulary, definitions, problem solving, and memorization. They typically had (or seemed to have) low achievement in other subjects besides mathematics. They had little imagination, curiosity, or spark when it came to education. These, and others, have been presented as definite characteristics of the low achiever through the years. A few educators indicated that the conventional classroom teaching methods might have contributed to or even been the cause of some of the reported "characteristics" of low achievers.

Methodology

A fundamental feature of classroom organization—grouping—has been a source for disagreement among educators working with low achievers. The majority of mathematics educators seem to have favored a homogeneous classroom for instruction in mathematics. Others have indicated that the variety and challenge evident in a heterogeneous classroom would be beneficial to the low achiever. The apparent conflict has not been resolved. Other questions of methodology which need to be studied involve the pacing of the material, the physical structure of the classroom, the activities within the classroom, and the use of educational media.
In addition to the problems mentioned above, the problem of what to teach the low achievers has been a critical one throughout the history of mathematics education. Weiss (158) wrote in 1969 that:

It does not require an intensive reading of the literature to discover that wide and deep disagreement exists among teachers of mathematics as to what should be taught to the low achiever. (158, 571)

In a survey of 200 leading mathematics educators in the nation, Weiss reported that the courses most frequently mentioned as appropriate for the low achiever included: 1) a course to strengthen computational skills, 2) a course based on consumer applications, and 3) a general mathematics course, taught with some different methodology (e.g., slower, less depth, simpler problems, more examples).

Purpose of this Study

Preliminary Description

It is the aim of this study to deal with some of the specific problems mentioned in the previous section dealing with the low achiever. In particular, the area under consideration is that of methodology—the use of educational media. Other problem areas pertain to the study, but are not part of the experimental design. For example, the classes to be used in the study are grouped in a homogeneous manner rather than heterogeneously. Further, the content for this study is taken from "a course based on consumer applications," one of the course options included in the survey.
by Weiss. Other alternatives for instructional content of methodology will not be studied.

The particular medium chosen for this study is that of photographic slides. These slides were designed to illustrate concepts and principles of insurance—a unit which is normally included in a course based on consumer applications.

**Purposes**

The primary purpose of this study is to investigate the effects of classroom use of photographic slides dealing with insurance on classes of low achieving consumer mathematics students in secondary school.

A secondary purpose is to investigate the effects of this instructional unit and its use on the secondary school teachers who participate in the study.

An ancillary purpose is the verification of general characteristics of low achievers reported in the mathematics education literature with those characteristics reported by the teachers who participate in the study.

**Specific Objectives**

**Conjectures**

It is a conjecture of the investigator that use of slides in the study of consumer mathematics will: a) benefit the explanation of principles, and b) stimulate interest and discussion among the students. If the student interest can be stimulated in this manner, it is conjectured that: a) the understanding and learning of the material by the students
will be significantly aided, and b) a noticeable improvement in the students' attitude toward the subject of mathematics will occur. Further, it is conjectured that the visual images presented on the slides will provide a mental image of the concepts which will aid the students in their retention of the material.

Objectives

With the above conjectures in mind, the following are the objectives which will be used to govern the experimental design:

1) to investigate the effects of classroom use of photographic slides in a unit dealing with insurance on the achievement of consumer mathematics students as measured by an objective test,

2) to investigate the effects of classroom use of photographic slides in a unit dealing with insurance on the attitude of consumer mathematics students as reported by their teachers, and

3) to investigate the effects of classroom use of photographic slides in a unit dealing with insurance on a delayed measure of achievement of consumer mathematics students as measured by an objective retention test.

Overview

The purpose of the first part of this chapter was to lay the groundwork for the reader regarding the low achiever and the way in which he is taught. Further, the specific problem concerning the low achiever to be investigated--the use of a certain educational media--was described. This overview will briefly describe
the content of the remaining chapters.

Chapter II reports on the results of a search of the educational literature for materials which relate to the low achiever, educational applications of audiovisual media, or the teaching of consumer mathematics. The elements of each area which have bearing on this study are then summarized at the end of the chapter.

Chapter III includes a description of the content of the insurance unit and how it was selected. Details are given concerning the production of the sets of slides which were an integral part of the experimental treatment. The student worksheets are also described, with an explanation of the role they played in the total instructional unit. The evaluation instruments discussed include a 40-question objective post-test, the 18-question objective retention test, and the teacher questionnaire.

Chapter IV presents a discussion of the experimental design, with descriptions of the experimental and control groups. The experimental hypotheses are also included. The experimental procedures are explained, including the initial contact with the Columbus Public Schools, the pilot study, and the work with the participating teachers. The student, teacher and school populations are described with some representative statistics.

Chapter V presents the results of the administration of the evaluation instruments. Included are some other statistical descriptions of the populations, some reactions of the participating teachers, and the changes in the students as reported by the teachers. The
scores for the experimental and control groups on the objective tests are then analyzed by appropriate statistical techniques.

The conclusions and recommendations which can be made from the experimental results are presented in Chapter VI.

**Definitions for the Study**

Most of the terms used in this study have a connotation in agreement with that of the educational literature. The following are defined operationally for the purposes of this investigation:

**Achievement**—the raw score attained by a student on an investigator-designed objective instrument. The two objective instruments used in this investigation are a 40 item multiple-choice post-test and an 18 item true-false retention test.

**Attitude**—a summary of the student's interest in mathematics and his participation in the classroom, as observed by his teacher and reported on an investigator-designed questionnaire.

**Audiovisual**—that area of educational media included in the "Projected Visuals" category established by the Department of Audiovisual Instruction of the National Education Association. The specific examples included are: motion pictures, slides, filmstrips, film-loops, and the overhead projector.

**Consumer Mathematics Course**—that secondary school mathematics course offered by the Columbus Public Schools during the 1971-1972 school year entitled "Applied Mathematics." This course had originally been entitled "High School Mathematics" during the 1969-1970 school year when it was first introduced into the curriculum. The students enrolled in the course are in grades 10-12 and had experienced
previous difficulty in a general mathematics course. The textbook assigned for use in the course is Mathematics in Daily Use by Hart, Schult and Irvin. (58)

Control Group—the collection of Applied Mathematics classes using the investigator's insurance unit without the set of insurance slides. Experimental Group—the collection of Applied Mathematics classes using the entire investigator's insurance unit.

Instructional Unit in Consumer Mathematics—the set of materials prepared by the investigator for instruction in insurance. The materials include: a unit outline; a script; insurance vocabulary sheets; student worksheets for fire insurance, automobile insurance, and life insurance; an answer key for the worksheets; multiple-choice post-tests; true-false retention tests; a teacher questionnaire; and a set of 142 2- by 2-inch photographic slides stored in 2 Kodak "Carousel" slide trays. (The written materials are included in the Appendix.)

Insurance Slides—a set of 142 2- by 2-inch photographic slides prepared by the investigator for use in the instruction of insurance for the renter or homeowner, automobile insurance, and life insurance. Low Achiever—a secondary school student in the Columbus Public Schools characterized by a) failure in at least one mathematics course, and b) placement in mathematics at least one year behind his age group. Retention—the measure of knowledge as obtained by administration of a 2-week delayed achievement test. Participating Student—a secondary school student enrolled in a class of Applied Mathematics during the 1971-1972 school and receiving
instruction aided by all or part of the investigator's insurance unit.

Participating Teacher—a teacher of secondary school students having responsibility for at least one class of Applied Mathematics during the 1971-1972 school year and teaching with the aid of all or part of the investigator's insurance unit.

Assumptions

The following assumptions are made by the investigator as part of this study:

1. The judgment of the investigator's instructional unit on insurance as an adequate coverage of insurance for the renter or homeowner, automobile insurance, and life insurance, is valid.

2. The objective instruments and the teacher questionnaire will assess the variables for which they are being used in this study.

3. The process used in the assignment of classes to experimental group or control group will not bias the experimental investigation. Since the preferences of the teachers influenced the assignments, the classes were not assigned through a true random-selection process.

4. The normal quality of instruction for the teachers having classes in the control group will not be adversely affected by their not being selected for the experimental group.

5. The teachers' observation and reporting of the students' attitude during the instruction of the unit will be accurate.
6. The participants will respond to questions in an honest manner.

**Limitations**

The following are limitations which are inherent in the study:

1. The enrollment of the individual Applied Mathematics classes, the professional experiences of the participating teachers, and the degree of student attrition may influence the results of the investigation.

2. The evaluation instruments may not be sensitive to changes in the students' achievement and retention.

3. The knowledge and ability of the investigator may limit the effectiveness of the instructional unit.

**Delimitations**

The following are delimitations which govern the scope of the investigation:

1. The study will be limited to teachers and students in Applied Mathematics classes in Columbus secondary schools during the 1971-1972 school year.

2. Only the utilization of a specific medium (slides) on a specific curricular component (a unit on insurance) will be analyzed.

3. The only student attribute to be statistically analyzed will be achievement, as measured by the investigator's evaluation instruments.

4. The attitude of the students will be determined by the teachers' responses on the investigator's questionnaire.
This completes the introductory chapter. Chapter II presents a review of the educational literature which relates specifically to the problems of: a) the low achiever in the classroom, b) the use of audiovisual materials for instruction, and c) the teaching of consumer mathematics.
CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter presents a review of research studies and other literature pertinent to this investigation. Three major areas of educational knowledge are reviewed: the low achiever, the use of audiovisual media (restricted to projected visuals), and the teaching of consumer mathematics.

The first major section of the chapter reports on what has been learned about teaching the low achiever. As discussed in Chapter I, literature exists which uses descriptive phrases other than that of "low achiever" to describe this type of student. Examples of these include: underachievers, low ability, below average achievers, slow learners, and modified. The use of "disadvantaged," "retarded," and "exceptional" has generally not been found in literature to describe a person who has low achievement in mathematics. However, isolated cases have been found where "educationally disadvantaged" and "retarded learner" were used for this purpose. It is realized by the investigator that the classes of secondary school students participating in this study may not be composed truly of just low achievers. There may be some students who have at least an "average" ability but have not had success in
the mathematics classroom (underachievers); there may be some students who are quite capable in elementary mathematics but require a longer-than-normal amount of time to comprehend the material (slow learners). For these reasons, the first section presents a review of the literature for characteristics of the students that are likely to be placed in a class of consumer mathematics for low achievers.

The second major section of the chapter reports on what has been learned about applications of audiovisual media to the classroom. Studies in areas other than mathematics are included when it appears that they have something to contribute to this investigation.

The third major section of the chapter reports on the teaching of consumer mathematics. Included is a brief historical development of this area of the mathematics curriculum, followed by some results of research studies and program investigations.

**Characteristics of the Low Achiever**

Some surveys and studies have been made to categorize the specific characteristics of low achieving students. The discovery of basic influences which caused these distinguishing characteristics was also of interest in these studies. Wiener (162) studied the neurological, psychological, achievement, and sociological characteristics of 582 children over a period of 13 years. He reported that a significantly low birth weight was a strong indicator of later achievement difficulties, particularly in arithmetic. Hunte (73) wrote that the student's "intimate society may frown on education and its value" (73, 12) and
have an influence on the classroom achievement of the student. However, after a survey of related research studies, she concluded "that there are far more variables, other than environment, involved in low achievement." (72, 68)

In research on the underachiever, Snellgrove (144) found from a study of 196 secondary school students that a) underachievers have personal, social and adjustment disorders which are distinguishable as a group, and b) these disorders decreased in severity as the students moved from junior high school to the end of senior high school. Specific characteristics of the underachiever which were reported include: a) the number of male underachievers in secondary school is significantly higher than the number of female underachievers, b) motivation in a subject correlated positively with a high grade in that subject, c) underachievers frequently did not know the reasons for their underachievement, and d) they typically had unrealistic goals.

Fenner (45) discovered that the consistent, chronic underachiever was almost nonexistent in the secondary school. In a study of 84 students judged to be underachievers, "many had both over and under achievement classifications on their school records." (45, 600) He concluded from the study that a rating of "underachiever" was a very subjective description—totally dependent upon predictors which were variable.

The textbook by Johnson (78) is an example of those written on the education of the slow learner. His definition of this type of student is one who scores "between approximately 75 and 90 I.Q. on
a verbal intelligence test." (78, 42) This capacity for intellectual growth or rate of growth is the biggest difference between these students and their classmates, according to Johnson, for their "general appearance and reactions are much the same as those of children in general." (78, 29) If they are held in impossible learning situations over a period of years, they frequently become frustrated and insecure, with associated psychological reactions: aggressiveness, inattention, overcompensation for failure and shortcomings, and deviant behavior.

The Low Achiever in Mathematics

Reported Characteristics

The literature dealing with the characteristics of those students who have had low achievement in mathematics has been surveyed by Travers, LeDuc and Runion. (156) They reported that the abundant lists of student characteristics could be divided into "two sections: characteristics which arise from social and emotional problems, and characteristics arising from learning difficulties or achievement failures in mathematics." (156, 3) A summary of the first type includes:

High rate of absence.
Goals based on a view of the immediate future.
Low motivation.
Antisocial behavior.
Short attention span.
Inability to see practical uses of mathematics. (156, 3)

A summary of the second type includes:

A record of failure in mathematics and a fear of the subject.
Achievement scores at least two years below grade level.
Reading and comprehension difficulties in many cases.
Inability to follow directions well.
Tendency to leap to conclusions.
Inability to generalize. (156, 7-8)

Some noteworthy generalizations not included in the above summaries have been reported by Ross (133) in an investigation of underachievers in arithmetic. He found that: a) underachievement in arithmetic did not become apparent until the fourth grade, b) the home environment was generally unstimulating, c) underachievement generally coexisted in other subjects (particularly reading), and d) personal problems such as low vitality and actual sickness appeared frequently.

Conferences

Reports have been presented of several conferences where the major problem discussed was the teaching of the low achiever. Examples of these conferences are those held in: a) Washington, D.C. in 1964, (165) b) Stanford, California in 1964, (6) c) New York in 1968, (72) (147) and d) Charlottesville, Virginia in 1969. (107) The goals of these conferences have generally been: 1) to study and better understand the low achiever in mathematics, and 2) to analyze and replicate successful experimental low achiever programs. An overall statement about the low achiever presented at a New York conference typifies the attitude of the conference representatives:

Low achievers, underachievers, and slow learners cannot keep pace with average and above average learners. They need more time for the formulation of ideas. They need more time for developing skills and concepts. For them the curriculum must be presented in small doses for longer periods of time. (147, 18)
Recommendations which arose from these conferences are incorporated into the next section.

**Recommendations and Programs**

Recommendations for working with the low achiever in mathematics have appeared frequently in the literature. A comprehensive review of these recommendations has been made and reported by Travers, LeDuc and Runion. (156) Rather than list individual recommendations made by each of the separate authors, this summary of recommendations is presented:

1. Employ repetition through spiraling.
2. Take small segments of material.
3. Use language which the class is likely to understand.
4. Dramatize the material.
5. Individualize the problem assignments.
6. Pay attention to reading the problems.
7. Provide variety within the class period.
8. Use concrete approaches to the subject matter.
9. Provide activities.
10. Hold frequent reviews.
11. Use praise freely.
12. Display good student work.
13. Build assignments which lead to success.
14. Use diagnostic testing before and after teaching.
15. Measure the student against himself.
16. Correlate mathematics with other subjects whenever possible.
17. Establish consistent classroom management policies.
18. Use audio-visual techniques when possible.
19. Try supervised study rather than homework.
20. Grade work the day it is turned in.
21. Do not insist on verbalization.
22. Allow the use of calculators of (sic) tables. (156, 28-29)

The reader interested in detailed presentations of background material for these recommendations is invited to read Travers, LeDuc and Runion, (156, 10-29) and Woodby. (165, 91-93)
Several projects and programs have been instituted over the last decade to develop special techniques for working with the low achiever. In a paper prepared for the School Mathematics Study Group (SMSG), Fitzgerald (48) cited a survey made and reported by Hoffman of programs for slow learners. It was reported that the programs generally shared one or more of the following characteristics:

1. a mathematics laboratory.
2. the use of calculators.
3. a regulated program. . . . with a change of activities to accommodate the short attention span of the slow learners.
4. provision for reinforcement of early basic concepts.
5. the use of many manipulative devices.
6. the proper and controlled use of games, puzzles, and other motivational techniques.
7. use of remote terminals tied into computers. (48, 13-14)

A specific program utilizing the laboratory approach in mathematics is the Low Achievement Motivational Project (L.A.M.P.) in the Des Moines Public Schools. It is reported that a primary goal of this project is the improvement of the students' attitude toward mathematics. (48, 12)

Another successful program in Iowa for the low achiever is the Central Iowa Low Achiever Mathematics Project (CILAMP). A description of the most interesting and effective teaching techniques for junior high school students is presented in a CILAMP report. (24) The activities described are all of a desk-top pencil-and-paper variety. Materials which have been produced by teachers working in the CILAMP program are described by Casey, (20) Nibbelink, (111) and Zimmerman. (167) (168)
Some programs for the low achiever had their emphasis in an individualized learning situation. Facklam and Tibbett (44) reported on a successful remedial program for underachievers where undue conflict, competition, and pressure were avoided. Blaser (11) reported on an optional vocation-related mathematics course in an individualized instruction and small group setting. No evaluation was presented.

In response to the recommendations for teaching the low achiever presented previously, many special courses have been introduced into the school curriculum. Butler (16) has reported a course for the low achiever based on the material of modern mathematics. A special course in general mathematics geared to the student's interest levels and ability to learn was described by Richmond. (126) Other general courses have been described (94) (25) which had an emphasis in practical applications and life situations. It was stressed that small classes, attractive classrooms, adequate materials and texts, interested and skilled teachers, and the use of many sensory and manipulative devices were essential to such courses.

The development and evaluation of a course which integrated the traditional algebra and geometry with elements of consumer mathematics was reported by Rogler. (129) He felt that the number one goal of meeting the needs in today's world had been accomplished through abundant practical applications from industry and from consumer problems. (129, 2)

Work with the low achiever and underachiever has been reported
on the college level by Beal. (4) The courses available for these students were remedial in nature. Generally, these courses existed to enable the students to return to a regular college mathematics classroom.

Research: Elementary

One view of the implications of educational research for the teaching of the low achiever is expressed by Johnson:

Present day research related to learning in children does not indicate that slow learners have any unique learning problems as compared to normal children of the same developmental level. . . . No unique methods of teaching arithmetic are indicated. (78, 231)

In a review of the literature, however, it seems that the view of Johnson is one held by a minority of educators. Most educators feel that the slow learner, low achiever and underachiever are significantly different from their classmates and warrant special methods of instruction.

Another review of the research on teaching the elementary school low achiever has been made and reported by Suydam and Weaver. (150) The report of this review included studies of the academically disadvantaged and the environmentally disadvantaged. The conclusions made in a summary by the authors which have bearing on this study are:

1. the academically disadvantaged profit from special instructional attention.
2. the rate of learning, methods and materials of instruction must be adapted for the slow learners.
3. active involvement with manipulative materials appears to be especially important for the slower students.
4. students who are disadvantaged mathematically may also be having
difficulty in other ability areas.

5. it is important to individualize instruction for these
students. (150, 6-7)

These conclusions seem to represent a view that opposes the view
presented previously by Johnson.

A study reported by Small (143) attempted to discover specific
factors which might be highly correlated with low achievement in the
elementary grades. In a clinical study with a small group of
underachievers and low achievers, no consistent pattern was found
for either group in abilities to function on a concrete, semi­
concrete, or an abstract reasoning level. A recommendation made
at the conclusion of the study was for the design of programs which
would reduce the students' anxiety toward mathematics.

A similar study by Neufeld (110) investigated the personality
characteristics of low achievers and high achievers in elementary
school mathematics. The characteristics which were found to be
associated in a significant manner with the low achiever were: a)
a low sense of personal worth, b) a low sense of social standards,
c) presence of withdrawal tendencies, and d) poor community relations.

In an attempt to raise achievement and attitude in elementary
school low achievers, Sherer (141) introduced college students into
the elementary classroom as tutors. The tutors used a variety of
materials and devices in a series of 20 40-minute tutoring sessions.
At the end of the experimental treatment, no significant differences
in achievement or attitude measures were found between the experimental
and control groups.

To study the effects of individually prescribed instruction on elementary school students, Deep (33) conducted an experiment with over 400 students. At the conclusion of the study, no significant differences in arithmetic achievement were found between groups when pre-test performance was taken into account.

A study of laboratory techniques was conducted by Hoefner (67) with elementary school underachievers. Small groups of students received individually prescribed instruction via a multi-media approach for six minutes each day of the study. The instruction was aimed at development of computational skills, arithmetic conceptualization and application. After a year of experimental treatment, analysis of arithmetic achievement did not reveal any significant differences. The experiment was conducted three times with the same statistical result.

Another study using educational media was reported by Schilling. (138) Forty color/sound movies were used in a curriculum package for a special fourth grade mathematics presentation. No statistical analysis was made of the results. A questionnaire revealed: a) increased attention, b) more enjoyment, and c) less frustration among the students.

The use of desk calculators in the elementary school classroom was investigated by Longstaff. (92) The results after a study with fifth grade students were far from positive. No achievement difference was disclosed between the experimental and control groups.
Furthermore, the desk calculators were received by the students as toys—something to provide classroom diversion.

Research: Junior High School

The majority of the research studies reported in the educational literature have been at the junior high school level. Studies were found which investigated changes in both teaching methodology and content.

A study which investigated the underlying characteristics of the junior high school student is that reported by Degnan. (34) Working under the hypothesis that underachievement is primarily a motivational problem, Degnan made attitude and anxiety measurements of underachieving eighth graders. Significant differences between measures of underachievers and average achievers were found in anxiety level, attitude towards mathematics, and a ranking of mathematics with other school subjects.

Sederberg (139) attempted to discover what kind of course was the most appropriate for ninth grade low achievers. A random assignment was made of ninth graders to classes studying either general mathematics or modified algebra. After the course of instruction, the students in the general mathematics classes measured higher than the algebra students on an arithmetic computation test. This difference, and other differences in skills and attitude, were not found to be statistically significant. A concluding remark in the report questioned the value of mandatory mathematics for all ninth graders.
Some research with junior high school students involved the creation of an entirely new course. A long-term program reported by Broussard, Field and Reusswig (13) involved low achievers in three schools over a period of three years. The experimental treatment utilized filmstrips for drill, audio tape for individual lessons, and video tapes for teacher improvement. In addition, field trips, paid attendance for special Saturday classes, active participation of local business people, and desk calculators were utilized. After six months of the experimental treatment, the mean computational growth of the experimental classes was significantly higher than that of the control classes. After a full year, the experimental classes measured significantly higher in mathematical reasoning. Further, a higher percentage of those who had received the experimental treatment were enrolled in a mathematics course in high school, when compared to the students in the control group.

Another long-term study was conducted and reported by Devenny. Special courses were designed for junior high school underachievers which had very little stress in computational skills. At the end of a one year study with seventh graders, the experimental group and control group had increases in their computation and application measures. The differences were not significant, but the control group had a higher measure of computational ability, while the experimental group had more positive changes in attitude. The same classes from this study were used for an investigation of eighth grade underachievers. The experimental treatment again
consisted of a special non-computational course of instruction. At the end of the investigation, the students in the control group were more advanced in computational skills than those in the experimental group. For measures of mathematical concepts different from computation, the experimental group was generally higher than the control group—with some differences reaching statistical significance. Both groups had started the eighth grade with negative attitudes toward mathematics, in spite of what the measures had indicated at the end of the seventh grade. At the end of the eighth grade, the control group attitude measure was even more negative; the experimental attitude measure had become substantially positive.

Another course innovation was instituted by Easterday (39) in an investigation of seventh and eighth grade low achievers. The experimental treatment included instruction which blended units of modern mathematics into the traditional general mathematics course. No statistical comparison was reported, but the apparent success of the students in the course was very positive and encouraging.

A course innovation which has been recommended and investigated is that involving the pacing of the material. It has been proposed that the more "difficult" material might be learned by the slower students if it were presented at a more reasonable rate. Herriot (59) (60) investigated this proposal with a two-year study of modern mathematics for seventh and ninth grade slow learners. The control group studied arithmetic and algebra in a normal course lasting one year. The experimental group studied the same material in a course which ran for two years. An analysis of achievement
measures at the conclusion of the study determined that the experimental group did have a substantially higher mathematics achievement gain.

Several studies have reported on the effects of programed instruction with junior high school students. Holtan (68) varied mathematical applications as motivational vehicles with ninth grade low achievers. The stress of the programed instruction was geared to one of four application areas: 1) automobiles, 2) farming, 3) social utility, or 4) intellectual curiosity. The students were grouped according to their responses on an interest rating instrument. After two periods of instruction with the programed materials, no significant differences were discovered between the achievement of any two groups.

Jones (79) combined programed instruction with use of games and desk calculators in his investigation. After nine weeks of treatment, ninth grade low achievers had an achievement growth measure of one year.

Wiebe (161) studied the effects of programed instruction, teacher instruction, and reinforcement on ninth grade low achievers. Three different experimental groups received programed instruction for five days followed by a retention test after seven days. Treatment "A" consisted of a full class period of programed instruction followed by immediate reinforcement. Students receiving treatment "B" were taught for half a period by their teacher, and then worked on programed materials for the remaining part of the period with immediate
reinforcement. Treatment "C" was similar to "B" except that the reinforcement of the material studied was delayed until the succeeding day. A control group took the criterion test the same number of times as the experimental groups. The only difference which reached significance was the measure of the pre-test to post-test gain for treatment "B" when compared to the other groups. There were no significant differences between groups for the post-test to retention test measure.

Tanner (152) reported on the use of programmed materials by seventh grade low achievers for a full semester. While the control group studied a sixth grade textbook, the experimental group studied programmed materials judged to be at the fifth grade level. A measure of arithmetic fundamentals disclosed no significant differences between the two groups at the end of the investigation. Significant differences in favor of the control group were found in measures of arithmetic reasoning and problem solving ability.

A narrative approach for the learning of mathematics was developed and investigated by Nibbelink. (112) A fictitious historical account of the discovery of non-negative integers and the basic operations was used as a novel instructional vehicle for underachievers. For several achievement measures which were made, the only comparison reaching statistical significance was in the students' knowledge of arithmetic algorithms. The difference was in favor of the experimental group. The experimental approach was reported to be generally more enjoyable and easier for the students.
Computer-assisted instruction was used by Shaw (140) in a study of the influence of drill on the arithmetic achievement of low achievers. The experimental strategies used in the study were drill, drill with feedback, and mixed drill in both addition and subtraction. The statistical analysis was confounded when each of the treatments—including that of the control group—resulted in a significant achievement gain from pre-test to post-test. The investigator concluded that some factor other than that of the treatment may have been influencing the results.

Cech (23) found that ninth grade low achievers could compute better with a desk calculator than without, but that student attitude and computational skill were not increased following classroom use of the calculators.

As Sherer (141) studied the influence of tutors on elementary school students, Harrison (57) studied their influence on junior high school low ability students. Sixty-six students were tutored for one hour each day by a mathematically proficient high school junior or senior. After ten hours of tutoring, the experimental group scored significantly higher in achievement than the control group which had received no tutoring. Later measures at fifteen and twenty-five hours revealed differences which were no longer significant.

The role of discovery and teacher direction in the classroom was investigated by Maynard and Strickland. (101) Three experimental methods were used to teach low ability students in mathematics: 1) non-verbalized student discovery of principles and generalizations, 2) student-teacher development of principles and generalizations,
and 3) teacher statement and application of principles followed by student application. Female subjects generally achieved significantly better under the directed methods, but other differences—including all retention measures—were found to be non-significant.

Another investigation of student discovery was conducted by Kleckner (84) in a mathematics laboratory setting. After a year of experimental treatment, it was found that the control group achieved significantly higher on a test of general mathematics knowledge than the discovery-laboratory group.

The value of review lessons in multiplication was the objective of study in an investigation by Gibney. (53) After eight days of instruction, classes of seventh grade low achievers reviewed the material covered. The control group used the review techniques suggested in their textbook; the experimental group used specially prepared intensive review sheets. The difference between groups in pre-test to post-test gain was not found to be significant. After four weeks, a measure of delayed achievement was taken. A significant difference in favor of the experimental group for pre-test to retention test gain was reported.

The final report included in this survey of the research on the junior high school level is that made by Hughes and Nelson. (71) They investigated the effects of reward on high and low achieving ninth grade students. In taking a battery of tests, students in the experimental group were given a cash reward after a simulated evaluation of their answer sheets. No apparent effect due to the
reward was discovered by the analysis of the data. A conclusion made by the investigators was that the students probably felt they would still get the "reward" regardless of how good or how bad they did on the tests.

Research: Senior High School

The research studies reported for secondary school situations were very similar in nature to those conducted with junior high school students. Investigators looked at basic characteristics of the low achievers, as well as the effects of various learning situations on their achievement and attitude.

Beaton (5) studied a small group of college preparatory students classified as underachievers. She found, for underachievers, a high frequency of parents who disliked mathematics, along with a student attitude toward mathematics that was less favorable than that of average achievers.

The effects of competition on achievement in mathematics was investigated by Paulson. (120) Programed textbooks in algebra were used as the medium for instruction. One comparison was made between students grouped homogeneously and those grouped heterogeneously. A second comparison was made between students receiving an individual report of their progress and those whose performance was made public to all members of their group. Analysis of achievement at the conclusion of the treatment revealed that, in general: 1) homogeneous groups scored higher than heterogeneous groups, and 2) groups receiving public display of results interacted more, verbalized more, and scored higher than groups receiving private feedback.
Extra attention in how to read mathematical materials was the emphasis in a study made by Dramer. (38) After five months of instruction in reading mathematics, a small group of underachievers averaged more than seven months of mathematical growth. A favorable change in behavior and self-confidence was noted for these students as a result of the special course.

Programed materials in geometry were not found to be effective with secondary school students in a study conducted by Silberman. (142) This conclusion was made for over, normal, and under-achievers.

Another study of the use of calculators in the classroom was reported by Ellis and Corum. (43) The experimental treatment involved the use of calculators in a mathematics laboratory by secondary school low achievers. Measures of their achievement, attitude, and academic motivation revealed no significant differences when compared to a control group.

A study conducted by Burgess (15) investigated the regular usage of mathematical games by low achievers. It was hypothesized that motivation from games would result in improved attitudes without a sacrifice in achievement. After eight weeks of treatment, the attitude measure of the experimental group was significantly higher than that of the control group. A few significant differences in achievement measures were discovered—all favoring the control group.

A special project was designed by Bingham (10) in 1967 to improve the instruction of basic skills for low achievers. Multi-sensory aids were developed for an instructional unit dealing with fractions, ratio and proportion, and per cent. The design of these
aids permitted their usage in a classroom where individualized instruction was stressed. One method of instruction was provided by audio tape—designed for the "drill" phase of the unit and for explanation of difficult story problems. A second instructional technique included sets of slides with prepared audio tapes. The basic number operations were explained by these "packages;" practice sheets were included for the students to work on after the tapes had concluded. A third variety of instruction involved the viewing of a video tape while working with various manipulative materials.

The entire instructional unit included two audio tapes, thirteen tape/slide sets, and four video tapes. The materials were used in a one-week study with a small class of low achievers. No statistical comparison or analysis was made, although it was noted that the general classroom morale had increased.

Research: College

The only report found in the literature search for college research on the low achiever is the study by Block. (12) The problem investigated was the apparent dependence of success in collegiate mathematics upon an extensive reading ability and a thorough knowledge of English. It was found that programed instruction could be designed to provide a course which required only limited reading skills. After ten weeks of instruction with the special materials, the experimental group was found to have an achievement superior to a lecture-and-text control group. It was also observed that the experimental group progressed faster than the control group.
A discussion of the implications of this literature for this study will be made at the conclusion of this chapter.

Some Effects of Audiovisual Techniques on Learning

A General View

If the teaching profession can offer nothing better than the Cro-magnon habit of scribbling on the wall with a piece of rock, then the mass media of the outside world will have a greater effect than the teacher on the minds of the students who present themselves for instruction each morning. (7, 10)

This statement was made by an educator who has been "sold" on the educational value of audiovisual media. His view is perhaps a bit extreme, but his basic point is well taken. He seems convinced that the teachers of the twentieth century must maximize the benefits available in the presently known instructional technology if they are to be effective. This seems to be the view of many educators. The merit of the statement has not been fully accepted, however, for debate and research continues on the overall impact and value of classroom use of media.

Visual Learning

The study of the effects of educational media depends somewhat on the basic effects on the viewer of the visual presentation. This particular psychological aspect of instruction has been studied and discussed. In one such discussion by Gagne and Gropper, (51) it was noted that "possible outcomes resulting from the use of visual presentations are improved retention of what is learned, and as a somewhat related matter, improved transfer of learning to novel situations." (51, 23) It was felt that the visual presentation
might establish a visual image, rather than a verbal image, in the
memory. As evidence for the hypothesis, findings from summaries
of research made in 1950, 1960 and 1962 "have shown that gains
relatable to the use of visual presentations in many kinds of
learning tasks persist over periods of weeks and months." (51, 23)

Bending (7) theorized that a visual presentation combined with
a discussion of the presentation was better educationally than just
the visual presentation. He felt that the attention of the viewer
would be more concentrated, and memory would actually be prolonged.
(7, 106)

A different view has been expressed by McKeachie. (96) From
a review of the research literature, he concluded that:

visual materials may distract the students from
the verbal content upon which tests are usually
based. One's general conclusion would be that
any additional stimuli contribute to learning
only insofar as they have special cue value for
the learning desired. Presumed motivational values
of visual presentations may not be important in
the usual classroom learning situation. (96, 291-292)

In a report on the survey of audiovisual communication research
made by Allen, Campeau (18) noted that:

there is a dearth of research on the educational
value of pictorial illustration, and that what
little evidence has been reported amounts to a
few pro- and con- findings which contradict each
other. He suggests that there is a need to study
factors within pictorial illustration that lead
to increased learning, to identify the kinds of
content best communicated by still pictures, and
to evaluate various techniques for implementing
their use. (18, 130)
From these references, it appears that the effects of visualization on learning are subject to debate—and further research.

Research and Surveys

Examples of reviews of audiovisual research are those reported by: Allen, (1) Campeau, (18) Edling, (41) Hoban and van Ormer, (66) the Department of Audiovisual Instruction of the National Education Association, (109) Popham and Sadnavitch, (123) Rossi and Biddle, (134) Samuels, (136) and Wendt and Butts. (159)

Three of these reviews were restricted to specific areas of media utilization. Samuels reported on what was known about the use of pictures in teaching. A conclusion from the survey was that research did not show whether the use of pictures helped or hindered the educational processes. (136, 405) Hoban and van Ormer reviewed the film research which had been conducted in the period 1918-1950. From this research, the investigators compiled a list of favorable instructional techniques in film usage. The techniques which seem to have most frequently had a positive effect were 1) repetition, and 2) participation or practice of the relevant behavior. (109, 128) Popham and Sadnavitch reported on state-wide usage studies of science films. From investigations conducted in Kansas, Utah, and Wisconsin, no conclusive results were obtained. (123)

The other six reviews were more comprehensive—reporting on several areas of audiovisual research. Organizations backing these reviews include the Department of Audiovisual Instruction (DAVI) of the National Education Association, the ERIC Clearinghouse on Educational Media and Technology, the American Educational Research
Association, and the Center for Research and Evaluation in Applications of Technology in Education. The reader is invited to investigate these references (1) (18) (41) (109) (134) (159) for a more thorough discussion of this research.

Two studies have been located which look primarily at the effects of audiovisual applications on the teacher, rather than on the students. A survey by Battelle Memorial Institute (3) found that the classroom use of audiovisual materials was generally not an integrated part of the course or curriculum. "In addition, the respondents often said that the teachers are not adequately trained in the use of audiovisuals or do not have a favorable attitude toward audiovisuals." (3, 9) The presence of a negative attitude on the part of the teachers was also reported by Tobias. (155) He found that teachers felt threatened by aspects of instructional technology which had a connotation of automation—with the corresponding sense of "replacement."

Some studies have reported on the use of pictures in the classroom. A review of research by McNeil and Keisler (121) noted that "students who were required to make oral responses about the pictures learned significantly more than students who were simply asked to think about their answers." (121, 17) Spaulding (145) made the generalizations that:

1. Illustrations are an effective interest-getting device.
2. Illustrations help the reader interpret and remember the content of the accompanying text material. (145, 43)
There was a tendency for the students to lose interest in the instruction when "a) the picture treated a subject about which the respondent knew nothing or in which he was not interested, and when b) the picture was vague as to content or action." (145, 39)

A report of two research studies on the use of color or black-and-white films revealed no specific benefit for either kind. A study with fifth and ninth grade students conducted by Lumsdaine showed no significant differences in achievement or student interest. (28, 4) A study by Vander Meer conducted with ninth and tenth grade students showed no significant differences in achievement on a post-test or retention test.

A general statement about films and film research has been made by Hoban: (65)

The state-of-the-art of instructional films is bounded by a general opinion that a) in terms of "entertainment" (holding of attention, and arousing excitation, interest, and activity) they tend to be mediocre, b) in terms of equipment, reliability is not as high as desired, and c) logistical support is not adequate to insure availability of films when and where films are needed. (65, 6)

The preceding statement was made in 1971. More than twenty years previous to that, in 1949, Hoban had made some summary statements about the film research up to that date. He had noted the benefits of seeing movies and reading books on the same subject—the double exposure effect—and the great value of a pre-film introduction by the teacher. (64, 10-11) He predicted at that time that films would "have their greatest power to stimulate learning when they appear to present a great deal of new or novel material." (64, 12)
It appears that the research in the subsequent years did not support this prediction.

An investigation by Wendt and Butts (32) used a series of 54 films on world history with classes of tenth grade students. The control group covered the history course without the films in two semesters. The group that used the films completed the course in only one semester. A slight achievement difference in favor of the control group was not found to be significant.

A study of the Nebraska Film Program by Meierhenry (102) disclosed no specific support for either film use or traditional teaching. Experiments involving the use of films in history and science produced results which were: a) significantly in favor of the film groups in 18 cases, b) significantly in favor of the control groups in 13 cases, and c) not significantly different in 11 cases. (102, 160) It was noted that the film use appeared to correlate with heightened teacher imagination, more active class discussions, and a greater concern by teachers to be well-prepared. (102, 183)

A study of the use of films during a two-week chemistry unit was made by Nelson. (75) He reported significantly better achievement for the experimental group on both a post-test and a five-week retention test.

Ash and Carlton (114) investigated the influence of note-taking during filmed presentations. Two films were used with four groups of college freshmen. One group saw a film and immediately took a post-test. The second group was allowed to take notes during the showing of the film. The third group was allowed to study their
notes for ten minutes before taking the test. A fourth group served as a control group for the study and did not view the films. The test data ranked the first group over the third group, the third group over the second, and the second over the control group. (114, 5-6) It was concluded that note-taking while watching a film can interfere with the students' ability to learn from the film.

Three reports on the use of filmstrips have included a statement about the benefits of including planned and efficient discussions along with the filmstrip presentation. Twyford (47) noted this in studies of the classroom use of filmstrips in science. Diamond (37) reported it for seminars of introductory college courses in the humanities and social sciences. Huck (69) found it to be true when working with pre-service and in-service teacher orientations.

The use of the overhead projector in a college drafting course was investigated by Muns. (105) He used overhead visuals and a transparent "projection box" in the study of orthographic projection in a four-week study. No significant difference was reported between experimental and control groups on either a post-test or retention test.

Crosby (31) (118) studied the use of the overhead projector in a high school course in "machine design and strength of materials." Although there was no apparent difference in achievement between groups, the investigator reported that the experimental group covered the material faster, had better discussions and motivation, and exhibited an increased depth of learning. (118, 13)

Investigations in the application of a multi-media approach
have been made in the sciences. Fritz (49) developed 25 slide/tape units and 125 overhead transparency composites for use in a high school physics course. In addition, 39 films produced by the Physical Science Study Committee were included in the program. No significant differences were found in achievement or attitude between experimental and control groups after a one-year study.

The audiovisual-tutorial approach to instruction has been studied by both Lyon (93) and Maccini. (95) Both studies used film-loops, slides, realia, and other instructional materials in an earth science course for undergraduates. The audiovisual-tutorial instruction was provided when the students were at carrels studying independently. No comparison was made in either investigation between the students in the tutorial program and students receiving instruction by any other method. A comparison of pre-test and post-test measures did indicate that the students satisfactorily learned the content of the instruction.

Applications of Audiovisual Techniques to Mathematics

History

An historical survey produced by the author (151) designated the period of the Second World War as the apparent genesis of classroom use of projected visuals in mathematics. Educators in the field of mathematics began to notice the potential of visual media when the Armed Forces had such success with military training aids.

The first form of media to be used prominently in the teaching of mathematics was the motion picture. Hildebrandt (62) compiled
a list of those films which might be useful in the mathematics classroom. The general areas of the films included: geometry, advanced mathematics, teaching of mathematics, mathematics and art, architecture, nature, weights and measures, finance, physics, engineering and astronomy.

Official sanction of the potential of films was given by the National Council of Teachers of Mathematics in 1945. The Committee on Multi-Sensory Aids wrote in the 18th Yearbook of the NCTM:

Films are a valuable instrument for teaching mathematics. In their use mathematics is far behind the sciences. It is hoped that this type of visual aid to mathematics will be more fully developed in the near future. (29, 41)

In this "bible" of mathematical media, advice was given for the production and use of lantern slides, filmstrips, and motion pictures. A major portion of the publication dealt with the production and use of physical models, rather than with visual media.

In the period 1948-1954, Syer and Johnson published descriptions and appraisals of commercial films and filmstrips for the mathematics classroom. (151, 72) But when their series ended, there followed a period of five years in which essentially nothing was published in that area. This seems to be very strong evidence of the general lack of both interest and confidence at that time in visual approaches for teaching mathematics. The focus at the time was towards improving the quality of the mathematical and scientific preparation of the college-bound student. This apparently did not include the use of audiovisual methods.
The passing of the National Defense Education Act in 1958 made funds available for the utilization of new media of communication in the educational programs offered by the schools. When the schools had buying power, the commercial producers manufactured equipment and software. Large school systems, even cities, could afford to try out widespread use of films, filmstrips, overhead projectors, and other "experimental" media. Educators today can look back at the period and see one glaring mistake in the movement: the interests, training, and desires of the classroom teacher were largely ignored. The result was a frequent misuse or avoidance of instructional technology by the teachers.

Research: Films and Filmstrips

The compilations of research reports in mathematics by Suydam (148) (149) show relatively few studies at the secondary school level using audiovisual materials. For both volumes, a total of 8 references are listed which report on the production or use of films or filmstrips. There are no reports of research for other projected media. (148, 139-143) (149, 147-149)

A comprehensive investigation of the use of films and filmstrips in geometry was made by Johnson. (76) (77) (82) Fifteen experiments were run with classes studying circles and loci. The experimental classes used various combinations of films and filmstrips. The control group classes spent a comparable amount of time on discussion or studying. The results were, in general, inconclusive. The one area in which the results were consistently in favor of the experimental group was in retention of learning after using three
films and three filmstrips. (77, 367)

Three studies using films or filmstrips in classroom investigations were already described in the section on research for the low achiever. Hoefner (67) reported inconclusive results; Schilling (138) reported increased attention and less frustration; Broussard, Fields and Reusswig (13) reported a significant gain in computation skills.

The objective of the investigation by Tiemens (74) (154) was the improvement of student motivation. High school algebra students either: 1) saw films about the use of algebra in occupations, 2) read the same material in booklets, or 3) received no special experimental treatment. Analysis of a motivational inventory given before and after treatment revealed a significantly higher motivation gain for males seeing the films than for any other group.

Carpenter and Greenhill (19) compared the relative effectiveness of filmstrips in college algebra to programmed materials and television. No significant differences were found between teaching techniques or between pacing variations.

The achievement of junior college students taking college algebra was investigated by Banister. (2) The experimental group received supplementary multi-media lessons outside of the classroom. The achievement of the experimental group was significantly higher than that of the control group which did not get supplementary lessons.

Research: Slides and the Overhead Projector

The investigation of Bingham (10) which used slides and other media with low achievers has already been described. He reported
after a treatment period of five days that the general morale had increased.

A use of slides on the college level was reported by McNerney. (98) The experimental treatment utilized slides of pages from elementary school mathematics books with classes or prospective elementary school teachers. The measures of achievement and attitude were slightly in favor of the experimental group, but were not statistically significant.

Five investigations were located which utilized the overhead projector in mathematical studies. One involved the teaching of high school algebra—the others were in geometry.

Herschl (61) used the overhead projector for instruction in algebra for 18 weeks. At the end of the treatment, the class using the overhead had a non-significant advantage in achievement over the conventionally taught class.

Marshall (100) reported pre-test to post-test growth for students studying geometry with an overhead projector. The students reported that the work was easier to follow than the presentations of previous years.

Paige (119) matched the use of overhead visuals in an experimental group with the use of colored chalk in a control group. After studying perimeter, area and volume for 3 weeks, no significant differences were found.

Classroom verbalization was aided in a study of the overhead by Stafford, (146) but no statistical analysis was made.
Miller (104) compared the effectiveness of the overhead projector with that of a chalkboard presentation in a unit on lines and angles. The achievement of the experimental group on immediate quizzes and in-class assignments the following day was significantly better than that of the control group.

Research: Multiple Applications

Investigations by Twyford, (26) and Church, Brown and Twyford (27) have compared the relative effects of instruction by several media. During a one-year algebra course, the medium of instruction was varied. The students in the class were able to indicate electronically whether or not they felt they were learning anything during the class period. A record of the responses was kept at 30-second intervals. The mean positive response for each variety of media was: a) chalk-talk, 28%; b) overhead with grease pencil, 26%; c) overhead with visuals, 17%; d) lecture, 6-1/2%; and e) films, filmstrips and kinescopes, 2%. (27, 344)

Other References

The reader interested in further background information on the use of the overhead projector in the mathematics classroom is invited to read Osborne, (116) and Krulik and Kaufman. (86) Both would be useful to the classroom teacher or researcher for the design and use of overhead visuals.

The reader who is familiar with films and filmstrips in mathematics is invited to investigate a new commercial offering: set of slides for elementary school mathematics, algebra and geometry. (56) No information is available yet on their effectiveness in
The classroom, but they are worthy of study and evaluation.

The Teaching of Consumer Mathematics

History

The contemporary subject of consumer mathematics had its earliest beginnings in vocational training and the use of practical applications in arithmetic. When our society developed a need for a great number of workers in white-collar positions during the 1800's, secondary school courses in business education became available. The task of preparing students for specific business positions depended less and less on apprentice arrangements—it became a part of the school curriculum. Students in these business education programs worked with problem situations that could be expected to arise in everyday business: keeping ledgers, bookkeeping, accounting, profit and loss, finances, taxes, investments, commercial arithmetic, etc. Other students—those not in a business program—saw practical applications from "life situations" in their arithmetic textbooks.

Examples of textbooks for the serious student of bookkeeping, accounting, and the like, are those by Kitson (83) and Rosenberg. (131) The content of these textbooks included a few units which are seen today in a course for the consumer. The textbooks in their entirety would not be appropriate, however, for they are far too specialized. Kitson even indicated in his book that it was ideal for the serious business student. The mathematical content had been determined by an analysis of actual business processes. (83, 97)
Some problems arose in the teaching of commercial mathematics during the early 1900's which were discussed by Lomax. (91) He noted that business educators generally felt no real need for the offering of special courses in business mathematics, yet business officials were seriously displeased with the skills of graduates of business programs. "Why weren't the educators interested in educating?" The paradox might have occurred as the teaching specialities of business education became more and more narrowed. Teachers trained for subjects like accounting and shorthand were being assigned to classes of business arithmetic. Being poorly prepared for this in both content and method, these teachers were generally not enthusiastic and apparently did a poor job. (91, iii)

The situation was not much better from the mathematician's point of view. Trimble (157) wrote that the "functional" mathematics taught in the 1930's was supposed to "function" in everyday life. Topics from business (e.g., insurance, budgeting) were included in general mathematics courses with the feeling that all was satisfactory if a student happened to coincidently learn some mathematics on the side. Difficulties arose when teachers expected some mathematical concept like ratio to be mastered from a study of a business topic like insurance. This approach just was not effective. Trimble's conclusion was that the mathematics should be taught first; afterwards, it would be an easy task to apply it to topics of business. (157, 3)

The study of "social mathematics" for purposes of consumer education was an accepted idea during the 1930's. Material was
adopted from commercial mathematics programs which would be of value for the homeowner. The sample problems in the arithmetic and algebra textbooks turned more to realistic situations which were closer to the lives of the students. All of this was done within an overall educational movement to gear education to the important problems of real life.

Saidel (135) reported that most of the arithmetic of business was taught in grade 7 from the earliest graded courses of study until about 1925. After that, grade 8 became increasingly popular as the location for business arithmetic material. No apparent uniformity appeared in the placement of business material in the secondary school. It was reported to appear throughout grades 9 to 12. Saidel noted that the placement of the material most affected those who stayed in school: a late placement would not expose those who dropped out of school to the material.

To implement the ideas of consumer applications in the classroom, teacher educators felt that the public school teachers probably needed specialized training. Richtmeyer (127) reported on a survey made in 1935 of 209 secondary school teachers, 92 college mathematics department heads, and 17 curriculum specialists. It was the consensus of the group that prospective secondary school mathematics teachers should have a course in practical and social applications. As a result of the survey, an outline for such a course was prepared. It included such topics as: use of the slide rule, use of geometry in shop work, use of surveying instruments, applications to agriculture, compound interest and finances, statistics, home
economics applications, applications to the social sciences, and miscellaneous supplementary applications. (127, 51)

The momentum of the consumer education movement carried it through the years of World War II. Benz (8) reported that an appropriate course for some high school seniors was "Applied Arithmetic," which studied various consumer topics. Special publications were prepared for the teacher with details for implementing consumer education principles into each of the traditional subject areas. An example of these for mathematics is that produced by Risinger. (128) He suggested that "contemporary problems such as housing, food, clothing, conservation, war, unemployment, and the wise use of leisure time" were areas that should be included in the mathematics curriculum. (128, 4) A program which investigated these areas had been tested at the junior and senior high school levels. From this pilot program, a recommendation was made that most teachers would have to prepare their own units and worksheets. Very few good materials were found to be written especially for consumer mathematics. (128, 6) Another report of successful programs in the tenth through twelfth grades described functional courses entitled "Business Mathematics" and "Mathematics of Personal and Home Finance." (108, 17-19)

A survey conducted by Gager (50) investigated the feeling of the educational community towards the consumer mathematics curriculum. He stressed that there was a need for "the development of a mathematics course on the junior college level built to be interesting, useful, and of immediate as well as of permanent value to the students." (50, 5) To contribute to the welfare of most of
Gager felt that such a course should follow the guidelines described by the 1940 Joint Commission of the Mathematical Association of America, Inc., and the National Council of Teachers of Mathematics in their report "The Place of Mathematics in Secondary Education." That is, there should be in the "twelfth grade a course designed to acquaint the seniors with the quantitative approach to the problems of modern society," including budgets, installment buying, investing, insurance, taxes, and national policies. (50, 41)

A cross-section survey of 770 educators indicated approval of a course like this, with the following as the 10 most preferred topics:

1. savings
2. personal budgets
3. family budgets
4. interest on money
5. life insurance
6. thrift
7. income tax
8. banking
9. property tax
10. cash discount  (50, 74)

An evaluation of the consumer mathematics movement was made and published in reports from 1944-1947 by the Commission on Post-War Plans of the National Council of Teachers of Mathematics. "The commission recognized a need for courses in social mathematics, to ensure mathematical competency in everyday affairs." (117, 244) However, the commission reported that the headlong rush into the consumer education movement had introduced some basic errors:

1. Attempting to teach to completion in grades 7 and 8 topics for which the children are not ready.
2. The use of obsolete materials.
3. Too much computation, and failure to emphasize the social implications. (117, 245)

The solution for the problem seemed to be in the design and offering of separate courses at the junior and senior high school levels.

Another evaluative effort was the Consumer Education Study—initiated in 1942 with funds from the National Better Business Bureau. The National Council of Teachers of Mathematics prepared a report for this study which was similar to the report made by the commission. This report, "The Role of Mathematics in Consumer Education," reiterated the suitability of consumer topics for mathematics instruction, the apparent inadequacies of the teaching, and the three basic errors of the movement. "Applications to taxation, installment buying, banking, and investments are remote from the interests" of junior high school adolescents. (106, 74) To provide guidance for the design and operation of effective courses, the following nine points were discussed:

1. Establishing an atmosphere of optimism and vigor.
2. Striking the keynote of method: Learning by doing.
3. Tailoring the room to suit the purpose.
4. Enriching instruction with a variety of teaching materials.
5. Using realia.
6. Using community resources.
7. Blending the specific and the abstract.
8. Establishing a sound relationship with the organized consumer movement.

Examples of textbooks which might have been used in consumer courses are those by: Hindle and Feldman; (63) Huffman, Twiss and
Whale; (70) Joseph and Keiffer; (80) Kanzer and Schaaf; (81) Lennes and Sutton; (88) Leonhardy and Ely; (89) McMackin, Marsh and Baten; (97) and Marino and Fawcett. (99) The text by Lennes and Sutton made a strong issue of "the first and chief requirement of a course of this kind is unremitting drill on fundamental operations with integers, fractions, mixed numbers and decimals." (88, iii) It was also stated that the text followed "the seven cardinal features of a good textbook in mathematics: interest, simplicity, attractiveness, thoroughness, logical sequence, careful gradation, and practical applications." (88, iv) The textbook by Huffman, Twiss and Whale was "lesson-planned, with 133 daily units" and would "inspire students to greater achievements than they have ever experienced before in their study of the subject." (70, v) The only text which seemed to exhibit some awareness of the learning difficulties of slower students was that by Joseph and Keiffer. It was stated that an attempt had been made to adapt the content of the book to the students' level of interest and maturity, using numerous drawings and photographs, with printing done in two colors. (80, i) For the most part, the textbooks did not reflect the nine points laid down by the Council.

The stress during the 1950's was towards the teaching of the college preparatory subjects, rather than those having special benefit for the consumer. The status of consumer mathematics courses sank considerably during that time, but has made a gradual comeback.

"Increasing emphasis upon consumer and homemaking education may
be expected during the 1970's," wrote Gorman and Magisos (54, 3) in a survey of consumer education. In making their prediction, they detected a need for internal management within the family, a growth in the number of discerning buyers, and a special yearning within the population for knowledge about financial decision-making.

Many new textbooks have appeared within the past few years for use in consumer mathematics classes. Their abundance probably reflects the accuracy of the prediction made by Gorman and Magisos. Examples of those published from 1965 to 1970 include textbooks by: Hart, Schult and Irvin; (58) Piper and Gruber; (122) Price, Musselman, Hall and Weeks; (124) Rosenberg and Lewis; (132) and Wilhelms, Heimerl and Jelley. (163) Some of those published since 1970 are: Brown, Simon and Snader; (14) Kravitz and Brant; (85) Lankford and Goe; (87) and Lewis. (90) A comparison of these recent textbooks with those used before 1965 shows considerably more discussion of the social implications of consumer mathematics.

Research

A relatively small number of investigations have been reported which have a bearing on a secondary school course in consumer mathematics. Those that were located were primarily investigations of a business or vocational arithmetic class.

When business officials reported dissatisfaction with graduates of commercial programs, Cassiday (21) (22) surveyed the textbooks used in a majority of such courses. He found that the items necessary for a worthwhile commercial mathematics course were for
the most part included within the textbooks. The conclusion from this study was that even adequate and satisfactory textbooks could not guarantee a competent graduate.

Hantjis (55) has surveyed the graduates themselves, rather than the textbooks. He investigated the kinds of errors made by students who had just completed a senior high school business arithmetic course. The greatest frequency of errors occurred in computational problems; the second largest represented a lack of knowledge of the subject. He concluded that the business arithmetic courses were not effective in their instruction.

Gamble (52) studied the effectiveness of business arithmetic courses as a function of their grade placement: ninth, tenth, eleventh, or twelfth. In a study of over 700 students, he found that the greatest gain from pre-test to post-test occurred with business arithmetic students in the ninth grade. All groups achieved poorly, however. A pattern reported by Gamble was that the mean number of correct answers was close to one-half of the mean number of problems attempted.

Eirich (42) compared the business mathematics achievement of students who had completed a course in business mathematics, algebra, or general mathematics. He reported that the achievement in business mathematics was significantly higher for business mathematics students than for that of either of the other two groups.

The influence of student attitude on probable mastery of commercial arithmetic was investigated by Billig. (9) From the application of a scale developed through an analysis of written
essays, Billig concluded that attitude was a significant factor. Tener (153) studied the effect of mode of presentation on business mathematics students over four months. One course was taught in essentially a verbal manner, a second was basically computational, while a third treatment was a combination of the first two. Each technique produced measured gains in computation and verbal problem solving ability, but there were no significant differences between methods.

**Instructional Materials Guides**

To assist the teachers in the use of consumer mathematics textbooks and in the production of instructional units, some agencies have produced general outlines and guides. Noteworthy examples are those of the North Carolina State Department of Public Instruction, (113) Rogler, (130) and Winget. (164) These materials include practical applications, review exercises, practice problems, and references to instructional aids.

Other examples of supplementary guides to consumer mathematics are the annotated bibliography (166) produced for the President's Committee on Consumer Interests, and the annotated bibliography of audiovisual materials prepared by Oppenheim. (115)

**Insurance and Media**

Since the investigation under consideration involves the use of a visual medium in the teaching of insurance, this section will review what is commercially available to the teacher in that area.

The bibliography of Oppenheim (115) included 1 filmstrip and 1 movie which present information about insurance. The teaching
guide of the North Carolina State Department of Public Instruction (113) includes 6 films which could be used in an insurance unit.

The instructional materials index of the Westinghouse Learning Corporation (160) shows the availability of 5 filmstrips, 6 films, and 5 transparency sets which deal with insurance. A bibliographical file of audiovisual materials compiled by Raab (125) includes 3 of the 5 filmstrips in the Westinghouse list.

The quantity of visual materials for insurance instruction which are commercially available takes greater meaning when compared to data for other areas of mathematics. The materials file developed by Raab will be used as a reference for the comparison. The figures are included in Table 1.

Table 1
Approximate Number of Commercial Audiovisual Materials in Selected Mathematical Areas

<table>
<thead>
<tr>
<th></th>
<th>All Areas of Mathematics</th>
<th>Algebra</th>
<th>Trigonometry</th>
<th>Business</th>
<th>Insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>films and film-loops</td>
<td>900</td>
<td>300</td>
<td>23</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>filmstrips</td>
<td>1400</td>
<td>300</td>
<td>7</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>videotapes</td>
<td>1200</td>
<td>430</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>transparencies</td>
<td>1500</td>
<td>400</td>
<td>135</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
It is apparent from the figures that not all the films, filmstrips, and transparencies in the other references were included in the materials file of Raab. Regardless, even if they were included, the paucity of commercial materials for use by the consumer mathematics teacher is clear. Until the commercial producers make more materials available, the teachers will have to rely on their own creativity—or do without.

**Implications of this Literature for this Study**

The review of the literature presented in this chapter has disclosed no previous investigation similar to the one under consideration. That is, no study involving both the use of a projected visual media and the teaching of low achieving consumer mathematics students was discovered. In fact, there were no studies at all which involved classes working entirely on a contemporary version of the topic of consumer mathematics.

Studies which were most closely related to this investigation involved a media which did not replace the function of the classroom teacher. Those which utilized filmstrips were investigations by: Diamond, (37) Twyford, (47) and Huck. (69) Studies which utilized the overhead projector were those by: Muns, (105) Crosby, (118) Herschl, (61) Marshall, (100) Paige, (119) Stafford, (146) and Miller. (104) The only applicable study which used slides and allowed for class discussion was that by McNerney. (98)

The basic observations and conjectures reported in the literature which have a significant bearing on this investigation are included in the following list. The references are made to
investigations which included that specific observation or conjecture.

About low achieving students:

A. likely to have reading difficulties (12) (38) (78) (133) (156)
B. have a fear of mathematics (143) (156)
C. have a low attitude towards mathematics (5) (15)
D. have a generally low motivation (34) (156)
E. high motivation is critical for success (48) (144)
F. have a short interest span (48) (156)
G. have a high rate of absence (156)
H. work best in homogeneous grouping (120)
I. have trouble following directions (156)
J. have a low vitality (133)
K. more frequently male than female (144)
L. need a slower instructional pace (60) (147) (150)
M. need to see practical value in mathematics (129) (156)
N. benefit from audiovisual techniques (10) (138) (156) (165)
O. have fewer adjustment disorders in senior high school than in junior high school (144)

About audiovisual techniques:

P. visual presentations might aid retention (51) (77) (145)
Q. practice the activities presented visually (109)
R. include discussion with the visual presentation (7) (37) (47) (69) (102) (109) (118) (121) (134)
S. use media which do not replace the classroom teacher (134) (155)

These observations and conjectures were used to guide the design of
the investigation under consideration.

This completes the review of the related literature. The next chapter will describe the instructional materials which were used in the investigation: the insurance unit outline, the set of slides, the worksheets, and the evaluation instruments. Details are given regarding background information and the design of each of the components.
CHAPTER III

INSTRUCTIONAL MATERIALS DEVELOPMENT

The previous chapters have described briefly the problem under consideration and the literature pertinent to that problem. From a literature search conducted by the investigator, a list was compiled of observations and conjectures which might have a significant bearing on the investigation. This list included 15 items related to the low achiever and the teaching of the low achiever, and 4 items regarding audiovisual techniques.

This chapter presents a description of the instructional materials used in this investigation: the insurance unit outline, the set of slides, the worksheets, and the evaluation instruments. Details are given regarding background information and the design of each of the components.

Content of the Insurance Unit

The secondary school mathematics course in the Columbus Public Schools which normally included the study of insurance was entitled "Applied Mathematics." The course was originally called "High School Mathematics" (see Appendix A) when it was first offered during the 1969-1970 school year. It was designed for students who had experienced previous difficulties in general mathematics courses.

61
The basic format of the course was organized around the mathematics of daily living situations—what could be called "consumer mathematics."

The textbook adopted for this course was Mathematics in Daily Use, by Hart, Schult and Irvin. (58) The mathematical content of the book was primarily arithmetic, but there was some material from intuitive geometry and elementary algebra. Each of the 12 chapters included a chapter preview that was "illustrated on the opposite page," (58, vi) instruction, practice problems, chapter reviews and chapter tests. Some of the chapters included sets of cumulative problems and diagnostic tests. The table of contents listed:

1. Mathematics Used at Home and in School; Whole Numbers
2. Mathematics Used in Home and Business Problems; Fractions
3. Mathematics Used in Science and Business; Decimals
4. Mathematics Used in Vocational Problems; Measurement
5. Mathematics Used in Comparing Numbers; Percentage
6. Mathematics Used in Presenting Statistics; Graphs
7. Protecting Family Income
8. Community Activities
9. Business Activities
10. Introduction to Algebra
11. Signed Numbers Used in Expressions and Equations
12. Introduction to Geometry (58, ix)

It is seen in the previous list that "insurance" was not the topic of an entire chapter. Most of the insurance applications were contained in chapter 7: Protecting Family Income. The basic composition of the chapter was as follows: the family budget, comparative pricing, the cost of electricity, installment buying,
automobile insurance, cost of owning an automobile, home ownership, savings bonds, fire insurance, and life insurance. A brief discussion of disability insurance was presented in the following chapter.

Before the instructional unit was designed, the investigator conferred with two teachers who had taught the course the previous year. Both of the teachers indicated to the investigator that the textbook presentation of insurance was very inadequate. They also indicated that an instructional unit on insurance which was accurate, thorough, and designed for the low achievers in the classroom would be well-received by the teachers of Applied Mathematics.

To construct such a unit, eight other recent textbooks in the area of consumer mathematics were surveyed. (14) (85) (87) (90) (122) (124) (132) (163) The survey revealed that each included material on automobile insurance, insurance for the renter or homeowner, and life insurance. Some also included information on probability, health insurance, disability insurance, and unemployment insurance. Where the textbook used in the Applied Mathematics course had used 3 pages to cover automobile insurance, 3 for fire insurance, and 4 for life insurance, some of the other textbooks had included an entire chapter on each of these areas. The arithmetic averages for the 3 basic areas of insurance for these texts were between 10 and 12 pages.

The content of the insurance unit for the investigation was determined by a survey of the eight references mentioned above. It
was decided by the investigator that the unit would be a thorough study of: insurance principles, insurance for the renter or homeowner, automobile insurance, and life insurance. Further details for the unit were obtained from materials supplied by the following organizations: Ohio Insurance Institute (Columbus, Ohio); Insurance Information Institute (New York, N.Y.); Institute of Life Insurance (New York, N.Y.); Columbus Fire Prevention Bureau; Columbus Police Department, Bureau of Detectives; and several of the major automobile insurance agencies in Columbus. The final insurance unit outline used by the participating teachers is presented in Appendix B.

A summary of the major sections within the unit outline includes:

I. Introduction to Insurance
   A. Meaning of Insurance
   B. Principles of Insurance

II. Insurance for the Renter

III. Insurance for the Homeowner
   A. Homeowner's Policies
   B. Insurance Needs
   C. Insurance Coverage and Protection
   D. Indemnity and Premium Problems

IV. Auto Insurance I
   A. State Financial Responsibility Law
   B. Automobile Accidents
   C. Accident Costs
   D. Liability Insurance
   E. Factors Affecting Premium

V. Auto Insurance II
   A. Collision Insurance
   B. Comprehensive Insurance
   C. Factors Affecting Rates
VI. Auto Insurance III
A. Uninsured Motorist
B. Towing Insurance
C. No-Fault Insurance
D. Reducing Your Premium

VII. Life Insurance
A. Introduction
B. Term Insurance
C. Whole-Life or Straight-Life Insurance
D. Limited-Payment Life Insurance
E. Endowment Insurance

The unit outline was judged to be a thorough coverage of insurance principles by 3 secondary school teachers who had previously taught a consumer mathematics course.

Production of the Slides

Once the content of the insurance unit was determined, the investigator surveyed the unit outline for subject matter which could be presented visually. As it turned out, the study of insurance was found to involve real situations, examples which were real objects, and principles which could be elucidated through the use of visual media. A frame home was compared to a brick home in a discussion of fire risk; insurance for a plane trip was shown as an example for term life insurance; two cars side-by-side exhibited characteristics which determined the cost of comprehensive and collision automobile insurance. It appeared to the investigator that the production of a visual presentation of insurance principles and concepts was a realistic objective.

At this point in the planning, the medium for the investigation could have been either overhead projector visuals, filmstrips, or slides. It was determined that the production of overhead visuals
would have been financially prohibitive. The investigator decided that a drawing of a house or an automobile would not have had the same effect as a photograph of the real object. And a "slide" the size of an overhead visual would have been fantastically expensive. The production of filmstrips would have been an exacting chore, requiring either: a) the exposure of each frame of the camera film in the exact sequence of the required filmstrip with a special half-frame camera, or b) the use of special copying equipment, once all of the shots were in slide-form. This, too, was ruled out as a choice primarily because of finances. The medium selected for the investigation was therefore chosen to be photographic slides. This medium was within the production capabilities of the investigator.

A thorough planning of the set of slides was aided by a procedure described in a Kodak publication, Producing Slides and Filmstrips. (40) The sequence of the instruction gradually improved as the insurance material was transferred to "planningcards." "With the cards in place, the planningboard shows at a glance the continuity of the presentation and how the narrative ties in with the visuals." (40, 8)

The finished product was the design for a set of 142 slides. A classification of the slides put them into the following categories: a) 47 were pictures of real objects that could be immediately identified—realia; b) 29 were verbal in nature, expressing some ideas in words; c) 15 were numerical problems which were worked as examples; d) 2 were numerical problems which had to be completed by the viewer; e) 13 were charts or graphs; and f) 36 were tables
of numerical values. The classification is provided in detail in Appendix C.

The verbal slides—titles, definitions, brief explanations—were all lettered by the investigator on poster-board. The background was either red, blue, green or yellow; the lettering was black or white, or a combination of the two. Some of the black lettering was done with a Leroy mechanical lettering set. The other lettering, both black and white, was done with "Para-tipe" dry-transfer letters. Letters were used with measures of 18 pt. through 72 pt. The numerical problems were produced in a similar manner.

A few of the charts were taken directly from educational materials provided by the Insurance Information Institute. The graphs and other charts were drawn with pen-and-ink by the investigator on appropriate graph paper. Some of the tables used were those presented in insurance rating materials; others were typed on white paper with a "Primary Typewriter."

The actual photography was done during the autumn months of 1971. All slides were taken in natural light with Kodak "Kodachrome II" film. No filters, photolamps, or high speed film was used. The camera body was the "T.L.S." single-lens reflex 35 mm. camera sold by Sears, Roebuck and Co. Special features included a CdS through-the-lens exposure meter, and shutter speed to 1/1000 sec. Most of the slides of realia were taken with a Ricoh f:1.4 55 mm. automatic lens on the camera body. Wide-angle shots and all of the close-up copy work were taken with a Novoflex f:3.5 35 mm. macro-wide angle lens on the camera body. The greatest magnification
was achieved in the copying of a chart which measured approximately 35 mm. by 45 mm. The slides were all processed in the normal manner, and were returned in cardboard 2-by-2-inch mounts.

At least 3 exposures were made of each picture—using the same camera settings. The investigator had determined that 2 complete sets of slides would be an adequate quantity for circulation among the schools. This figure was determined by a compromise between experimental control of "treatment time" and production expense. In addition, 1 complete set was needed as a master and would not circulate. The 3 sets of 142 slides were completed with very few "re-takes." The 2 sets for circulation among the classes in the experimental group were all numbered and placed into Kodak "Carousel" slide trays.

A script was prepared to aid the teachers in the use of the slides. The script included: a) a descriptive name for each slide, b) some explanation of the content behind the picture, and c) some ideas for class discussions. The script is presented in Appendix D.

The set of insurance slides was judged to be a valuable asset to the teaching of insurance by: several secondary school teachers, the Mathematics Supervisor of the Columbus Public Schools, and the Director of Information of the Ohio Insurance Institute.

Production of the Worksheets

The review of the literature made in the previous chapter included statements about the worth of practice and active participation after instruction. It was also pointed out that low achievers need a change of pace during instruction, because of their short interest
span. In an attempt to satisfy both of these principles, worksheets were included as an important part of the instructional unit. These worksheets were given to the participating teachers for use in their classes. No attempt was made by the investigator to judge the work done by the students on these sheets.

The first handout sheet was the "Insurance Vocabulary" list. (See Appendix E) This was not a worksheet, but a list of 25 terms which were used in the study of insurance. Each term was followed by a brief, informal "definition." The vocabulary list was produced as a result of the pilot study (described in Chapter IV). The participating teacher in the pilot study suggested that the students would benefit if they had a vocabulary list for review and study purposes. Some of the participating teachers in the investigation utilized the sheet as a base for spelling and vocabulary drills and quizzes, and for a review of the unit.

The "Fire Insurance Worksheet" (See Appendix F) was designed to follow instruction in figuring the indemnity and insurance premium for various home situations. All four basic arithmetic operations were necessary to complete the sheet. The student also needed to be able to read a numerical table. Several of the problems were designed to reinforce the instructional ideas presented regarding: a) the relationship of the indemnity to the fire loss and face value of the policy, and b) the benefit of buying an extended policy over several one-year policies. The last problem could have been the stimulus for a discussion of "alternate methods of solution," or possibly
"the distributive property of multiplication."

The "Sample Application: Automobile Insurance" (See Appendix G) worksheet was patterned after an actual insurance form. It was used by the students in the premium determination for any driver and any automobile. The rate tables necessary for completion of the form were projected on the screen. Students needed to add and multiply correctly to complete the form. Since the teachers in the control group did not have the slides showing the rate tables, a special handout, "Automobile Insurance Rates," was prepared for them. (See Appendix H) The material presented in this handout was the same as that shown in the slides. Lists of "driver factors" and "basic premiums" were made available for the students in the control group. The numerical values for the automobile insurance rates were accurate and up-to-date; a complete "salesman's rate book" was provided by one of the major insurance companies in Columbus for use by the investigator.

The worksheet for life insurance consisted of 2 parts: the "Life Insurance Worksheet" itself, and the supporting table of "Annual Premiums." (See Appendix I) Most of the worksheet required the use of multiplication, once a figure had been located in the premium table; a small amount of subtracting was also needed. The problems were designed to reinforce: 1) the specific characteristics of the 4 basic kinds of life insurance policies, and 2) the extra expense of making "more frequent than annual" premium payments. The rates for life insurance premiums in the table were fictitious, but were similar to those presented in a current consumer mathematics
textbook.

The last handout described in this section is the "Answer Key for Worksheets." (See Appendix J) This sheet was given to the participating teachers, and contained the correct solutions to the problems on the fire and life insurance worksheets. Since the automobile insurance worksheet was applicable for any situation, there was no common "right" answer.

Development of the Evaluation Instruments

The evaluation instruments described in this section include the objective tests developed by the investigator, and the teacher questionnaire.

Objective Tests

The development of the objective tests involved a compromise between research findings and practicality. In the literature review presented in Chapter II, it was noted that low achievers generally had reading difficulties. To compensate for that, a written test could have been constructed by the investigator which used only an elementary school vocabulary. To do that, however, would have prohibited the use of most of the terms which were fundamental to the study of insurance: they just weren't included in the vocabulary of the elementary school student. A second alternative would have been the administration of an oral test of insurance knowledge. This possibility would have been impractical. In a study of this size, such a test could not have been administered to several hundred students by either the investigator or the participating teachers.
The conclusion from these considerations was to construct instruments which were: objective, accurate in their use of vocabulary, did not insult the reading ability of most of the students, yet could be understood with relative ease by a high majority of the students. These objectives governed the writing of the questions used on the evaluation instruments.

Questions

An analysis of characteristics of questions which was made by Sanders (137) led to the construction of a "Taxonomy of Questions." This taxonomy was built on the basic ideas about educational objectives which had been explored and classified by Bloom. An outline of the taxonomy with some brief background notes is presented below:

Memory—requires the student to recognize or recall information.
Translation—requires the student to change an idea or information into a different symbolic form or language.
Interpretation—requires the student to relate facts, generalizations, definitions, values, and skills (e.g., comparison, implication, induction, examples, relationship of numbers, cause and effect).
Application—requires the student to solve a lifelike problem that requires the identification of the issue and the selection and use of appropriate generalizations.
Analysis—requires the student to solve a problem in the light of conscious knowledge of the reasoning processes.
Synthesis—requires original, creative thinking in the solution of a problem.

Evaluation—requires the student to make a judgment of good or bad. (137, 19-154)

In a discussion of these question categories with several mathematics teachers, it was stressed that low achievers and low ability students have a marked difficulty when attempting to solve questions of the last three types. For that reason, the decision was made to construct questions which were strictly in the first four categories: Memory, Translation, Interpretation, and Application.

The Post-Test

Facilities were available to the investigator for evaluating special answer sheets by matching. These sheets had spaces for the answers of 160 questions, with 5 options available in each question. They could be used for either a multiple-choice instrument, or a true-false instrument. To maximize the reliability of the measurement, the investigator constructed a multiple-choice instrument to be used as the post-test.

The suggestions of Sanders (137) for short-answer questions were followed in constructing the multiple-choice items:

A. Include at least four options, but do not use obviously phony ones.
B. Use "None of the above" or "All of the above" as a final option when appropriate.
C. Include enough questions to raise reliability.
D. Keep all options grammatically consistent. (137, 165)
The multiple-choice post-test used in the pilot study is included in Appendix K. The answer frequency of the 15 students who participated in the pilot study is included on the post-test; the correct alternative is indicated by underlining. The summary of test statistics from the administration of this instrument is included in Appendix L.

The 50 questions of the pilot study post-test were categorized in the following manner: 1) general principles of insurance, 11 questions; 2) insurance for the renter or homeowner, 8 questions; 3) automobile insurance, 16 questions; and 4) life insurance, 15 questions. The 50 questions were written on cards and placed into 4 "category bowls." Questions were selected randomly from each bowl, with each bowl being used in sequence, until bowl "2" was exhausted. The procedure was applied to the remaining bowls until all of the questions had been selected. The resulting post-test had the questions arranged in a repeating categorical sequence which started: 1, 2, 3, 4, 1, 2, 3, 4, 1, 2, ... In this manner, a student who could not complete the instrument in the allotted time would have been exposed to questions in all 4 categories.

The choice for the correct alternative was distributed over the 5 options a - e in the following manner: "a" was the correct choice for 10 questions, "b" was the correct choice for 10 questions, "c" was the correct choice for 9 questions, "d" was the correct choice for 12 questions, and "e" was the correct choice for 9 questions. The sequence of letters for the correct answer was also determined by a random draw ... except for a few questions
of the "All of these" variety which had to have an "e" option.

For reasons explained in Chapter IV, the post-test used in the actual study was reduced to 40 questions. Eleven of the original questions were dropped; one new question was written; and several of the other questions had minor changes in phrasing or alternate choices.

The post-test used in the investigation is presented in Appendix M. The answer frequency of the students who participated in the investigation is included on the post-test; the correct alternative is indicated by underlining. The summary of test statistics for the administration of this instrument is included in Appendix N.

The order of the questions in the post-test was basically the same as that used in the pilot study. The 40 questions were categorized in the following manner: 1) general principles of insurance, 8 questions; 2) insurance for the renter or homeowner, 9 questions; 3) automobile insurance, 12 questions; and 4) life insurance, 11 questions. Each of the options, a - e, was used as the correct choice for 8 questions.

An analysis by the investigator of the questions in the post-test revealed the following: 17 items were questions of memory, 12 items were questions of interpretation, and 11 items were questions of application. It should be further noted that 15 of the 40 questions were directly associated with a visual presentation made by one of the slides, and 11 of the 40 questions required the student to complete a pencil-and-paper computation.
The Retention Test

The retention test used by the investigator for a delayed measure of achievement was a true-false test with 18 statements. In constructing these statements, the investigator referred to Sanders' (137) suggestions for true-false questions:

A. Remember, the law of averages enters heavily into the score on these questions; so include enough items to establish reliability.
B. Do not overuse superlatives as they usually indicate the answer is false.
C. Do not yield to the temptation of making true questions consistently longer than false questions. (137, 164-165)

The retention test is included in Appendix 0.

The retention test included 6 items on each of the 3 areas of insurance studied in the unit. There were an equal number of true and false answers on the test, with the ordering of the questions determined by a random selection.

Of the 18 test items, 10 were directly associated with a visual presentation made by one of the slides. All of the test items were "memory" or "interpretation" in nature; none asked for the pencil-and-paper solution of a numerical problem.

The retention test was not designed for "machine scoring." It was a one-page test, intended to be included in a one-period examination with other sheets prepared by the classroom teacher. The retention test was hand-scored by the investigator.

The Teacher Questionnaire

The "Teacher Questionnaire" was designed to gather information from the participating teachers about 4 variables: 1) the topics
covered in the insurance instruction, 2) the length of time spent on the unit, 3) the strengths and weaknesses of the unit as noticed by the teacher, and 4) the changes which took place in the teachers and students as a result of the insurance instruction.

It was important to get a survey of the topics included by the teachers in their instruction to judge the "equivalence" of the control and experimental treatments. A list of 36 items was constructed as a sampling of the major content within the unit. The teachers responded to each of these items by marking: a) did not include, b) briefly mentioned, or c) discussed thoroughly. As these categories represented relative judgments, the instrument could only serve to detect gross differences between treatments.

"Student attitude" was determined by the remarks of the teachers on the appropriate "change or lack of change" section of the questionnaire.

The responses to "student attitude" and the other items of this part of the questionnaire are included in Appendix Q.

This concludes the discussion of the instructional materials developed for this investigation. The results from the administration of the evaluation instruments are presented in Chapter V. The next chapter, Chapter IV, discusses the research design of the investigation. Some details about the experimental procedures and population are also presented.
CHAPTER IV

RESEARCH DESIGN, PROCEDURES AND POPULATION

The previous chapters have briefly described the problem under consideration, the literature pertinent to that problem, and the instructional materials developed for the investigation.

This chapter includes the experimental design incorporated into this study for purposes of statistical analysis, along with the experimental hypotheses to be tested. A description is made of the pilot study undertaken as a trial of the materials and the modifications which resulted from this trial. The last sections of the chapter provide details regarding the selection of the participants and some of the logistics of the experimental trial.

**Experimental Design**

The experimental design for this investigation was basically a post-test-only control group one. A modification was made to include a retention test. This design was described by Campbell and Stanley (17) as one of three true experimental designs recommended for educational research. (17, 13) The symbolic arrangement presented by the authors for the basic experimental design was:

\[
\begin{align*}
R & \times 0_1 \\
R & \quad 0_2
\end{align*}
\]

where:
a) "R" indicates that the selection of subjects for the experimental and control treatment was made randomly;
b) "X" indicates the experimental treatment; and
c) "O_1" and "O_2" indicate the post-test measure taken from the experimental and control group, respectively.

The authors stressed that the comparison indicated by the symbolic arrangement of "X" with "no X" was an oversimplification. The comparison is actually with the specific activities of the control group which have filled the time period corresponding to that in which the experimental group receives the X. Thus the comparison might better be between X_1 and X_c, or between X_1 and X_0, or X_1 and X_2. (17, 13)

Bearing this in mind, a more accurate symbol for the experimental design—including the addition of a retention test—was:

\[
\begin{array}{cccc}
R & X_1 & O_1 & O_{r1} \\
R & X_2 & O_2 & O_{r2} \\
\end{array}
\]

X_1—the experimental treatment
X_2—the control treatment
O_1—the measure of post-test achievement of the experimental group
O_2—the measure of post-test achievement of the control group
O_{r1}—the measure of achievement on a retention test for the experimental group
O_{r2}—the measure of achievement on a retention test for the control group.

It must be pointed out at this time that the indication of random selection, "R," was not a true description of the situation.
It was not practical for the investigator to collect a list of classes which could be used in the study and randomly assign them to treatment groups. To conduct the study, the investigator needed the cooperation of the teachers in the schools. To gain this cooperation, the preferences of the teachers were taken, and influenced the assignments made for the classes to the treatment groups. (This is described in more detail in "Contact and Selection Procedures," a later section of this chapter.) This sacrifice of randomness of assignment was a primary weakness in the design.

It was decided to use this design rather than a "pre-test, post-test" design before the investigation began. The rationale of the investigator for making this decision to not include a pre-test was based on the following suspicions:

1) a test on material which had not been studied by the students would probably not have been received favorably by them;
2) a test which did not "count for the grade" would probably not have been a reliable measurement of the students' knowledge;
3) some participating teachers might not have allowed the loss of a class period for just "experimental design" reasons.

The students who participated in the experiment had all taken a battery of tests during their sophomore year of high school. For most of the participants, this had occurred during the month of November in 1971— at least 3 months prior to the investigation. The particular instrument used by the Columbus Public Schools was "Form Q, Level 4" of the Comprehensive Tests of Basic Skills. (30)
This test examined: 1) vocabulary, 2) reading comprehension, 3) language mechanics, 4) language expression, 5) spelling, 6) arithmetic computation, 7) arithmetic concepts, 8) arithmetic applications, 9) use of reference materials, and 10) use of graphic materials.

An examination of the sections on arithmetic concepts and applications showed that more than half of the questions required a knowledge of elementary algebra for their solution. It was felt that the low achievers being considered for this study would have guessed at many of these questions, and would have produced an achievement measure with questionable reliability. In the arithmetic computation section, only 9 of the 48 problems were algebraic. It was felt by the investigator that the students would have attempted this section with more confidence than they would have attempted either of the other arithmetic sections.

Since the experimental design did not include a pre-test, the "Arithmetic Computation" measure from the sophomore testing was recorded for those students included in the study. If these scores indicated that the experimental group and control group were not basically similar in computational ability before the treatment, then the scores would have been used as a covariate in the statistical analysis. If the scores indicated that the two groups were basically similar, then the achievement data would be analyzed by a t-test. The analysis of the "Arithmetic Computation" measures for initial similarity of the groups is presented in Chapter V.
It was beyond the realm of the investigation to actively involve the classroom teacher in a fairly unrestricted manner, and at the same time, guarantee that each class within a treatment group received the same instruction. The investigator felt that the former of these two variables was the more important of the two for the study. Since the similarity of treatment was not experimentally guaranteed, the unit of analysis for the study could not be the achievement score of the individual students. It would have been invalid to pool the scores of some 200 or more students and say that they had all been exposed to the same instruction. Instead, the mean achievement of each class was used as the unit of analysis for the study. In that way, generalizations with a greater validity could be made about classes receiving the experimental or control treatment.

**Experimental Hypotheses**

The conjectures of the investigator and the objectives of the study were presented in Chapter I. Conjectures were made that the use of slides in the classroom would: a) benefit the explanation of principles, and b) stimulate interest and discussion.

It was indicated in Chapter III that the 40 questions on the post-test could be categorized into 4 areas: 1) general principles of insurance; 2) insurance for the renter or homeowner; 3) automobile insurance; and 4) life insurance. Since it was possible that a visual approach might have been particularly appropriate for one or more of these, sub-test scores were recorded for each of the four categories. It was also noted that: 1) certain questions were directly associated with a visual presentation made with one
or more of the slides, and 2) several questions required a pencil-and-paper arithmetic computation. Sub-test scores were also recorded for these categories. On the retention test, items were identified as being directly associated with a visual presentation made with one or more of the slides. Scores for this set of items were recorded separately as another sub-test. The test items included in the sub-tests are indicated in Appendix W. The recording of the scores for these sub-tests allowed for the testing of several hypotheses.

Before stating the hypotheses, the following definitions are made:

Group E—the experimental group; the collection of Applied Mathematics classes using the insurance unit outline, slides, and worksheets designed by the investigator;

Group C—the control group; the collection of Applied Mathematics classes using the insurance unit outline and worksheets, but not the slides, provided by the investigator.

The following experimental hypotheses are those which were tested in this study:

$H_1$: There is no significant difference between achievement measures of Groups E and C on a test of overall insurance knowledge.

$H_2$: There is no significant difference between achievement measures of Groups E and C on a test of general insurance principles.

$H_3$: There is no significant difference between achievement measures of Groups E and C on a test of renter's insurance and homeowner's insurance principles.
H₄: There is no significant difference between achievement measures of Groups E and C on a test of automobile insurance principles.

H₅: There is no significant difference between achievement measures of Groups E and C on a test of life insurance principles.

H₆: There is no significant difference between achievement measures of Groups E and C on a test of visually-oriented insurance principles.

H₇: There is no significant difference between achievement measures of Groups E and C on a test of insurance-arithmetic computations.

H₈: There is no significant difference between achievement measures of Groups E and C on a delayed test of overall insurance knowledge.

H₉: There is no significant difference between achievement measures of Groups E and C on a delayed test of visually-oriented insurance principles.

The achievement data collected from the two treatment groups were analyzed with F tests and t tests. The report of the application of these tests is presented in Chapter V. The significance of the results of these applications for the experimental hypotheses H₁ - H₉ is discussed in Chapter VI.

Pilot Study

A pilot study of the insurance unit was conducted during November, 1971 at Northland High School in Columbus, Ohio. At
that time, there were 2 Applied Mathematics classes in Northland High School; both were assigned to the same teacher.

During a discussion of the insurance unit, the Applied Mathematics teacher had offered the use of his classes as participants in a pilot study. The investigator offered to teach the unit himself, and selected one of the two classes for the experimental treatment. The class selected had an enrollment of 18 students: 13 males and 5 females. As reported by their teacher, the group had an absence rate higher than that of the rest of the school, and a negative attitude towards mathematics.

At the time of the pilot study, the instructional materials in the unit consisted of: a) the set of slides, b) a fire insurance worksheet, c) an automobile insurance worksheet, d) a life insurance worksheet, and e) the 50-question post-test.

The investigator used 9 class periods to teach the insurance unit. The class actively discussed the material presented with the slides, and made an effort to finish the worksheets correctly. The regular class teacher remained in the back of the room and occasionally participated in the discussion. The post-test was administered the tenth day; 15 students were present on the day of the test.

The post-test used in the pilot study is presented in Appendix K. A summary of the test statistics is presented in Appendix L. A discussion of some of the test statistics is presented in the next section of this chapter.
Modification which Resulted from the Pilot Study

It should be observed on the post-test in Appendix K that questions 41 through 50 were not completed by all of the 15 students who took the test. It can be seen in Appendix L that 10 of the questions had a discrimination index that was negative—indicating that those questions did not discriminate well between the upper 27.5 per cent of the class and the lower 27.5 per cent of the class.

To have an instrument that was more likely to be completed in a class period, the post-test was reduced to 40 questions. Six of those questions with negative discrimination indices were dropped from the test; the other 4 were rewritten. Five other questions which had a low positive discrimination index were also dropped. The 11 items which were dropped from the 50-question post-test are indicated by an asterisk (*) in Appendix K. Question no. 40 on the 40-question post-test was a new question written after the conclusion of the pilot study. The new post-test is presented in Appendix M.

During the instructional period, it was pointed out by the regular teacher of the class that one of the slides seemed to be out of position. The slide showed two new automobiles on a new car lot. The discussion of the slide related the characteristics of these cars to the automobile insurance rates for each. During the pilot study, the slide was presented immediately before the slides dealing with liability insurance. Since the rate for liability insurance was primarily determined by driver factors—not automobile factors—the slide on the two cars seemed out of place. In talking
about the situation with the teacher, the investigator agreed that a better place for the slide would have been in the collision and comprehensive insurance section. The slides were rearranged and renumbered, with the slide under discussion becoming the new slide no. 78. (See Appendix D)

The regular teacher of the class in the pilot study also suggested that the students would benefit from the use of a vocabulary sheet. This sheet was described in Chapter III in the "Production of the Worksheets" section. The vocabulary sheet that was constructed as a handout for the students is presented in Appendix E.

The evaluation of the students' achievement in the pilot study was made by an administration of the 50-question post-test. For the 15 students that took the test, the arithmetic mean of the scores was 23.33 out of a possible 50. The minimum score was 11—the maximum was 36. The complete summary of the statistics is presented in Appendix L.

At the conclusion of the pilot study, the decision was made to construct a retention test for use during the full study. This test was to be administered to the participating classes from 8 to 13 days after the post-test had been given. A description of the retention test was presented in Chapter III in the section entitled, "The Retention Test." The test which was constructed is presented in Appendix 0.
Contact and Selection Procedures

In order to use classes from the public schools in Columbus for a research study, permission had to be first obtained from the Assistant Superintendent for Special Services. In order to obtain this permission, the research proposal was first discussed in detail with the Mathematics Supervisor of the school system. The slides and the complete set of written instructional materials were presented and reviewed. The proposal was approved by the Mathematics Supervisor and was recommended to the Assistant Superintendent for Special Services. The formal approval for the study reached the investigator during the first week of February, 1972. The letter of approval is presented in Appendix R.

A telephone discussion with the Supervisor of the Department of Audiovisual Services revealed that every high school in the school system should have had at least one Kodak "Carousel" projector available for use by the teachers. With projectors available at each school, unique arrangements which might have significantly affected the experimental treatment were not necessary for participation of the classes. A second discussion with the Mathematics Supervisor initiated a survey of the high schools for Applied Mathematics classes. It was discovered that 13 of the 14 high schools in the school system had at least one class in Applied Mathematics. (The school which had none was Mifflin High School.) A more detailed description of the school population is presented in the next section of this chapter.
The investigator contacted at least one mathematics teacher in each of the 13 high schools which had an Applied Mathematics class. This was accomplished between February 4, 1972 and February 11, 1972.

In order to meet the teachers who had Applied Mathematics assignments, the investigator first conferred with the principal or an assistant principal of each high school. A typical meeting lasted 20 minutes, in which time the content of the insurance unit and the purposes of the study were explained. The investigator assured the administrator that participation in the experiment was strictly a voluntary choice of the teachers. In general, the administrators gave encouragement to the investigator for the experimental study, and permission to present the description of the study to the mathematics teachers.

When the investigator first met a teacher of Applied Mathematics within each school, he presented to the teacher a sample package of the written materials. (See Appendixes B, D - G, I - J, M - N, and P) In addition, an introductory handout was provided which described the study. (See Appendix S) The introductory session with the teachers took from 5 to 30 minutes, depending on the available free time of the teachers. Without exception, the instructional unit was received enthusiastically by the teachers.

The investigator left the sample package of materials in each high school when the meeting had ended. The teachers were advised to study the materials more carefully at their leisure. In the schools where the investigator could not talk with each of the Applied Mathematics teachers, extra handouts were left with the
teacher who had participated in the initial discussion.

The last page of the introductory handout was a "sign-up" sheet for the teachers. After studying the materials and the description of the study, the teachers were to decide whether or not they wanted to participate. If the decision was affirmative, they were given the opportunity to indicate their preference for assignment to treatment group: a) experimental group, b) control group, or c) either group. (This preference was briefly discussed in the section of this chapter entitled "Experimental Design.")

The teachers also indicated some time periods during which the insurance unit could be included in their teaching schedules.

As the sign-up sheets were received by the investigator, the preferences for treatment group and time period for participation were reviewed. Whenever possible, the preference of each teacher was honored. It soon became clear that nearly all of the teachers wanted to use the slides in their instruction—only one sheet was returned with a specific preference for the control group. For this reason, the classes of the teachers who had marked "either" were assigned to the control group. In order to avoid discontent among the teachers of any one high school, all of the Applied Mathematics classes within a high school were assigned to the same treatment group. These considerations of assignment produced an experimental group of 16 classes and a control group of 13 classes. (A further description of the population is presented in the next section of this chapter).

Table 2 presents the relationship between the order in which
contact was made within each of the high schools and the order in which the insurance unit was first used in each of the high schools. The assignment of the classes in each school to treatment group is represented by: a) "E" for experimental group, and b) "C" for control group.

Table 2

Comparison of Order of Contact, Order of Participation, and Group Assignment for the High Schools

<table>
<thead>
<tr>
<th>High School</th>
<th>Order of Contact</th>
<th>Order of Participation</th>
<th>Treatment Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brookhaven</td>
<td>2</td>
<td>8</td>
<td>E</td>
</tr>
<tr>
<td>Central</td>
<td>12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>East</td>
<td>8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Eastmoor</td>
<td>7</td>
<td>10</td>
<td>C</td>
</tr>
<tr>
<td>Linden-McKinley</td>
<td>5</td>
<td>4</td>
<td>C</td>
</tr>
<tr>
<td>Marion-Franklin</td>
<td>10</td>
<td>9</td>
<td>E</td>
</tr>
<tr>
<td>Mohawk</td>
<td>11</td>
<td>1</td>
<td>E</td>
</tr>
<tr>
<td>North</td>
<td>4</td>
<td>5</td>
<td>E</td>
</tr>
<tr>
<td>Northland</td>
<td>3</td>
<td>11</td>
<td>E</td>
</tr>
<tr>
<td>South</td>
<td>9</td>
<td>7</td>
<td>C</td>
</tr>
<tr>
<td>Walnut Ridge</td>
<td>6</td>
<td>3</td>
<td>C</td>
</tr>
<tr>
<td>West</td>
<td>13</td>
<td>6</td>
<td>E</td>
</tr>
<tr>
<td>Whetstone</td>
<td>1</td>
<td>2</td>
<td>E</td>
</tr>
<tr>
<td>Mifflin</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

aTeachers in these schools did not participate in the study.

bThis school did not have an Applied Mathematics class.

cThe classes within each school were assigned to the same group.
The "order of contact" of the schools indicates the route taken by the investigator during the week of the introductions. The investigator travelled from the northern end of the city to the center; and then from the eastern end across to the west. This route was taken for reasons of transportation convenience. No natural "matching" is evident to the investigator between the "order of contact" and the "order of participation" shown in Table 2. There is a pattern in the assignment of classes to treatment groups, but this is a coincidental result. It has been assumed by the investigator to not have been a source of experimental bias. (See Chapter I, "Assumptions") The introductions were accomplished during one week of February, 1972. The participation in the study occurred over a four month period--February 17 through June 6, 1972.

Population: Schools and Teachers

At the time of the study--1971-1972--Columbus, Ohio was a city with approximately 550,000 residents. Neighborhoods existed within the city which could have been classified as: a) all-Black, b) integrated, c) all-White, d) inner-city, e) outer-city, f) poor, or g) affluent. The students in the Columbus high schools therefore came from a wide range of socio-economic backgrounds.

Just prior to the start of the 1971-1972 school year, the schools of the Mifflin Township (an area suburban to Columbus) were included in the public school system of Columbus. This brought the
number of high schools in the system to 14. Statistical data which described these schools were made available to the investigator as they were being collected for publication. (103) This information is presented in Table 3. The figures provide background information on the: a) size of the schools, b) overall achievement of the school population, and c) social make-up of the school population.

The three schools which did not have classes participating in the study were Central, East, and Mifflin. It has already been pointed out that Mifflin did not have any classes in Applied Mathematics and could not be a part of the study. All of the Applied Mathematics classes at Central High School were taught by the same individual. By coincidence, a full-year study which involved the use of desk calculators was being conducted with these classes. The teacher felt that it would have been impossible to consider participating simultaneously in two studies. The Applied Mathematics classes at East High School were also under the direction of one individual. In that situation, the teacher felt that the insurance unit would not have fit into his teaching schedule. He chose not to participate for that reason. A recap of the number of Applied Mathematics classes and teachers is given in Table 4.
Table 3
Some Descriptive Data on the High Schools in the Columbus Public School System, 1971-1972

<table>
<thead>
<tr>
<th>School</th>
<th>Enrollment</th>
<th>Absence Percentage</th>
<th>Percentage Above Age in Grade Level</th>
<th>Percentage of White Pupils</th>
<th>Size of Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brookhaven</td>
<td>1586</td>
<td>7</td>
<td>7</td>
<td>98</td>
<td>72</td>
</tr>
<tr>
<td>Eastmoor</td>
<td>1466</td>
<td>9</td>
<td>5</td>
<td>81</td>
<td>74</td>
</tr>
<tr>
<td>Linden-McKinley</td>
<td>1598</td>
<td>13</td>
<td>14</td>
<td>20</td>
<td>91</td>
</tr>
<tr>
<td>Marion-Franklin</td>
<td>1306</td>
<td>13</td>
<td>9</td>
<td>67</td>
<td>76</td>
</tr>
<tr>
<td>Mohawk</td>
<td>500</td>
<td>18</td>
<td>8</td>
<td>32</td>
<td>73</td>
</tr>
<tr>
<td>North</td>
<td>1513</td>
<td>9</td>
<td>9</td>
<td>89</td>
<td>75</td>
</tr>
<tr>
<td>Northland</td>
<td>1498</td>
<td>6</td>
<td>5</td>
<td>100</td>
<td>67</td>
</tr>
<tr>
<td>South</td>
<td>1910</td>
<td>18</td>
<td>11</td>
<td>65</td>
<td>91</td>
</tr>
<tr>
<td>Walnut Ridge</td>
<td>1848</td>
<td>8</td>
<td>5</td>
<td>97</td>
<td>90</td>
</tr>
<tr>
<td>West</td>
<td>2019</td>
<td>8</td>
<td>8</td>
<td>87</td>
<td>89</td>
</tr>
<tr>
<td>Whetstone</td>
<td>1749</td>
<td>8</td>
<td>3</td>
<td>99</td>
<td>77</td>
</tr>
<tr>
<td>Central&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1306</td>
<td>22</td>
<td>14</td>
<td>69</td>
<td>97</td>
</tr>
<tr>
<td>East&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1355</td>
<td>19</td>
<td>18</td>
<td>0</td>
<td>68</td>
</tr>
<tr>
<td>Mifflin&lt;sup&gt;b&lt;/sup&gt;</td>
<td>678</td>
<td>-&lt;sup&gt;c&lt;/sup&gt;</td>
<td>9</td>
<td>58</td>
<td>51</td>
</tr>
<tr>
<td>School System</td>
<td>20,332</td>
<td>11</td>
<td>9</td>
<td>71</td>
<td>1091</td>
</tr>
</tbody>
</table>

<sup>a</sup>From the Columbus School Profile (103)

<sup>b</sup>Classes in these schools were not used in the study.

<sup>c</sup>This figure was not reported.
<table>
<thead>
<tr>
<th>School</th>
<th>Number of Applied Math. Classes</th>
<th>Number of Classes Used in Study</th>
<th>Number of Applied Math. Teachers</th>
<th>Number of Participating Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brookhaven</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Eastmoor</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Linden-McKinley</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Marion-Franklin</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mohawk</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>North</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Northland</td>
<td>2</td>
<td>1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>South</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Walnut Ridge</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>West</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Whetstone</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Central</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>East</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Mifflin</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<sup>a</sup>Does not include the class used in the pilot study.

Instead of making references to specific teachers by name, or to specific classes by period, a code was established to preserve anonymity. The code is presented in Table 5.
### Table 5
Identification Code for the Classes and the Participating Teachers

<table>
<thead>
<tr>
<th>School</th>
<th>Classes</th>
<th>Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brookhaven</td>
<td>EC1&lt;sup&gt;a&lt;/sup&gt;, EC2</td>
<td>ET5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Marion-Franklin</td>
<td>EC3, EC4, EC5, EC6, EC7</td>
<td>ET6, ET7, ET8</td>
</tr>
<tr>
<td>Mohawk</td>
<td>EC8, EC9</td>
<td>ET1</td>
</tr>
<tr>
<td>North</td>
<td>EC10, EC11</td>
<td>EC3</td>
</tr>
<tr>
<td>Northland</td>
<td>EC12</td>
<td>ET9</td>
</tr>
<tr>
<td>West</td>
<td>EC13, EC14</td>
<td>ET4</td>
</tr>
<tr>
<td>Whetstone</td>
<td>EC15, EC16</td>
<td>ET2</td>
</tr>
<tr>
<td>Eastmoor</td>
<td>CC1&lt;sup&gt;c&lt;/sup&gt;, CC2, CC3, CC4</td>
<td>CT5&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Linden-Mckinley</td>
<td>CC5, CC6</td>
<td>CT1, CT4</td>
</tr>
<tr>
<td>South</td>
<td>CC7, CC8, CC9, CC10, CC11</td>
<td>CT3, CT6</td>
</tr>
<tr>
<td>Walnut Ridge</td>
<td>CC12, CC13</td>
<td>CT2</td>
</tr>
</tbody>
</table>

<sup>a</sup>EC1 designates Experimental Group Class 1  
<sup>b</sup>ET5 designates Experimental Group Teacher 5  
<sup>c</sup>CC1 designates Control Group Class 1  
<sup>d</sup>CT5 designates Control Group Teacher 5

A survey of background information on the participating teachers is presented in Table 6.
Table 6

Selected Characteristics of the Participating Teachers

<table>
<thead>
<tr>
<th>Teacher Code</th>
<th>Sex</th>
<th>Number of App. Math. Classes</th>
<th>Years: Full-Time Teaching</th>
<th>Years: Consumer Math</th>
<th>Bachelor's Deg. Type</th>
<th>Major(s)</th>
<th>Minor</th>
<th>Master's Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET1</td>
<td>M</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>BS</td>
<td>Math &amp; Phy.Sci.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ET2</td>
<td>F</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>BA</td>
<td>Art</td>
<td>Math</td>
<td>M.A., Art</td>
</tr>
<tr>
<td>ET3</td>
<td>F</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>BS</td>
<td>Math</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ET4</td>
<td>M</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td>AB</td>
<td>Math</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ET5</td>
<td>M</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>BS</td>
<td>Math</td>
<td>P.E.</td>
<td></td>
</tr>
<tr>
<td>ET6</td>
<td>M</td>
<td>2</td>
<td>11</td>
<td>1</td>
<td>BS</td>
<td>Math</td>
<td></td>
<td>M.S., Math</td>
</tr>
<tr>
<td>ET7</td>
<td>M</td>
<td>2</td>
<td>7</td>
<td>1</td>
<td>BS</td>
<td>Math</td>
<td>P.E.</td>
<td>M.A., Adm.</td>
</tr>
<tr>
<td>ET8</td>
<td>M</td>
<td>1</td>
<td>16</td>
<td>7</td>
<td>BS</td>
<td>Soc.Std.</td>
<td>Math</td>
<td></td>
</tr>
<tr>
<td>CT1</td>
<td>F</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>BS</td>
<td>Educ</td>
<td>Math</td>
<td></td>
</tr>
<tr>
<td>CT2</td>
<td>M</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>BS</td>
<td>Hist</td>
<td>Math</td>
<td></td>
</tr>
<tr>
<td>CT3</td>
<td>F</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>BA</td>
<td>Math &amp; Hist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT4</td>
<td>M</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>BS</td>
<td>MathEduc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT5</td>
<td>F</td>
<td>4</td>
<td>10</td>
<td>1</td>
<td>BS</td>
<td>Business</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT6</td>
<td>M</td>
<td>1</td>
<td>7</td>
<td>1</td>
<td>BS</td>
<td>Chem</td>
<td>Math</td>
<td></td>
</tr>
</tbody>
</table>

^aIncludes one class used in the pilot study
It is interesting to note some features that appear in Table 6: a) the teachers generally had little previous experience in teaching a consumer mathematics course; b) the only teachers holding a Master's degree were participants in the experimental group; c) several of the teachers did not have mathematics as the major area of their earned degrees; and d) the teachers were not "first-year" or inexperienced.

**Logistics of the Experiment**

The first day of active participation by a teacher in the study was February 17, 1972. The last retention test was given June 6, 1972. During that time the investigator travelled many hundreds of miles—perhaps close to a thousand—in conducting the investigation with the high schools.

The ideal travel arrangement to work with any one of the participants would have followed this outline:

TRIP 1: initial introduction of the study and materials;
TRIP 2: bring the instructional materials to the participating teacher before the first instructional day of the unit;
TRIP 3: grade the post-tests for the teacher, pick up the tests and answer sheets, leave the retention tests;
TRIP 4: grade the retention tests, pick up the teacher questionnaire, pick up the other materials which are not to be left with the teacher.

This travel arrangement was generally followed for the teachers having classes in the control group. The most frequent deviation was caused by an incomplete teacher questionnaire. Where that
happened, the teacher was requested to mail it to the investigator.

Working with the classes in the experimental group caused many more problems than working with the control group classes. The difference was primarily caused by the slides—the two sets had to be circulated between the classes in the experimental group. The classes in the control group were independent—the scheduling at one high school didn't influence the scheduling at another. The classes in the experimental group definitely did depend on each other. If teacher "A" didn't finish with the slides according to plan, teacher "B" would have had to ad-lib until the instructional materials could be delivered.

The emergency solution to the problem of scheduling the slide trays was provided by making more trips and treating the two trays in each set as separate items. After a teacher had completed the presentation of the first tray, it was really not needed during the rest of the experimental treatment. Because of this, two different classes could be working from the same set of trays. And since there were two complete sets for circulation, there could theoretically have been four different experimental classes running at the same time in different schools. On one occasion there were—along with several classes in the control group. Fortunately, this hectic arrangement lasted only one week. There were other times when three classes in the experimental group were running simultaneously.

In administering the post-tests and retention tests, the teachers were allowed to give a "make-up" examination on the day
immediately following the scheduled test day. It was felt by the teachers and the investigator that this technique might provide a broader representation of the class enrollments without sacrificing control of the testing situation. Between the time of the post-test and the retention test, the teachers could (and generally did) go over the answers to the post-test. They did not, however, formally review the insurance material between the two tests. The delay between the post-test and retention test was always at least 8 days but less than 14 days.

It was mentioned earlier that the investigator graded the tests for the participating teachers. This was done as an added incentive to obtain participants for the study. The post-test answers were all entered by the students onto special answer sheets designed for machine grading. A sheet with holes punched into the correct answer positions made the hand-grading of these tests a relatively easy task.

The scores for the sub-tests mentioned earlier in this chapter ("Experimental Hypotheses" section) were obtained when the sheets were machine-scored. The retention tests were a "write in true or false" variety and were also fairly easy to grade. A templet placed over the graded retention tests provided a quick way of finding the scores for the retention sub-test.

A major problem of a study of this kind was found to be communication between the participants and the investigator. It happened only rarely that one reached the other with only one phone call. It was more normal to leave a message to be placed in the other party's mailbox. Sometimes a message was forwarded but
never received by one party, or was misunderstood. Both of these
situations occurred and caused confusion and extra—sometimes
unnecessary—trips to the schools.

Three situations occurred involving the use of the slides
which were out of the ordinary. When the investigator brought the
slide trays and other materials to one of the schools, it was
discovered that someone had stolen the slide projector over the
weekend. There was not another "Carousel" projector in the school.
The solution suggested by the investigator was to borrow another
projector from another school or from the central audiovisual
services department. The teacher indicated that there was no
need to go to all that bother. She would be perfectly willing to
remove the slides from the tray one-at-a-time and show them with
the school's manual slide projector. And that is how she presented
her insurance unit.

A second incident involved some Business Education classes at
another high school. The teacher who had the Applied Mathematics
classes and who was anticipating the use of the slides in his
classes talked to one of the Business Education teachers about
the insurance unit. The second teacher felt that the unit would
be ideal for her classes in Business Arithmetic. The two teachers
planned their teaching schedules in a way that the classes could
be covering the insurance unit during the same two weeks. When the
classes were scheduled during the same period of the day, the
teachers combined the classes into one room and "team taught" the
unit. While this was happening, a second Business Education teacher
found out about the unit. She wanted to know why she hadn't been included in the arrangement and demanded to be given a chance to use the materials at a later date. When one set of slides had completed its assigned circulation among classes, the third teacher was loaned a set of the instructional materials for use in her Business Arithmetic classes.

The third situation involved what the investigator had worried about from the beginning of the study—the loss or damage to a slide. One of the participating teachers had a student helper operate the projector during the class instruction. At some time during the running of the first tray, the student had removed one of the slides from the tray. In its place, he had inserted one of his own taken at a class party. The investigator discovered the switch when he checked the tray before presenting it to the next participant. When the teacher could not locate the missing slide, the investigator replaced it with a duplicate which had been stored in a non-circulating set of slides.

This concludes the discussion of the research design, experimental procedures, population characteristics, and some logistics of the experiment. The next chapter will present the results of the administration of the evaluation instruments: the teacher questionnaire, the post-test, and the retention test. The initial equivalence of the control and experimental groups will be tested, along with the statistical analysis of the test data.
CHAPTER V

ANALYSIS OF DATA

The previous chapter has presented information about: a) the design and hypotheses of the experiment; b) the pilot study and the modifications which resulted from it; c) the school and teacher populations; d) the procedures associated with contacting and selecting participants; and e) some of the logistics in the conducting of the experiment.

This chapter presents data which describes the students in the experimental and control groups, and an analysis of the data collected from the administration of the evaluation instruments.

The "Teacher Questionnaire" provided information about: a) the content of each teacher's presentation of the unit on insurance, b) the length of time spent on the instruction by each teacher, and c) the changes which took place in both the students and teachers during the course of instruction. The report of student attitude is one of the areas included in this section. The post-test provided a measure of the students' achievement at the end of the insurance instruction. The retention test provided a measure of the students' achievement after a delay of 8 to 13 days.
Selected Characteristics of the Student Population

The first characteristic to be studied was the class attendance of the students. The investigator had been "warned" by several of the participating teachers that the students in the Applied Mathematics classes had a high rate of absenteeism. The prediction most frequently made was that 25 per cent of the class would be absent on any one day. When compared to the figures in Table 3, this absence rate was definitely worse than the averages of the entire schools. These absences were caused by sickness, school suspensions, and "cutting"—unauthorized absence for either the class period or the entire school day.

The comparison of class enrollment, attendance for the post-test, and attendance for the retention test is presented in Table 7. It should be pointed out that a student was allowed to take a test on either of two days: the scheduled test day, or the following make-up test day.
Table 7
Comparison of Class Enrollment and Class Attendance

<table>
<thead>
<tr>
<th>Class</th>
<th>Class Enroll.</th>
<th>No. that took Post-test</th>
<th>Pct.</th>
<th>No. that took Ret. Test</th>
<th>Pct.</th>
<th>No. that took both tests</th>
<th>Pct.of no. that took Post-Test</th>
<th>Pct.of Class Enroll.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC1</td>
<td>35</td>
<td>26</td>
<td>74</td>
<td>28</td>
<td>43</td>
<td>24</td>
<td>93</td>
<td>69</td>
</tr>
<tr>
<td>EC2</td>
<td>35</td>
<td>23</td>
<td>66</td>
<td>25</td>
<td>45</td>
<td>22</td>
<td>96</td>
<td>63</td>
</tr>
<tr>
<td>EC3</td>
<td>26</td>
<td>21</td>
<td>81</td>
<td>23</td>
<td>36</td>
<td>20</td>
<td>95</td>
<td>77</td>
</tr>
<tr>
<td>EC4</td>
<td>22</td>
<td>16</td>
<td>73</td>
<td>20</td>
<td>36</td>
<td>14</td>
<td>88</td>
<td>64</td>
</tr>
<tr>
<td>EC5</td>
<td>25</td>
<td>21</td>
<td>84</td>
<td>17</td>
<td>34</td>
<td>16</td>
<td>76</td>
<td>64</td>
</tr>
<tr>
<td>EC6</td>
<td>24</td>
<td>17</td>
<td>71</td>
<td>13</td>
<td>28</td>
<td>11</td>
<td>65</td>
<td>46</td>
</tr>
<tr>
<td>EC7</td>
<td>15</td>
<td>14</td>
<td>93</td>
<td>14</td>
<td>23</td>
<td>13</td>
<td>93</td>
<td>87</td>
</tr>
<tr>
<td>EC8</td>
<td>23</td>
<td>10</td>
<td>44</td>
<td>8</td>
<td>11</td>
<td>5</td>
<td>50</td>
<td>22</td>
</tr>
<tr>
<td>EC9</td>
<td>21</td>
<td>11</td>
<td>52</td>
<td>7</td>
<td>11</td>
<td>7</td>
<td>64</td>
<td>33</td>
</tr>
<tr>
<td>EC10</td>
<td>24</td>
<td>14</td>
<td>58</td>
<td>16</td>
<td>24</td>
<td>12</td>
<td>86</td>
<td>50</td>
</tr>
<tr>
<td>EC11</td>
<td>18</td>
<td>12</td>
<td>67</td>
<td>12</td>
<td>21</td>
<td>11</td>
<td>92</td>
<td>61</td>
</tr>
<tr>
<td>EC12</td>
<td>18</td>
<td>17</td>
<td>95</td>
<td>14</td>
<td>25</td>
<td>13</td>
<td>77</td>
<td>72</td>
</tr>
<tr>
<td>EC13</td>
<td>20</td>
<td>14</td>
<td>70</td>
<td>13</td>
<td>23</td>
<td>11</td>
<td>79</td>
<td>55</td>
</tr>
<tr>
<td>EC14</td>
<td>20</td>
<td>14</td>
<td>75</td>
<td>9</td>
<td>14</td>
<td>9</td>
<td>60</td>
<td>45</td>
</tr>
<tr>
<td>EC15</td>
<td>26</td>
<td>26</td>
<td>100</td>
<td>24</td>
<td>24</td>
<td>100</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>EC16</td>
<td>21</td>
<td>18</td>
<td>86</td>
<td>18</td>
<td>18</td>
<td>100</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>Avg.</td>
<td>23</td>
<td>17</td>
<td>74</td>
<td>16</td>
<td>14</td>
<td>82</td>
<td>62</td>
<td>62</td>
</tr>
<tr>
<td>CC1</td>
<td>17</td>
<td>14</td>
<td>82</td>
<td>13</td>
<td>13</td>
<td>93</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>CC2</td>
<td>16</td>
<td>14</td>
<td>88</td>
<td>14</td>
<td>11</td>
<td>79</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>CC3</td>
<td>23</td>
<td>17</td>
<td>74</td>
<td>18</td>
<td>16</td>
<td>94</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>CC4</td>
<td>19</td>
<td>12</td>
<td>63</td>
<td>12</td>
<td>9</td>
<td>75</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>CC5</td>
<td>28</td>
<td>17</td>
<td>61</td>
<td>15</td>
<td>12</td>
<td>71</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>CC6</td>
<td>24</td>
<td>15</td>
<td>63</td>
<td>15</td>
<td>15</td>
<td>100</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>CC7</td>
<td>29</td>
<td>16</td>
<td>55</td>
<td>8</td>
<td>8</td>
<td>50</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>CC8</td>
<td>23</td>
<td>20</td>
<td>87</td>
<td>19</td>
<td>18</td>
<td>90</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>CC9</td>
<td>15</td>
<td>11</td>
<td>73</td>
<td>8</td>
<td>8</td>
<td>73</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>CC10</td>
<td>13</td>
<td>10</td>
<td>77</td>
<td>9</td>
<td>9</td>
<td>90</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>CC11</td>
<td>12</td>
<td>10</td>
<td>83</td>
<td>7</td>
<td>6</td>
<td>60</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>CC12</td>
<td>14</td>
<td>10</td>
<td>72</td>
<td>9</td>
<td>9</td>
<td>90</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>CC13</td>
<td>13</td>
<td>11</td>
<td>85</td>
<td>11</td>
<td>11</td>
<td>100</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Avg.</td>
<td>19</td>
<td>14</td>
<td>74</td>
<td>12</td>
<td>11</td>
<td>82</td>
<td>61</td>
<td></td>
</tr>
</tbody>
</table>

a The average of the experimental group class means
b The average of the control group class means
From the data presented in Table 7, the following summary statements were made: 1) the average enrollment in Applied Mathematics classes was considerably less than the more typical school system class size of 30-35; 2) the average percentage of enrolled students that were present on the days of the post-test administration was the same for both treatment groups—74 per cent; 3) the average percentage of students who took the post-test that also took the retention test was the same for both treatment groups—82 per cent; and 4) the average percentile of enrolled students that were present for the administration of both tests was approximately the same for both treatment groups—61 and 62 per cent.

It appears from the data that the prediction of a 25 per cent absence rate was an accurate one, on the average. When it would be necessary for the students to be present regularly over a 2-week period, it appears that an absence rate of 40 per cent—based on class enrollment—would be a better prediction. In comparing the students who took the retention test with those that took the post-test, it appears that a core of about 60 per cent of the class enrollment attended class regularly. The extremes for this statistic included a low of 22 per cent and a high of 92 per cent.

Other characteristics of the students in the classes were reported by the teachers on the questionnaire. (See Appendix Q) A summary of these characteristics with the references to the specific teachers that made them is included below:
1. high absence rate ET7, ET8, CT3
2. low reading ability ET3
3. elementary vocabulary ET2
4. short attention span ET1, ET6
5. do not participate in class ET3, ET8
6. indifferent attitude ET1
7. inability to follow directions ET3
8. need drill, repetition and reinforcement ET3, ET9, CT3, CT6
9. more attentive and enthusiastic with worksheets than lecture CT1

The number of instruction days required for the insurance materials was requested from the teachers on the questionnaire. This information was provided by 14 of the 15 participating teachers. (One of the teachers having classes in the control group did not return the questionnaire.) The data for days of instruction with the experimental treatment included: a) 9 days, 2 teachers; b) 10 days, 3 teachers; c) 11 days, 1 teacher; d) 12 days, 3 teachers; and e) 14 days, 2 teachers. The average time spent in teaching with the experimental treatment was about 10 days. The data for days of instruction with the control treatment included: a) 9 days, 3 teachers; b) 10 days, 1 teacher; and c) 15 days, 1 teacher. The average time spent in teaching with the control treatment was also about 10 days.

On the questionnaire, the teachers rated their class presentation of a list of 36 insurance concepts and principles. (See Appendix P) The options available for each item were: "Did Not Include," "Briefly Mentioned," and "Discussed Thoroughly." The response percentages of the 9 experimental group teachers and 5 of
the control group teachers that returned the questionnaire are presented in Appendix T. A judgment of "similarity of presentation" has been made by the investigator with the aid of the following scheme:

A. The correspondence of presentation between the experimental and control groups was rated Strong if the difference in every major column was less than 10 percentage points.

B. The correspondence of presentation between the experimental and control groups was rated Weak if the difference in any one of the 3 major columns was greater than 50 percentage points.

C. The correspondence of presentation between the experimental and control groups was rated Mixed if the differences in the major columns satisfied neither A. nor B.

An example of a strong correspondence is that exhibited in item 5, "Insurance involves sharing the loss with others." Among the teachers having classes in the experimental group, 2 marked "Briefly Mentioned," and 7 marked "Discussed Thoroughly." Since there were 9 teachers involved, the approximate percentages corresponding to these responses were 22 and 78, respectively.

Among the teachers having classes in the control group, 1 marked "Briefly Mentioned," and 4 marked "Discussed Thoroughly." The corresponding percentages were 20 and 80. Since the difference between 22 and 20, and the difference between 78 and 80 were both less than 10, the correspondence of presentation between the groups was rated Strong.
An example of a weak correspondence is that exhibited in item 10, "The neighborhood fire protection affects the renter's premium." The experimental group teachers indicated 1 "Briefly Mentioned" and 8 "Discussed Thoroughly," with corresponding percentages of 11 and 89. The control group teachers indicated 1 "Did Not Include," 3 "Briefly Mentioned," and 1 "Discussed Thoroughly," with corresponding percentages of 20, 60, and 20. The differences in percentage points for the 3 categories were 20, 49, and 69. Since one of these was greater than 50, the correspondence of presentation between the groups was rated Weak.

A summary of the ratings showed: a) 11 items which were rated Strong; b) 4 items which were rated Weak; and c) 21 items which were rated Mixed. From these results, the investigator judged that there were no gross differences between the insurance presentations of the experimental group teachers and the control group teachers.

Reactions of the Participating Teachers

An example of teacher enthusiasm towards the instructional unit was presented in Chapter IV in the anecdotal account of the Business Education teachers.

In talking with teachers about their participation, several wanted to know whether or not the materials would be available for use the following year. They seemed pleased when they were assured that the materials would be available. One teacher inquired whether the investigator was planning to construct similar materials in other areas.
The general reaction included praise for materials that were complete, and more importantly, up-to-date. One teacher estimated that he probably would have needed ten years of evening work to research and develop an equivalent set of materials.

The complete collection of teacher responses--both positive and negative--is presented in Appendix Q. Rather than reproduce them here, the reader is invited to read through the responses in the Appendix. The entries made under the headings "Strengths," "Weaknesses," "Teacher Attitude," and "Additional Comments," are most applicable. Further information on "change in teacher attitude" is provided in the next section of this chapter.

Changes in the Students and Teachers as Reported by the Teachers

The questionnaire allowed the participating teachers to note changes which took place in the students and themselves as a result of the insurance instruction. Categories of change which were included were: "Student Attitude," "Student Enthusiasm," "Student Attendance," "Class Discussion," and "Teacher Attitude." Of the 15 participating teachers, information regarding these changes was not reported by 2 teachers--both having classes in the control group. The complete collection of responses for the remaining 13 teachers is presented in Appendix Q.

A review of the changes reported by the teachers was made with the following symbolic notation:
++ = strong positive change 
+ = positive change 
0 = no change 
- = negative change 
-- = strong negative change.

The review is presented in Table 8.

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Student Attitude Change</th>
<th>Student Enthusiasm Change</th>
<th>Student Attendance Change</th>
<th>Class Discussion Change</th>
<th>Teacher Attitude Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET1</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>ET2</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>ET3</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>ET4</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>ET5</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>ET6</td>
<td>-</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>ET7</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>ET8</td>
<td>-</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ET9</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
</tbody>
</table>

CT1 0 + 0 + ++
CT2a
CT3 ++ + 0 + ++
CT4b
CT5 + + 0 + +
CT6 + + 0 + +

a No responses were included for this section.
b The questionnaire was not returned.
If any differences in "change" existed between the two treatment groups, Table 8 reveals that they were certainly not obvious. Similar positive changes seemed to have occurred for each group in: a) student attitude, b) student enthusiasm, c) class discussion, and d) teacher attitude. The insurance instruction did not seem to have much effect at all for either treatment on the attendance of the classes. It should be noted that no reports of negative change were made for: a) student enthusiasm, b) class discussion, and c) teacher attitude. Further, the most reports of strong positive change occurred in: a) student attitude and b) teacher attitude, followed by c) class discussion.

**Statistical Analysis**

The raw data for the statistical analysis is presented in Appendix U. These data were compiled from: a) the arithmetic computation test, b) the post-test, c) the six sub-tests within the post-test, d) the retention test, and e) the sub-test within the retention test. The analysis of the arithmetic computation measures was conducted to reveal whether the experimental and control groups had a similar or dissimilar computation achievement prior to the study. The results of this analysis determined the statistical technique used in the analysis of the post-test and retention test data.

The class means presented in Appendix U for "Arithmetic Computation" were derived from data recorded at the Division of Special Services of the Columbus Public Schools. The investigator
obtained the computation scores for only those students who had taken the post-test—rather than for the entire class enrollment. The maximum possible score on that test was 48. The average of the class means was between 21 and 22.

Since only two groups were being compared, it was felt that a t-test would be the appropriate statistical technique for the analysis. This view was expressed by Campbell and Stanley. (17)

The simplest form would be the t-test. Design 6 is perhaps the only setting for which this test is optimal. (17, 26)

There was a danger in applying a t-test, however, if no consideration had been given to the underlying assumptions of the t-distribution. The application of a t-test was warranted when the two groups represented independent random samples from equally variable populations.

It was stressed in the "Experimental Design" section of Chapter IV that the lack of random assignment of classes to treatment groups was one of the weaknesses of the study. It was one of the assumptions, however, that the assignment of classes would not bias the experiment.

The question of "equal variance" or "homogeneity of variance" was one which could be treated statistically. Ferguson (46) has described the F-ratio test for homogeneity of variance. The results of the test determined which t-test was applicable. If the variances were not shown to be significantly different, the basic t-test could be applied. If the variances were found to be different, a t-test which adjusted for the difference in variance could be
applied. The method for the latter situation used in this study was that of Cochran and Cox, as described by Ferguson. (46, 143) The F-ratio test and t-tests are included in Appendix V.

To verify or refute the similarity of the two groups at the start of the experiment, the "F-ratio, t-test" technique was applied to the arithmetic computation data. The means and variances of the scores for each group are presented in Table 9. In this, and in subsequent tables, the following symbols were used: a) "E" represented the experimental group, b) "C" represented the control group, c) "N" denoted the sample size, and d) "X" and "S^2" represented, respectively, the mean and the unbiased estimate of the variance.

Table 9

Means and Variances of the Arithmetic Computation Measures

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>X</th>
<th>S^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>16</td>
<td>21.97</td>
<td>8.94</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>21.77</td>
<td>11.47</td>
</tr>
</tbody>
</table>

An F-ratio was computed to test the hypothesis at the .05 significance point that the variances of this computation measure for Groups E and C were equal. The computed value of F was 1.29. The critical value of F was 2.02 with "(12, 15)" degrees of freedom so that the hypothesis could not be rejected.

The t-test which assumed homogeneity of variance was next applied to the data in Table 9. The hypothesis tested at the .05
level of confidence was that the means of the computation measure for Groups E and C were equal. The obtained value of t was .16 , which was not significant. With 27 degrees of freedom, the critical value for rejection was 2.05 . Thus, the hypothesis could not be rejected.

The preceding analysis indicates that the two groups were sufficiently similar at the start of the experiment to use a t-test analysis rather than an analysis of covariance.

The data for the post-test and retention test measures is presented in Tables 10-14. The sub-tests of the post-test and the retention test are the following:

Sub-test A—Insurance for the Renter or Homeowner
Sub-test B—Automobile Insurance
Sub-test C—Life Insurance
Sub-test D—General Principles of Insurance
Sub-test E—Direct Association with a Slide
Sub-test F—Computation
Retention Sub-test—Direct Association with a Slide.
### Table 10
Means and Variances of the Post-Test and Sub-Test A

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Post-test</th>
<th>Sub-test A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\bar{X}$</td>
<td>$s^2$</td>
</tr>
<tr>
<td>E</td>
<td>16</td>
<td>16.53</td>
<td>12.25</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>15.77</td>
<td>4.48</td>
</tr>
</tbody>
</table>

### Table 11
Means and Variances of the Sub-test B and the Sub-test C

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Sub-test B</th>
<th>Sub-test C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\bar{X}$</td>
<td>$s^2$</td>
</tr>
<tr>
<td>E</td>
<td>16</td>
<td>4.64</td>
<td>1.14</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>4.52</td>
<td>.92</td>
</tr>
</tbody>
</table>

### Table 12
Means and Variances of the Sub-test D and the Sub-test E

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Sub-test D</th>
<th>Sub-test E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\bar{X}$</td>
<td>$s^2$</td>
</tr>
<tr>
<td>E</td>
<td>16</td>
<td>3.59</td>
<td>.84</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>3.41</td>
<td>.19</td>
</tr>
</tbody>
</table>
Table 13
Means and Variances of the Sub-test F and the Retention Test

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Sub-test F</th>
<th>Retention Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\bar{X}$</td>
<td>$s^2$</td>
</tr>
<tr>
<td>E</td>
<td>16</td>
<td>4.27</td>
<td>.65</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>4.52</td>
<td>.36</td>
</tr>
</tbody>
</table>

Table 14
Mean and Variance of the Retention Sub-test

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>$\bar{X}$</th>
<th>$s^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>16</td>
<td>6.92</td>
<td>.31</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>6.72</td>
<td>.48</td>
</tr>
</tbody>
</table>

F-ratios were computed for the variances presented in the preceding tables. For the post-test and all of its sub-tests, the variance of the scores for the experimental group was larger than that of the control group. In this situation, the critical value for the F-ratio with "(15, 12)" degrees of freedom was 2.62 at the .05 significance point, and 4.01 at the .01 significance point.

For the retention test and its sub-test, the variance for the scores of the control group was larger than that of the experimental group. In that situation, the critical value for the F-ratio with "(12, 15)" degrees of freedom was 2.02 at the .05 significance point, and 3.67
at the .01 significance point. Since the hypotheses being tested were not directional, the test of significance was two-tailed rather than one-tailed. The significance level or confidence level was therefore twice the significance points of .05 and .01, providing levels of .10 and .02. The results of the F-ratio computations are presented in Table 15.

Table 15
F-ratio Values and Significance Levels for Homogeneity of Variance Tests

<table>
<thead>
<tr>
<th>Measure</th>
<th>F</th>
<th>Critical Value</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-test</td>
<td>2.73</td>
<td>2.62</td>
<td>.10</td>
</tr>
<tr>
<td>A</td>
<td>1.88</td>
<td>2.62</td>
<td>N.S.</td>
</tr>
<tr>
<td>B</td>
<td>1.24</td>
<td>2.62</td>
<td>N.S.</td>
</tr>
<tr>
<td>C</td>
<td>1.82</td>
<td>2.62</td>
<td>N.S.</td>
</tr>
<tr>
<td>D</td>
<td>4.42</td>
<td>4.01</td>
<td>.02</td>
</tr>
<tr>
<td>E</td>
<td>2.14</td>
<td>2.62</td>
<td>N.S.</td>
</tr>
<tr>
<td>Retention</td>
<td>2.06</td>
<td>2.02</td>
<td>.10</td>
</tr>
<tr>
<td>Ret. Sub.</td>
<td>1.55</td>
<td>2.02</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

The F-ratios were computed to test the following nine null hypotheses:
1. The variances of the post-test measures for E and C are equal.
2. The variances of the sub-test A measures for E and C are equal.
3. The variances of the sub-test B measures for E and C are equal.
4. The variances of the sub-test C measures for E and C are equal.
5. The variances of the sub-test D measures for E and C are equal.
6. The variances of the sub-test E measures for E and C are equal.
7. The variances of the sub-test F measures for E and C are equal.
8. The variances of the retention test measures for E and C are equal.
9. The variances of the retention sub-test measures for E and C are equal.

Since the values of the F-ratios for sub-tests A, B, C, E, F, and the retention sub-test were not significant at the .05 point, then hypotheses 2, 3, 4, 6, 7, and 9 could not be rejected. The t-test applied to these sub-tests was one which assumed homogeneity of variance.

Since the values of the F-ratios for the post-test and the retention test were significant at the .05 point, then hypotheses 1 and 8 were rejected with a confidence level of .10. Since the value of the F-ratio for sub-test D was significant at the .01 point, then hypothesis 5 was rejected with a confidence level of .02. The t-test applied to the data for the post-test, retention test, and sub-test D was one which compensated for the lack of homogeneity of variance.

The appropriate t-test was performed on the data to test the following null hypotheses:
10. The means of the post-test measures for E and C are equal.
11. The means of the sub-test A measures for E and C are equal.
12. The means of the sub-test B measures for E and C are equal.
13. The means of the sub-test C measures for E and C are equal.
14. The means of the sub-test D measures for E and C are equal.
15. The means of the sub-test E measures for E and C are equal.
16. The means of the sub-test F measures for E and C are equal.
17. The means of the retention test measures for E and C are equal.
18. The means of the retention sub-test measures for E and C are equal.

The values of t and the significance levels which resulted from these t-tests are presented in Table 16.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Group E Mean</th>
<th>Group C Mean</th>
<th>Higher of Two Groups</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-test</td>
<td>16.53</td>
<td>15.77</td>
<td>exp.</td>
<td>.724</td>
<td>.48</td>
</tr>
<tr>
<td>A</td>
<td>3.67</td>
<td>3.57</td>
<td>exp.</td>
<td>.415</td>
<td>.65</td>
</tr>
<tr>
<td>B</td>
<td>4.64</td>
<td>4.52</td>
<td>exp.</td>
<td>.294</td>
<td>.70</td>
</tr>
<tr>
<td>C</td>
<td>4.66</td>
<td>4.31</td>
<td>exp.</td>
<td>.892</td>
<td>.38</td>
</tr>
<tr>
<td>D</td>
<td>3.59</td>
<td>3.41</td>
<td>exp.</td>
<td>.695</td>
<td>.49</td>
</tr>
<tr>
<td>E</td>
<td>7.04</td>
<td>6.34</td>
<td>exp.</td>
<td>1.398</td>
<td>.18</td>
</tr>
<tr>
<td>F</td>
<td>4.27</td>
<td>4.52</td>
<td>con.</td>
<td>-.865</td>
<td>.40</td>
</tr>
<tr>
<td>Retention</td>
<td>11.79</td>
<td>11.69</td>
<td>exp.</td>
<td>.316</td>
<td>.69</td>
</tr>
<tr>
<td>Ret. Sub.</td>
<td>6.92</td>
<td>6.72</td>
<td>exp.</td>
<td>.799</td>
<td>.43</td>
</tr>
</tbody>
</table>

None of the obtained values of t was significant at the .05 confidence level or better. For this reason, none of the hypotheses 10-18 could be rejected. Correspondingly, none of the experimental
hypotheses $H_1$ through $H_9$ which were presented in Chapter IV could be rejected.

The value of $t$ which was closest to being critical was that of the sub-test E. The value of $t$ was 1.398, which, with 27 degrees of freedom, could cause a rejection of the hypothesis at a significance level of .18. Sub-test E was a measure of test items which were directly associated with a visual presentation made by a slide.

A discussion of the conclusions which could be made from this data analysis is presented in Chapter II.

This concludes the analysis of data for the investigation. The next chapter presents a summary of the experiment, some conclusions made from the data analysis, and some recommendations for future investigations in this same area of mathematics education.
CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

Summary

This study compared the effects of two different treatments of insurance instruction on classes of secondary school consumer mathematics students. The experimental treatment consisted of instruction by the regular classroom teacher, aided by: a) a unit outline on insurance for the renter or homeowner, automobile insurance, and life insurance; b) a set of 142 slides which illustrated the insurance principles; c) worksheets for arithmetic computation practice and reinforcement of some of the insurance principles; and d) objective post-tests and retention tests. The control treatment consisted of instruction by the regular classroom teacher, aided by: a) a unit outline on insurance for the renter or homeowner, automobile insurance, and life insurance; b) worksheets for arithmetic computation practice and reinforcement of some of the insurance principles; and c) objective post-tests and retention tests.

The use of the slides in the experimental treatment was intended to serve as a motivational device for the students and as an aid to their learning and remembering the content of the insurance instruction.
The investigation was conducted during the school year, 1971-1972, with participating classes in eleven high schools from the public school system of Columbus, Ohio. The course title of the classes which participated in the study was "Applied Mathematics." This course was designed for students in tenth, eleventh, or twelfth grade who had experienced previous difficulty in a general mathematics course. The basic format of the course was organized around the arithmetic needed for daily living situations—what could be called "consumer mathematics."

A pilot study was conducted at one of the high schools in the school system with a class of 18 students: 13 males and 5 females. The experimental treatment was administered by the investigator using 9 class periods for instruction and 1 class period for the pilot study post-test. As a result of the pilot study: 1) the post-test was reduced to 40 test items; 2) a retention test was developed for a delayed measure of achievement; 3) a vocabulary handout sheet was developed; and 4) minor changes were made in the worksheets and the sets of slides.

To obtain participants for the study, the investigator visited 13 of the 14 high schools in the school system and discussed the study proposal and instructional materials with at least one mathematics teacher in each building. Of the 21 teachers of Applied Mathematics in the system, 15 returned a form indicating a desire to participate in the study.

The assignments of the teachers to experimental or control treatments followed the preferences indicated by the teachers. The
resulting assignment produced an experimental group of 16 classes taught by 9 teachers, and a control group of 13 classes taught by 6 teachers. Each teacher was allowed to schedule the instruction of the unit into a convenient period of time from the second week of February through the first week of June. The average time needed for instruction by teachers in both groups was approximately 10 class periods. The investigator transported the written instructional materials and the slides between schools and graded the tests for the teachers.

A measure of the students' ability in arithmetic computation was recorded from the school records. An F-ratio and t-test analysis of these data indicated that the two treatment groups were not significantly different in arithmetic computation ability prior to the insurance instruction.

The measures of achievement of the participating students after the treatment were obtained by administration of a multiple-choice post-test and a true-false retention test. The retention test was administered from 8 to 13 days after the conclusion of the insurance instruction. Indication of affective changes and data about the teaching of the unit were obtained from teacher questionnaires.

The average value of the experimental group class means for the post-test was 16.53. The average value of the control group class means for the post-test was 15.77. The average value of the experimental group class means for the retention test was 11.79. The average value of the control group class means for the retention
The statistical analysis of the test data first employed an F-ratio test for homogeneity of variance between groups. The results of this test determined which t-test could be applied to the class means. Nine null hypotheses were stated regarding the difference between means on the achievement tests and sub-tests. None of these hypotheses were rejected with a .05 confidence level or better after application of the t-tests. The average measures of the experimental group were higher than those of the control group for 8 of the 9 achievement scores. The exception was a post-test measure of arithmetic computation. The greatest confidence level with which an hypotheses could have been rejected was .18. This occurred on a sub-test of questions which were directly related to a visual presentation made by a slide.

If students were absent on the scheduled day for administration of the objective test, they were allowed to take the missed test on the following day. The summary of the data on enrollment and test attendance is presented in Table 17.

<table>
<thead>
<tr>
<th></th>
<th>Enrollment</th>
<th>No. that took Post-test</th>
<th>No. that took both tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp.</td>
<td>373</td>
<td>275</td>
<td>230</td>
</tr>
<tr>
<td>Con.</td>
<td>246</td>
<td>177</td>
<td>145</td>
</tr>
<tr>
<td>Total</td>
<td>619</td>
<td>452</td>
<td>375</td>
</tr>
</tbody>
</table>
It was found that the number of students attending class on any typical day was, on the average, about 75 per cent of the class enrollment. It was also discovered that the number of students who attended class regularly over a two-week period was, on the average, about 60 per cent of the class enrollment.

From the responses to a survey of the content of the insurance instruction, it was judged that no gross differences existed between the insurance content of the presentations made by the experimental group teachers and that of the control group teachers. From another survey, it was judged that similar positive changes occurred for students in both treatment groups in attitude, enthusiasm, and class discussion. A similar finding was made for teacher attitude. Neither group experienced any significant change in student attendance during the treatment period. Two of the teachers having classes in the experimental group did report that student "cutting" decreased during the treatment period.

**Conclusions**

On the basis of the results reported in Chapter V, it can be concluded that exposure to the experimental treatment did not result in achievement which measured significantly different from achievement resulting from exposure to the control treatment. That is, classes of low achieving students studying insurance with the benefit of insurance slides and worksheets did not achieve significantly different from classes of low achieving students studying insurance with the benefit of only the worksheets.
It can also be concluded that the inclusion of a) worksheets, or b) slides and worksheets, in the instruction of insurance at the secondary school level caused a positive change as judged by the participating teachers in the: 1) attitude of the students; 2) enthusiasm of the students; 3) attitude of the teachers; and 4) class discussion. This change occurred in relation to the previous classroom instruction of the school year. It can be concluded that the addition of a) worksheets, or b) slides and worksheets, to the instruction of insurance at the secondary school level did not cause any apparent effect on the student attendance in the classes.

It should be emphasized that the above conclusions have application to the specified population and to the instructional materials developed for this study. Any replication of this study, or application of the above conclusions, should take into consideration the limitations and delimitations of the investigation.

Discussion

One of the notable features apparent in the report of the investigation was student attrition in the sample population. The data for this feature are presented in Tables 7 and 17. Working with an enrollment of 619 students in 29 Applied Mathematics classes, only 452 were present for the administration of the post-test. The loss of 167 students represented almost 27 per cent of the enrollment of the classes. For the administration of the retention test, 41 students were present who had not taken the post-test. Further, 77 of the students that had taken the post-test were not present on
either of 2 days allowed for the retention test. The final number of students that could be used as a base for a delayed measure of achievement was 375—approximately 61 per cent of the class enrollment.

This apparent characteristic of classes of low achievers certainly influenced the effectiveness of the two-week instructional unit. Students who had missed a class period or more of instruction and then had returned would have needed individual attention from the teacher to get "caught-up." Having missed the instruction they might not have participated in nor cared about the class discussion of the particular topic. The classroom teacher might have had to spend an unusually large amount of class time checking on the whereabouts and excuses of the students. All of these factors, and possibly more, would have detracted from the efficiency and planning of the instruction. A similar situation regarding experimental mortality was reported by Nibbelink (112) in work with seventh grade underachievers.

Similar positive changes in student attitude, enthusiasm, and class discussion were reported by teachers having classes in the experimental group and teachers having classes in the control group. This reporting seems to indicate an important positive value in using non-textual materials in the instruction of these students. Although measures of these variables were not made prior to the experiment, the reports of the participating teachers made comparative statements about instructional techniques used in earlier units. The reactions of the teachers to these new
materials—with or without the slides—seem to indicate that the instructional unit was appropriate for low achievers and the teaching of insurance. Some of the key comments of the participating teachers which indicated this are included below (with the teacher identification code):

"They were very eager to respond with their own experiences on these topics." CT3

"Students a bit more involved." CT6

"For the first time they could feel like a class participant." ET3

"The students were particularly motivated when they had examples." ET3

"The students seemed to become involved more with this material because it dealt with a topic which they are already or soon will be concerned with. They could relate to it." CT3

"More initiative was shown in discussion insurance than regular math." ET3

"I would say they were more enthusiastic than they have been most of the school year." CT3

"Number of students participating in the discussions increased." ET2

"Usually lively and about 90% participation." ET3

"It seemed to improve—in quality and in number of discussions. It also seemed to invoke discussion from more students than in earlier classes, prior to this unit." ET6

"Some people entered in that participated very little normally." ET9
"They were eager to respond with their own experiences or their parents. Also, they had questions which they had been wondering about." CT3

"More opportunity here for discussion than many other topics—students liked that." CT6

"A refreshing change." ET7

"The availability of the visual aids are always a boon." ET9

"Learning along with the students." CT1

"I felt more cooperation out of the students . . . and became more involved in the discussion than I had in previous units." CT3

"Nice to have some facts and figures which are current to fit into the discussions." CT6

The statistical analysis of the achievement data neither substantiated nor negated the value of classroom instruction of insurance aided by slides, as compared to classroom instruction of insurance without the benefit of the slides. The comments included above seem to provide support for the design and application of instructional materials which are judged by the teachers as accurate and up-to-date.

The achievement measures of the experimental group were higher, on the average, than the achievement measures of the control group on 8 of the 9 test scores. There is the possibility that this was a function of the particular makeup of the group since the pre-investigation measure of arithmetic computation was also higher for the experimental group. However, the situation is not that clear-cut. The sub-test which produced a higher score for
the control group was Sub-test F—Computation. If the groups had followed the trend indicated by the pre-investigation measure, then the control group certainly wouldn't have gotten the higher computation measure. It appears that the treatment did have an effect on the achievement measures of the groups. The difference with the highest confidence level was in the measure of test items which were directly related to a visual presentation made by a slide. And the difference was in favor of the experimental group—the classes that viewed the slides. However, the conclusion cannot be made at this time that the visual approach was definitely more effective. The t-test analysis of the post-test did not reach the accepted significance levels for Sub-test F. And a sub-test of similar items on the retention test did not show that the possible benefits of a visual approach were evident after a delay of 8 to 13 days.

The discussion already presented in this section has dealt with the primary and secondary purposes of the study: to investigate the effects of classroom use of slides dealing with insurance on low achieving students and their teachers. An ancillary purpose was the verification of the characteristics of low achievers reported by the participating teachers with those reported in the educational literature.

In Chapter V, nine descriptive characteristics were listed which had been included in replies on the teacher questionnaires. Among the nine, four were characteristics associated with social and emotional problems, three were associated with learning
difficulties, and two were prescriptive in nature. A comparison of these with the lists of characteristics and recommendations in the "Low Achiever in Mathematics" section of Chapter II shows that all nine were included in the lists from the educational literature.

**Recommendations for Program Revision**

After reviewing the investigation which was reported here, the following are recommendations which have been made for revision of the instructional materials and their use:

1) Develop more worksheets. Additional worksheets should be produced which give further reinforcement and practice with the insurance vocabulary and the arithmetic operations. Items on the sheets should deal with the spelling and definitions of the various insurance terms. Several sheets should be produced which have problems of premium and indemnity calculation—reinforcing the principles stressed in the insurance instruction.

2) Reproduce the automobile insurance tables on handout sheets. It was found that the slides of the automobile insurance tables were too finely detailed for use in a large classroom. This could be solved by providing each student with rate tables which could be used individually.

3) Provide more variation in the instructional procedures. Instead of showing and discussing slides for 2 or 3 days, followed by 1 day for a worksheet, each day could be spent
with some slide-viewing, some discussion, some written work, and possibly a review. The activities, and their emphasis, in each class period could vary—depending on the content of the particular area of insurance under discussion.

4) Construct a sub-unit on medical insurance. Insurance for health-care expenses is another of the more frequently purchased insurance plans that could be included in the instructional unit. The kinds of policies which are available could be described, along with some examples of the arithmetic involved.

5) Review the rates and figures. To keep the instructional unit accurate and up-to-date, the rates and figures would have to be reviewed annually or biannually. New tables, charts, and slides would have to be made which utilize the new figures. For that reason, it probably would be best to leave the unit in slide form, rather than replace it with filmstrips.

6) Allow for further activities within the program. If the circumstances would permit it, the instructional unit could be expanded to capitalize on some additional influence—as a guest speaker for part of the instruction and discussion, or student use of desk calculators with the worksheets.
Recommendations for Further Research

Several recommendations could be made regarding further research with: a) teaching the low achiever, b) audiovisual techniques, c) the teaching of consumer mathematics, and d) combinations of the three areas.

One suggested study would use consumer mathematics as a vehicle to investigate relationships which might exist between audiovisual presentations and the accomplishment of various types of educational objectives: memory, translation, interpretation, application, analysis, synthesis, and evaluation. It might be found that low achievers can perform certain kinds of tasks best after instruction aided with an audiovisual presentation.

Another study could have test items matched with verbal, graphical, and realia slides. This type of study might provide some information on the types of visual presentations which have the most impact on low achievers.

An investigation of placement procedures might help establish where in the secondary school curriculum a consumer mathematics course would be most profitably offered. Placement options might include: a) segregation by grade level, b) segregation by sex, or c) entry into the course restricted to a certain ability level.

Further information might be obtained about the low achiever from studies of audiovisual presentations in other topic areas within consumer mathematics. Some likely areas for development would include: credit and installment buying, taxes, and investments. If several of these units could be developed, a study
could be conducted which evaluated audiovisual presentations over a month or more—possibly an entire one-year consumer mathematics course.

A study similar to the one reported, but much more difficult to initiate, would match the use of the insurance unit in one group with another group studying the same unit with no supplementary materials. The difficult part would be the finding of a participating teacher and class that would not be allowed to use any extra materials. If such a study could be arranged, it might help establish the value of classroom use of worksheets and visual presentations with low achievers.

The preceding recommendations for further study were all made in the spirit of increasing the knowledge regarding the teaching of the low achiever. The investigation reported herein did not establish statistically the superiority of any one method for teaching the low achieving consumer mathematics student a unit in insurance. However, it is felt by the investigator that the worth of educationally sound consumer mathematics instructional materials—and the serious need for their development, production, and classroom use—has been demonstrated.
APPENDIX A

Description of the Course "High School Mathematics"
A new course in mathematics will be added to the curriculum of the Columbus senior high schools beginning with the 1969-70 school year. The name of the course will be HIGH SCHOOL MATHEMATICS.

Course content will consist of basic mathematical concepts and skills, together with practical applications of mathematics to everyday situations. The course is intended for pupils who have experienced considerable difficulty in previous mathematics courses and who need one or more courses to prepare them for daily living situations that require mathematics. Classes will be held 5 days per week. One unit credit will be awarded for successful completion of the course.

HIGH SCHOOL MATHEMATICS is not intended to replace any courses currently offered, although it is anticipated that some students who might have elected General Mathematics II, Business Arithmetic or Shop Mathematics because of a lack of a course more nearly suited to their needs and abilities will choose HIGH SCHOOL MATHEMATICS rather than or in addition to these courses.

This new course in the curriculum will make it unnecessary to form modified sections in any of the other mathematics courses in the senior high school. A textbook appropriate for this course will be adopted during this school year.
APPENDIX B

Insurance Unit Outline
## Suggested Teaching Schedule

<table>
<thead>
<tr>
<th>WITH SLIDES</th>
<th>WITHOUT SLIDES</th>
</tr>
</thead>
<tbody>
<tr>
<td>day</td>
<td>day</td>
</tr>
<tr>
<td>*1 Introduction to Insurance</td>
<td>1 Introduction to Insurance</td>
</tr>
<tr>
<td>*2 Insurance for the Renter</td>
<td>2 Insurance for the Renter</td>
</tr>
<tr>
<td>*3 Insurance for the Homeowner</td>
<td>3 Insurance for the Homeowner</td>
</tr>
<tr>
<td>4 Fire Insurance Worksheet</td>
<td>4 Fire Insurance Worksheet</td>
</tr>
<tr>
<td>*5 Auto Insurance I</td>
<td>5 Auto Insurance I</td>
</tr>
<tr>
<td>*6 Auto Insurance II</td>
<td>6 Auto Insurance II &amp; III</td>
</tr>
<tr>
<td>*7 Auto Insurance III &amp; Worksheet</td>
<td>7 Life Insurance</td>
</tr>
<tr>
<td>*8 Life Insurance</td>
<td>8 Life Insurance Worksheet</td>
</tr>
<tr>
<td>9 Life Insurance Worksheet</td>
<td>9 Post-test</td>
</tr>
<tr>
<td>10 Post-test</td>
<td>*Slides shown on these days</td>
</tr>
</tbody>
</table>

NOTE: The outline is intentionally brief. It should not be assumed that the descriptions will necessarily be complete "lesson plans."
INTRODUCTION TO INSURANCE

1. Meaning of insurance
   a. explanation of "risk"
   b. provides financial protection for various kinds of risks
   c. everyone lives with certain risks
   d. economic risks involve loss of property or earning power
   e. there are alternatives to insurance; e.g., savings account
   f. could be used as a forced savings plan
   g. began with protection for value of goods shipped by boat
   h. cost of insurance causes higher prices for goods and services
   i. examples: automobile, health, life, fire, travel, singer, dancer, artist,
      sports figure, farmer, credit cards, construction of building,
      mortgage, college expenses, ...
   j. cash would generally not be available for the things that get insured

2. Principles of insurance
   a. insurance involves sharing
   b. no insurance: each person pays his own losses (e.g., lost textbooks)
   c. study previous losses of a group of people to predict future losses
   d. the "fee" for participating is determined from this study
   e. insurance company invests these fees: corporations, mortgages, bonds, ...
   f. if fewer people lose than predicted, company makes adjustment
   g. if more people lose, company may be in financial trouble
   h. government regulation is needed to supervise insurance activities
   i. Law of Large Numbers can make prediction better than 99% accurate
   j. mathematics used for these predictions is called probability
   k. although the number of people suffering a loss can be estimated, it
      is impossible to "single them out"
   l. an insurance policy can decrease the financial loss from risks; it
      can't remove the risks

Possible Assignment for Students:
1. attach a newspaper or magazine article to a sheet of paper; explain how
   insurance was important to the article.
   or
2. work out the details for an imaginary insurance plan of your choosing
   (e.g., bicycle theft at the high school). Show how the insurance fee was
   determined.
INSURANCE FOR THE RENTER

1. Question and answer period
2. Discuss completed assignments
3. Renter's insurance
   a. Landlord has insurance on building -- typically not on the contents of the apartments
   b. Contents of apartment could easily be worth $3,000 or more
   c. Fire loss (fire, smoke, water damage): 2376 home and apt. fires in Columbus in 1970, total loss $912,565; average loss about $384
   d. Theft: 7971 burglaries in 1970, total loss $1,439,568; average loss about $252
   e. Greatest number of losses in the heavily populated areas; e.g., surrounding O.S.U.
   f. Other reasons for insurance: accident liability, heating system damage, weather damage, vandalism, vehicle damage, ...
   g. Factors affecting premiums: building construction, neighborhood, fire protection, policy coverage

Possible Assignment for Students:
1. Estimate the value of the contents, room by room, in an apartment or home. What are the most expensive items? How much insurance would be needed for complete protection?
INSURANCE FOR THE HOMEOWNER

1. Question and answer period

2. Review or explain vocabulary: policy, coverage, premium, indemnity

3. Homeowner's policies (only 4 types)
   a. basic: fire, theft, liability, weather damage, vandalism
   b. broad: adds heating system, building collapse, electrical injury
   c. special: most other causes of physical damage
   d. comprehensive: all-risk coverage
   e. representative costs in order: $70, $90, $115, $190

4. Insurance needs
   a. similar to renter
   b. fire loss is rarely total; buy less insurance than property value
   c. inflation increases property value; review insurance needs

5. Insurance coverage and protection
   a. factors affecting premium same as renters
   b. rural home: haul water by truck; pond or stream
   c. urban: fire can spread from home to home when close
   d. modern, complete fire equipment can deal with more varied situations
   e. extended policies cheaper than renewing an annual policy

6. Indemnity and premium problems (see worksheet for factors)

7. OPTIONAL: 80% Clause

Indemnity = (Face Value) - (Fire Loss)
80% of Property Value
AUTO INSURANCE I

1. State financial responsibility law
   a. every driver is required to have cash, capital, or insurance to cover accidents
   b. bodily-injury limits: $12,500 for one person; $25,000 for a group of people
   c. property-damage limit: $7,500

2. Automobile accidents
   a. every 3 seconds an accident in the U.S.
   b. every 11 seconds an injury or death
   c. cash awards are high; occasionally in hundreds of thousands of dollars
   d. primarily 2 types: either your car is the only one involved, or there is at least one other

3. Accident costs
   a. repairs to your car
   b. repairs to the property of others
   c. medical expenses
   d. out-of-work expenses (while in hospital, etc.)
   e. court liability suits

4. Liability insurance
   a. primarily "protects others" from your accidents
   b. bodily-injury; stated as 10/20, 50/100 ... meaning a maximum of $10,000 for any one person and a maximum of $20,000 to a group
   c. property-damage; stated as 5 , 10 , ... meaning a maximum of $5,000 for repairs to the other person's car, lawn, house, or whatever.
   d. medical payments (see vocabulary list)

5. Factors affecting premium
   a. territory; traffic density affects probability of accidents
   b. age and sex of driver, driver training
   c. accident experience of driver
   d. car use: pleasure, to work, for business
   e. coverage
   f. a factor is determined for each driver and his particular situation; the basic premium for his territory gets multiplied by that factor

6. Sample problems
AUTO INSURANCE II

1. Collision insurance
   a. you hit a tree or other object; no one else is involved
   b. liability insurance does not cover this circumstance
   c. collision insurance covers the damage to your car
   d. deductible ($50 or $100), saves insurance company money; you save money if you don't have accidents
   e. older car -- might be a waste of money to have collision insurance

2. Comprehensive insurance
   a. covers other "non-accident" damage to your car: vandalism, theft, ...
   b. deductible and older car, same as above

3. Factors affecting rates
   a. driver
   b. territory
   c. use of car
   d. age of car
   e. value of car -- more expensive car costs more to repair, and is stolen more frequently
   f. car horsepower -- "muscle" or high-performance cars are in a higher number of accidents, and are more frequently stolen
   g. coverage
   h. again, the basic premium is multiplied by the appropriate factor
AUTO INSURANCE III

1. Question and answer period

2. Uninsured motorist (see vocabulary sheet)
   a. approximately 10 million on the road
   b. in most states, your collision insurance would pay for the damage to your car; in others, the U.H. coverage would
   c. flat fee for everyone, about $5-10 per year

3. Towing insurance
   a. flat fee, $8 per year
   b. could join A.A.A. or motor club instead

4. No-Fault insurance (see vocabulary sheet)
   a. many different plans are being tried -- some do allow law suits, some don't
   b. states are carefully observing how they are working elsewhere
   c. might reduce indemnities, and hence, premiums

5. Reducing your premium
   a. if you have more than 1 car, you got a 10-15% discount by insuring them both with the same company
   b. some companies reduce your deductible by $10 for each year that you drive without an accident
   c. notify the insurance company of any change in your car, driving habits, or territory

6. Sample Problems
   a. indemnities for various claims
   b. premiums for various drivers and cars
   c. claims involving deductibles
LIFE INSURANCE

1. Introduction
   a. financial security for dependants after the death of the person insured
      (funeral expenses, bills, running the family until the wife gets a
      job or remarries)
   b. form of investment; retirement fund
   c. insurance needs vary with individual, family, and age
   d. savings account does not provide an immediate, high level of financial
      protection
   e. mortality table determines the probability of death at any age

2. Term insurance
   a. insured for only a fixed amount of time
   b. good for special years: low income, mortgage, college, ...
   c. no cash value
   d. cheapest kind of life insurance
   e. airplane insurance is an example

3. Whole-life or straight-life insurance
   a. could pay premiums continuously until death; pay more than face value
   b. more expensive than term -- has a cash value
   c. most widely sold policy
   d. payments remain steady -- may be too high when you retire

4. Limited-payment life insurance
   a. insured for life, but pay for a fixed number of years
   b. more expensive than whole-life; also has a cash value, higher
   c. young family might not be able to afford it

5. Endowment insurance
   a. pay for a fixed number of years
   b. if you are alive at the end, you get the face value
   c. most expensive
   d. primarily used as an investment

6. Sample problems (use life insurance rate table)
Materials exist which are free of charge to the high school teacher.

Write for the "order form" for Free Educational Materials:

Insurance Information Institute
Educational Division
110 William St.
New York, N.Y. 10038

Write for the "1971-1972 Catalog of Teaching Aids:"

Institute of Life Insurance
Educational Division
277 Park Ave.
New York, N.Y. 10017

For information on auto and fire insurance, or to request a guest speaker on insurance, contact:

Bob Bailey
Director of Information
Ohio Insurance Institute
620 E. Broad St.
Columbus, Ohio 43215
(phone 228-1593)
APPENDIX C

Classification of the Slides into Basic Categories
Classification of the Slides into Basic Categories

REALIA
1, 2, 3, 4, 5, 6, 12, 13, 15, 16, 20, 22, 23, 24, 25, 26, 27, 31, 32, 33, 34, 35, 36, 37, 46, 47, 48, 49, 50, 55, 61, 62, 72, 73, 74, 78, 80, 82, 92, 93, 95, 96, 98, 99, 118, 119, 120

VERBAL
7, 8, 10, 17, 44, 51, 52, 53, 64, 68, 75, 76, 77, 81, 84, 88, 94, 97, 114, 117, 123, 125, 128, 132, 134, 139, 140, 141, 142

NUMERICAL: SAMPLE PROBLEM

NUMERICAL: PROBLEM TO COMPLETE
30, 43

GRAPH OR CHART
11, 14, 18, 19, 21, 45, 112, 113, 115, 124, 129, 133, 137

TABLE OF VALUES
APPENDIX D

Insurance Script
INSURANCE SCRIPT

Notes and Questions for the Classroom Use of the Insurance Slides

Slides 1 - 71 are in slots 1 - 71 of tray 1
Slides 72 - 142 are in slots 1 - 71 of tray 2

DAY 1, SLOT 1 of TRAY 1

1. NEW AUTOMOBILE A new car is an example of an object which might be insured. Without insurance, it might be impossible to pay for damage caused by it and to it.

2. HOSPITAL Medical bills can cause tremendous worry when funds are not available to pay them. Health insurance is a kind which most people obtain, either individually or through a group plan.

3. FARMER'S CROP If the farmer depends upon a crop for his living, he might carry insurance against weather damage. A single hail storm or spring flood could bring financial disaster.

4. CREDIT CARDS Insurance has been available to cover purchases made with stolen credit cards. For the careful person, it is a questionable expense.

5. SPORTS FIGURES A sports personality, artist, musician, or other person who would lose earning ability if critically injured could insure his life's income. In each of these situations, the person is willing to sacrifice a small insurance fee rather than risk a fantastic loss.

6. TEXTBOOK This example gives a simplified view of how an insurance plan works. Suppose it cost $4 to replace this textbook if lost or stolen.

7. PREVIOUS YEAR STATISTICS A survey of the class shows that 3 books were lost last year. With no insurance, 3 people each paid the full amount, $4.

8. PREDICTION A prediction must be made for the situation in the future. Additional information might change the prediction from a repeat of the previous situation.

9. INSURANCE FEE With everyone sharing in the loss, each will pay 40c. That means that those who lose a $4 book will have paid 40c, and those who don't lose anything will also pay 40c. Discuss the "gambling" aspect of an insurance plan.

10. PREDICTION ERROR The prediction is rarely perfect; insurance companies must constantly review their figures and insurance rates. Government regulation helps reduce the number of insurance companies that become insolvent.
11. LAW OF LARGE NUMBERS  This principle from probability theory states that our prediction will be better and better as our statistical base gets larger. The figure can be found which will make the prediction correct better than 99% of the time.

12. CARS ON EXPRESSWAY  In this group of vehicles, it can be predicted that a certain number will be involved in an accident during the next year. However, the specific ones cannot be pointed out.

13. CARS IN PARKING LOT  Similarly, it can be predicted that a certain number of these cars will be stolen during the next year. A more refined prediction would state that certain kinds of cars (sports cars, expensive models) in the lot would be more likely to be stolen than the others.

14. INSURANCE INVESTMENTS  This graph shows how life insurance companies invest their premiums. When stocks and corporate bonds are combined, it is seen that the largest section goes to corporation investments. Explain briefly how some of these monies might be used ... and why premiums are invested in the first place.

DAY 2, SLOT 15 of TRAY 1

15. LIVING ROOM  Use this slide to show the dollar value of the contents of an apartment. Point out the sofa, carpet, TV, record changer, and the large record collection. Have the students calculate an estimate of the total worth. (The air conditioner should not be included.)

16. LIVING ROOM WITH PRICE TAGS  The total of the tags for this particular room is $1,921. (Records alone are worth $800) However, old furniture would not be replaced with brand-new items. Point out that pictures like these could be token and stored safely for insurance purposes.

17. FIGURES FOR OTHER ROOMS  Mention some of the personal property which might be included in the other rooms. The total for the apartment is over $4,000 -- it has taken several years to accumulate. Perhaps the apartment insurance could first have a low coverage... and then be increased after a few years.

18. COLUMBUS FIRES  These figures are for 1970. The fires are fairly evenly distributed throughout the city, and are less dense in the rural areas. The average fire loss is about $384.

19. COLUMBUS BURGLARIES  These figures are for 1970. The area around O.S.U. is significantly more dense than anywhere else in the city. The average theft is about $252.

20. APARTMENT ACCIDENT  A law suit could be brought against an apartment renter for accidental injury to a visitor, mailman, salesmen, etc. Renter's insurance can include liability protection.

21. OTHER APARTMENT LOSSES  These incidents (from home insurance) could occur to the renter. Point out those which you feel are most important.

22. BRICK APARTMENT BUILDING  A brick structure is moderately fire-resistant; it would not catch fire easily if an adjoining building were burning; a fire would spread "slowly" internally; and there would generally be little overall damage.
23. FRAME APARTMENT BUILDING  A wooden structure is considered significantly less fire-resistant. The danger from fire would be considerably greater in a building such as this, with a higher probability of loss.

24. FIRE HYDRANT  When seconds are critical, a fire hydrant near the structure could mean a smaller loss due to fire damage. The distance to the water supply is considered in fire insurance rates.

25. MODERN FIRE TRUCK  Modern, professional fire protection can reduce the risk of possible fire loss. The community fire protection is also considered: equipment, facilities, availability, training of staff, etc.

26. FIRE STATION  A modern fire station with a full complement of equipment is prepared to handle a wide variety of fire-fighting situations.

27. APARTMENT INSURANCE POLICY FACE  Point out the required information: neighborhood zone, fire hydrant distance, distance to fire station, construction of building.

DAY 3, SLOT 28 of TRAY 1

28. HOME FIRE I  Since the face value was more than the loss, it will be completely paid.

29. HOME FIRE II  The indemnity is the face value in this case -- the owner must pay the difference. If the face value should be more than the property value, and the loss were total, the indemnity would only be the property value ... you wouldn't be allowed to "make a profit" on a fire loss.

30. HOME FIRE III  The indemnity here would be $15,000.

31. BRICK HOME  As with apartments, brick structures have lower fire insurance rates because of their degree of fire-resistance.

32. FRAME HOME  Point out why the probability of a high loss is greater with a wooden structure.

33. PROXIMITY OF HOMES  This situation (on 17th Ave.) is potentially dangerous. Ask the students why? In other cities, some neighborhoods have frame buildings just inches apart from each other.

34. LADDER TRUCK  Equipment like this is important when there are many 2-story structures to protect. Some fire stations do not have a ladder truck.

35. SNORKEL TRUCK  This ultra-modern piece of equipment is the only one in Franklin County -- located in New Rome. It can handle a large number of fire and emergency situations which could not be handled by any other equipment.

36. VOLUNTEER FIRE STATION  This is the only volunteer fire department near Columbus -- located in Westerville. Ask the students how this might affect fire insurance rates.
37. RURAL HOME  There are no fire hydrants within a mile of this home. How would the fire-fighters get water? (haul by truck, or pump from a pond or stream)

38. FIRE RATING CHART  A letter code is given to each home depending on the fire protection, water supply, and neighborhood. A "higher" letter indicates a greater risk of fire loss.

39. FIRE INSURANCE RATES  These rates (in fractions of $) are given for the letter codes. If the number of hundreds of dollars of coverage is known, the premium can then easily be determined. Point out that .086 is a little over 6c; .300 is just 30c.

40. SAMPLE PROBLEM  The first step is finding the number of 100's (or $100 bills) in the desired coverage. Then, multiplication by the rate produces the premium.

41. EXTENDED RATES  In taking out a policy for several years, the insurance company saves money on paper work and employee time. Passing along the savings to the insured is accomplished through these extended rates.

42. FIRE INSURANCE PROBLEM I  Carefully move through the steps of the problem, showing where each figure comes from. You might multiply the annual premium by 5 to show the savings.

43. FIRE INSURANCE PROBLEM II  Have the students think through or actually work this problem. ($.320 per $100 is the rate; 2.7 is the 3-year factor) The annual premium is $49.60; total for 3 years is $133.92.

DAY 5, SLOT 44 of TRAY 1

44. FINANCIAL RESPONSIBILITY  In Ohio, as in most other states, each driver is legally required to be able to pay liability claims to certain limits. Insurance, cash, or capital could be the source of this payment.

45. CLOCKS  These clock faces show how frequently automobile accidents and injuries occur in the U.S.

46. NEWSPAPER ARTICLES  These reports show accidents that have happened in the last few months. Some of those involve only one car and its driver, one car and another person, or more than one car.

47. LIABILITY SUITS  These law suits all deal with automobile accidents. Few people would carry insurance to cover extreme situations like these. Damages of only a few thousand dollars are much more common.

48. DAMAGED AUTOMOBILE  Auto body damage is one obvious result of an accident. You would be required to pay for the damages if you were at fault; similarly, you'd want the other driver to be able to pay if it were his fault.

49. ORTHOPEDIC AIDS  Besides normal medical bills, orthopedic appliances might be required as the result of an accident. A permanent disability is one of the most expensive "injuries" in an automobile accident.
50. TIME CARD If a person is unable to work after the accident, he will probably be awarded an amount to make up for his lost salary.

51. BODILY-INJURY Describe bodily-injury insurance; explain the interpretation of "15/30."

52. PROPERTY-DAMAGE Describe property-damage insurance; explain the meaning of "10."

53. MEDICAL PAYMENTS Describe medical payment insurance; explain the meaning of "1."

54. INDEMNITY PROBLEM These expenses would easily be covered by even a minimum insurance policy. Very few of us would have that kind of cash.

55. OHIO MAP A state is usually divided into territories for insurance rating. Columbus is designated 03; Cleveland is coded 12 and is the most expensive area; Xenia is an example of a 40 territory, the cheapest.

56. TERRITORY 03 Here are some basic rates (in dollars). Notice the coverages and the abbreviations. For just a few dollars more each year, much higher coverages are available. Make a note of the $50 rate for 15/30 B.I.

57. TERRITORY 12 This territory represents Cleveland. Notice that the basic 15/30 rate is $83. Why would it be more expensive?

58. TERRITORY 40 The cheapest insurance is in the rural areas, designated by territory 40. The basic rate has dropped to $37.

59. ACCIDENTS BY AGE GROUP A survey of accidents shows some interesting features about young drivers as a group. What does this mean for their insurance rates? Why might they be involved in more accidents? Is it fair to group them together and charge them high rates?

60. RATES BY AGE Look what happens as a driver gets older. Compare the graphs for unmarried males, married males, and unmarried females. Who gets the closest to the average (or base) rate?

61. PREVIOUS ACCIDENTS You will be asked about your accident convictions when applying for insurance. The insurance company can then check with the motor vehicles office to verify the information. Those with accident convictions and serious traffic convictions will be charged more for insurance coverage.

62. CAR USED FOR BUSINESS This car is an example of a family car which is used in business operations. Since it is exposed to more traffic, it has a greater probability of being involved in an accident.

63. RATE TABLE Point out each of the 6 factors. Note that the driver training only affects ages 17-20. "Good student" means a full-time student with a B-average or more. "Pleasure" means not driven to work, or the distance from home to work is less than 3 miles.

64. DUSTER PROBLEM Here is a problem for an insurance quotation. Have the class remember the information so you can go to the next slide.
65. MALE DRIVER FACTORS Show how the information determines exactly one driver factor, 3.65. Return to the previous slide if the students do not remember the information.

66. TERRITORY 03 The basic rates for 20/40 B.I., 10 P.D., and 1 M.F. are $54, $40, and $7 respectively.

67. FINISHED PROBLEM Each basic rate gets multiplied by the driver factor (3.65); the sum is the annual premium for just the liability insurance. Point out that the distributive property would allow us to add the basic rates and do only one multiplication problem ... to get the same answer.

68. PINTO PROBLEM Here's another problem which should show how much these driver characteristics influence the insurance premium. Repeat the process as you did with the Duster problem.

69. FEMALE RATES Show how the driver factor 1.35 is determined.

70. TERRITORY 03 The same basic rates apply since the coverage is the same.

71. FINISHED PROBLEM The multiplication results are shown. Note the tremendous difference in premiums. In the "check," where did the "$101" come from?

DAY 6, SLOT 1 of TRAY 2

72. FRONT-END COLLISION What kind of accident could have caused this damage? (hit a tree or pole) Liability insurance would not pay for the damage since it's your own car! It requires another kind of insurance.

73. NEWSPAPER ARTICLES Here are some other things which might happen to you. Again, liability insurance would not cover these situations.

74. MISSING ANTENNA Suppose you found your antenna broken off one day. You might want insurance to pay for that situation. If it were the windshield, you definitely would!

75. COLLISION Describe collision insurance. (deductible feature is presented on slides 82-83)

76. COMPREHENSIVE Describe comprehensive insurance.

77. COMPREHENSIVE COVERAGE Here are some of the situations which would be covered under a comprehensive policy.

78. MAVERICKS Use these 2 1972 Mavericks to point out some facts about insurance. The blue car is a 6-cylinder and lists at $2700. The white Maverick has an 8-cylinder engine (1), lists at $3400, and is called the Maverick Grabber. The collision and comprehensive insurance rates for the Grabber are higher than the other because: a) it costs more, and therefore costs more to repair, and b) it is more likely to be stolen. Since it is a small car with a big engine, it is classified as a high-performance or muscle car. As a result, an extra charge is added. It's more likely to be raced, driven on the streets without proper caution, and be involved in accidents.
79. CHEVROLET RATES This section of an insurance schedule shows the symbols for various Chevrolets. Point out that cars with the biggest engines (e.g., 350 h.p. in an 8-cylinder Sport Coupe) have a higher automobile symbol than the lower-powered models. A person buying a high-performance car should consider the more expensive insurance as part of the cost of the car.

80. OLDER CAR Consider how much damage might be done to this old car. Many cars like this are worth little more than their scrap value. Their owners should seriously consider whether or not collision and comprehensive insurance is a wise purchase.

81. C & C FACTORS Review these factors and how they affect the insurance.

82. MINOR REPAIRS To repair this small dent, or to replace that broken antenna, worth $2.98, the insurance company might have to spend over $100 in paper work and man-hours. To save you and them money, the "deductible" form was introduced. Generally, you are able to purchase $50- or $100-deductible C & C insurance, with a lower premium. Explain. Summarize: full comprehensive is most expensive, $50-deductible is cheaper, and $100-deductible is the cheapest. You save money if you don't have accidents or damage.

83. SAMPLE CLAIM Explain the figures in this situation. (Talk about teaching profession and locking gas caps if the students are curious)

84. DUSTER PROBLEM This is the rest of the insurance for the driver studied before. Age group 1 represents a 1971 car. Symbol 3 is the symbol for a Duster.

85. SYMBOLS Point out the age group "1" just below the "71." The "3" is opposite "8 cylinder, Valiant & Duster." (Notice the "h" for high-performance opposite the 385 Barracuda, with a higher symbol.)

86. 03 C & C The comprehensive was $50-deductible, with an age group of 1 and symbol 3; the basic comprehensive rate is $12.

87. COMPLETED PROBLEM Each basic rate is multiplied by the driver factor 3.65. Again, a check is possible by adding first. The liability Insurance cost this driver $368.65. His total annual premium would then be over $750 !

88. PINTO PROBLEM For the Pinto, the age group is the same, but the car symbol is lower. Therefore we expect the basic rate to be lower.

89. SYMBOLS Notice that all Pinto models have a symbol of "2."

90. 03 C & C Show how the comprehensive rate is found to be $9, and the collision, $82.

91. COMPLETED PROBLEM The figures are the result of multiplying by 1.35. The liability figure was $136.35, for a total of about $250; that's $500 less than the other car and driver.
DAY 7, SLOT 21 of TRAY 2

92. HIT-SKIP ACCIDENT 1 Damage to your car by a hit-skip or hit-and-run driver would generally be paid for by your collision insurance.

93. HIT-SKIP ACCIDENT 2 If you had medical expenses in addition to the car body damage, you would need Uninsured Motorist coverage to pay for them. Similarly, if the other driver was driving without insurance, or just could not pay, your own insurance could pay your expenses. (The car of the other driver might be impounded and his license taken away.)

94. UNINSURED MOTORIST Describe U.M. insurance. The cost does not get multiplied by the driver factor. (In some states, the U.M. insurance also pays for the damage to the car body.)

95. TOW TRUCK Some people join an automobile club, or purchase towing insurance to take care of that expense. Towing can easily cost $30 or more if you become stranded on an expressway.

96. NO-FAULT ARTICLES Ohio insurance companies are watching the No-Fault plans of other states. It is something that the students should be aware of since it will affect them in the near future.

97. NO-FAULT INSURANCE Describe no-fault insurance briefly.

98. TWO CARS If a person owns 2 cars, a discount of 10-15% is available when they are both insured with the same company. That’s one way to save money.

99. INSURANCE FORM In purchasing insurance, many questions must be answered. Point out several of the important ones.

---

Turn off the projector and have the students fill out the top of the Automobile Insurance Worksheet. When they are ready to determine the driver factor (07), continue showing the slides.

100. FEMALE FACTORS Find the factor for any girls in the class first. If they cannot see the figures on the screen, you or someone else will need to help read them.

101. MALE FACTORS Use these for the boys. Be sure that they understand what "principal operator" means.

103. Be sure that the students have each chosen some car for this exercise. If they are working with a 1972 car, they will need an estimate of its list price. For the automobile symbol, go through the next series.

104. 1972 SYMBOLS If the car is a high-performance car, add "1" to the symbol shown. The following slides will provide a symbol for most other 1965-1971 cars, domestic and foreign.
105. AUTOMOBILE SYMBOLS  Move through these slides slowly until everyone has
determined his own symbol.

110.

111. 03 RATES  The students must select the coverages they want for bodily-injury,
property-damage, medical payments, comprehensive, and collision.
These limits should be entered on the worksheet. The basic rates can
also be found on this slide and entered on the worksheet. Help those
that can't find the right figures.
No further slides are needed for the completion of the worksheet.

DAY 8, SLOT 41 of TRAY 2

112. $10/MONTH SAVED  Use this graph to estimate how much would be saved through
the years if $10 were put in the sugar bowl each month.

113. $80/YEAR INVESTED  Point out that a savings account increases the investment
through interest, but not greatly. The same $80 spent on life
insurance would bring an immediate $10,000 "worth of security."
(For cash value, however, the savings account is always ahead of
the insurance policy.)

114. LIFE INSURANCE TERMS  Discuss these terms; the only new one is beneficiary.

115. CAUSE OF DEATH  This graph shows that the most frequent cause of death has
been heart trouble. Where would automobile fatalities be included?

116. MORTALITY TABLE  This is a very abbreviated table. For any group of 100,000
persons alive at age 10, it gives the number still expected to be
alive at age 20, 30, ..., 95. The probability of being alive could
be determined from the figures. About what age will represent ½ still
alive? A proportion could translate the 100,000 base to a base of
30 (one class).

117. TERM INSURANCE  Describe term insurance.

118. HAZARDOUS ACTIVITY  An activity like this, where the risk of death is
greater than usual, might be a reason to take out a special term
insurance policy.

119. AIRPORT  Many people feel that a plane ride fits into that situation. Much
money is spent each year on the purchase of flight insurance.

120. FLIGHT INSURANCE  This is the policy available at the Columbus airport. Notice
how cheap the rates are.

121. TERM RATES  These rates are for the more typical term insurance. The premium
for $2,000 would be 2 times the premium for $1,000, and so on. Why
do the premiums rise as the person gets older? Why isn't a premium
listed for a 15-year term for a 55-year-old?

122. SAMPLE PROBLEM  Explain the process for solving the problem; return to the
previous slide to find the $7.74 premium.
123. WHOLE-LIFE Describe whole-life insurance.
124. WHOLE-LIFE GRAPH If the person insured continues to pay premiums, he could eventually pay more than the amount received by the beneficiary. Estimate the age from the graph.
125. WHOLE-LIFE CHARACTERISTICS Discuss; explain cash value.
126. WHOLE-LIFE RATES These are similar to those seen before, but are higher. Notice the difference in premium between ages 15 & 20 and that between 55 & 60.
127. SAMPLE PROBLEM Describe the process, as before.
128. LIMITED-PAYMENT Describe limited-payment insurance.
129. LIMITED-PAYMENT GRAPH Show how the figures are applied to the graph. How much money has been paid in over the 20 years? How can the insurance company then afford to pay back $10,000?
130. LIMITED-PAYMENT RATES Briefly scan the rates. Why are the rates on the 30-year plan less than the 20-year plan?
131. SAMPLE PROBLEM Briefly discuss the process.
132. ENDOWMENT INSURANCE Describe endowment insurance.
133. ENDOWMENT GRAPH Analyze; note that the total premium almost matches the amount returned. Has much been gained? Would a savings account have gained more or less?
134. ENDOWMENT CHARACTERISTICS Summarize.
135. ENDOWMENT RATES Briefly scan.
136. SAMPLE PROBLEM Briefly review the procedure.
137. SAVINGS FEATURE Summarize; term is the cheapest but returns nothing to the insured; endowment is the most expensive and has the highest return to the person insured. If a person were only concerned with the welfare of the beneficiary, which would be the wisest purchase?
138. PERIODIC PAYMENT A single annual payment is too large for many people. Point out that a semiannual payment is not just 1/2 of the annual premium, etc. The extra payments involve more expense for the insurance company.

OPTIONAL: The last 4 slides could be used in a review of the insurance unit.

139. REVIEW Use class discussion to recall important features and principles of each of these terms.
APPENDIX E

Insurance Vocabulary
INSURANCE VOCABULARY

ANNUAL yearly; once a year

BENEFICIARY person designated to receive the insurance money upon the death of the person insured

BODILY-INJURY automobile insurance which pays for injury to persons hurt through the use of the insured's car

CASH VALUE money available to the insured in exchange for his life insurance policy while he is still alive

CLAIM a demand for payment through the coverage of an insurance policy

COLLISION automobile insurance which pays for damage you might cause to your own car

COMPREHENSIVE automobile insurance which pays for miscellaneous damage to your car, such as vandalism, theft, weather damage, etc.

COVERAGE what is insured, and for what face value

DEDUCTIBLE amount of money (generally $50 or $100) paid by the insured for collision or comprehensive damage -- the insurance pays the rest

ENDOWMENT life insurance which pays the face value of the policy to the insured at the end of the payment period if he is still alive

FACE VALUE maximum dollar amount that will be paid by the policy for a claim

INDEMNITY money received from the insurance company as payment on a claim

LIABILITY INSURANCE protects against injury or damage which you might inflict upon other persons or their property

LIMITED-PAYMENT life insurance which insures for life, but involves only a fixed number of premium payments

MEDICAL PAYMENTS automobile insurance which pays the medical bills of those in your car when you are at fault

NO-FAULT automobile insurance plan in which each driver's insurance company pays his own expenses, regardless of who caused the accident

POLICY the contract between you and the insurance company

PREMIUM payment made to the insurance company to purchase the insurance coverage
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROPERTY-DAMAGE</td>
<td>Automobile insurance which pays for damage to another person's property through the use of the insured's car</td>
</tr>
<tr>
<td>QUARTERLY</td>
<td>4 times a year; every 3 months</td>
</tr>
<tr>
<td>SEMIANNUAL</td>
<td>2 times a year; every 6 months</td>
</tr>
<tr>
<td>STRAIGHT-LIFE</td>
<td>Life insurance which insures for life but involves an unlimited number of premium payments</td>
</tr>
<tr>
<td>TERM</td>
<td>Life insurance which insures for a fixed period of time with a fixed number of premium payments; has no cash-in feature</td>
</tr>
<tr>
<td>UNINSURED MOTORIST</td>
<td>Automobile insurance which pays for your medical expenses if the other driver is unable to pay or can not be found</td>
</tr>
<tr>
<td>WHOLE-LIFE</td>
<td>Same as STRAIGHT-LIFE</td>
</tr>
</tbody>
</table>
APPENDIX F

Fire Insurance Worksheet
### FIRE INSURANCE WORKSHEET

**Fire Rates (1")**

*for $100 of insurance*

<table>
<thead>
<tr>
<th>CODE</th>
<th>BRICK</th>
<th>FRAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.086</td>
<td>.102</td>
</tr>
<tr>
<td>B</td>
<td>.076</td>
<td>.112</td>
</tr>
<tr>
<td>C</td>
<td>.086</td>
<td>.122</td>
</tr>
<tr>
<td>D</td>
<td>.136</td>
<td>.172</td>
</tr>
<tr>
<td>E</td>
<td>.300</td>
<td>.320</td>
</tr>
</tbody>
</table>

**Extended Rates**

<table>
<thead>
<tr>
<th>YEARS</th>
<th>FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>3</td>
<td>2.7</td>
</tr>
<tr>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>5</td>
<td>4.4</td>
</tr>
</tbody>
</table>

**Property Value**

<table>
<thead>
<tr>
<th>Number</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$10,000</td>
</tr>
<tr>
<td>2</td>
<td>$17,500</td>
</tr>
<tr>
<td>3</td>
<td>$9,000</td>
</tr>
<tr>
<td>4</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

**Face Value**

<table>
<thead>
<tr>
<th>Number</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$5,000</td>
</tr>
<tr>
<td>2</td>
<td>$12,000</td>
</tr>
<tr>
<td>3</td>
<td>$10,000</td>
</tr>
<tr>
<td>4</td>
<td>80% of Prop. Val. $17,200</td>
</tr>
</tbody>
</table>

**Fire Loss**

<table>
<thead>
<tr>
<th>Number</th>
<th>Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$800</td>
</tr>
<tr>
<td>2</td>
<td>$14,500</td>
</tr>
<tr>
<td>3</td>
<td>total</td>
</tr>
<tr>
<td>4</td>
<td>$17,200</td>
</tr>
</tbody>
</table>

**Indemnity**

<table>
<thead>
<tr>
<th>Number</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

### Neighborhood

<table>
<thead>
<tr>
<th>Neighborhood</th>
<th>Fire Code</th>
<th>Home</th>
<th>Basic Rate (per $100)</th>
<th>Face Value</th>
<th>Number of 100's</th>
<th>Annual Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>B</td>
<td>Brick</td>
<td>$8,000</td>
<td>$12,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>C</td>
<td>Frame</td>
<td>$11,800</td>
<td>$11,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>D</td>
<td>Brick</td>
<td></td>
<td>$8,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Extended Rate Times the Specified Number of Years**

8. same policy as problem 5; TWO YEARS

9. same policy as problem 6; FOUR YEARS

10. same policy as problem 7; THREE YEARS

11. Suppose you have an $18,000 fire insurance policy on your home. If the fire rating on your home changes from D to C, how much money will you save on an annual premium?
APPENDIX G

Sample Application: Automobile Insurance
SAMPLE APPLICATION: AUTOMOBILE INSURANCE

1. NAME ____________________________ AGE OF DRIVER _________

2. MALE _______ FEMALE _______ MARRIED _______ NOT MARRIED _______

3. OWNER OF CAR OR PRINCIPAL OPERATOR? YES _______ NO _______

4. FULL-TIME STUDENT WITH AT LEAST A "B" AVERAGE? YES _______ NO _______

5. COMPLETED DRIVER TRAINING (ages 17-20 only)? YES _______ NO _______

6. CAR USED FOR:
   FARM USE, PLEASURE DRIVING ONLY, OR DRIVEN LESS THAN 3 MILES TO WORK ______
   BUSINESS, OR DRIVEN 3 OR MORE MILES TO WORK ______

7. FROM THE CHARTS SHOWN ON THE SCREEN, DETERMINE YOUR DRIVER FACTOR _______

8. TO THIS DRIVER FACTOR, ADD THE FACTOR IN THE TABLE BELOW FOR YOUR TRAFFIC ACCIDENT CONVICTIONS IN THE LAST 12 MONTHS.

<table>
<thead>
<tr>
<th>Accident Conviotions</th>
<th>Additional Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>2</td>
<td>0.6</td>
</tr>
<tr>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td>4</td>
<td>1.8</td>
</tr>
</tbody>
</table>

TOTAL DRIVER FACTOR _______

9. AUTOMOBILE _____________________________ SYMBOL _______

10. YEAR 72 71 70 69 68 67 66 65
     AGE GROUP 1 1 2 3 4 5 6 6

11. INSURANCE COVERAGE AND BASIC PREMIUMS

   ______/  BODILY-INJURY $___________
   ______/ PROPERTY-DAMAGE $___________
       MEDICAL PAYMENTS $___________
   FULL or 50-DED COMPREHENSIVE $___________
   50 or 100-DED COLLISION $___________

TOTAL OF BASIC PREMIUMS = $

12. MULTIPLY THE "TOTAL DRIVER FACTOR" BY THE "TOTAL OF BASIC PREMIUMS"

PRODUCT = $

UNINSURED MOTORIST 8.00 CROSS OUT IF
TOWING 5.00 NOT WANTED

ANNUAL PREMIUM = $
APPENDIX H

Automobile Insurance Rates
NOTE: The "Sample Application" (the last page of this set) is for your information. These applications are not available to hand out to your students. If you wish to determine some sample auto insurance rates in class, you might use the sequence of steps presented in the application. The figures for the DRIVER FACTOR, AUTOMOBILE SYMBOL, and BASIC PREMIUMS are presented on the following pages.

A) The rate for the liability portion of automobile insurance (Bodily-Injury, Property-Damage, Medical Payments) is influenced primarily by the characteristics of the driver. These characteristics determine a "multiplier" or "factor". A factor for traffic accident convictions could be added to this (see step #8 on the Sample Application).

B) The driver factor is then multiplied by the basic premium for the selected coverages. The result is the premium for that particular driver. (see the Basic Premiums on page 2).

EXAMPLE I

boy, 17, unmarried
principal driver
no driver training
C+ grade average
no accidents
drives 5 mi. to work

Coverage:
20/40 B.I.
10 P.D.
1 M.P.

Premium Calculation
driver factor is 3.65
(3.65) ($54) = $197.10
(3.65) ($40) = 146.00
(3.65) ($7) = 25.55
$368.65

EXAMPLE II

girl, 17, unmarried
principal driver
driver training
B+ grade average
no accidents
drives 2 mi. to work

Coverage:
20/40 B.I.
10 P.D.
1 M.P.

Premium Calculation
driver factor is 1.35
(1.35) ($54) = $72.90
(1.35) ($40) = 54.00
(1.35) ($7) = 9.45
$136.35

C) The rate for Collision and Comprehensive insurance is influenced by both the characteristics of the driver and the automobile being driven. The Automobile Symbol and Age Group determine the basic premium (on page 2).

YEAR 72 71 70 69 68 67 66 65
AGE GROUP 1 1 2 3 4 55 66 6
### Automobile Symbols for any 1972 car

<table>
<thead>
<tr>
<th>Factory Price</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 - 1600</td>
<td>1</td>
</tr>
<tr>
<td>1601 - 2100</td>
<td>2</td>
</tr>
<tr>
<td>2101 - 2750</td>
<td>3</td>
</tr>
<tr>
<td>2751 - 3700</td>
<td>4</td>
</tr>
<tr>
<td>3701 - 5000</td>
<td>5</td>
</tr>
<tr>
<td>5001 - 6500</td>
<td>6</td>
</tr>
<tr>
<td>6501 -</td>
<td>7</td>
</tr>
</tbody>
</table>

### DRIVER FACTORS

<table>
<thead>
<tr>
<th>Age</th>
<th>Pleasure or Business</th>
<th>With Good Student (B avg.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pleasure or Business</td>
<td>Discount</td>
</tr>
<tr>
<td></td>
<td>Farm or To Work</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pleasure or Business</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Farm or To Work</td>
</tr>
<tr>
<td>17</td>
<td>1.75</td>
<td>1.50</td>
</tr>
<tr>
<td>18</td>
<td>1.60</td>
<td>1.35</td>
</tr>
<tr>
<td>19</td>
<td>1.50</td>
<td>1.25</td>
</tr>
<tr>
<td>17</td>
<td>1.60</td>
<td>1.35</td>
</tr>
<tr>
<td>18</td>
<td>1.50</td>
<td>1.25</td>
</tr>
<tr>
<td>19</td>
<td>1.40</td>
<td>1.15</td>
</tr>
<tr>
<td>17</td>
<td>1.95</td>
<td>1.60</td>
</tr>
<tr>
<td>18</td>
<td>1.85</td>
<td>1.50</td>
</tr>
<tr>
<td>19</td>
<td>1.75</td>
<td>1.40</td>
</tr>
<tr>
<td>17</td>
<td>1.70</td>
<td>1.35</td>
</tr>
<tr>
<td>18</td>
<td>1.65</td>
<td>1.30</td>
</tr>
<tr>
<td>19</td>
<td>1.60</td>
<td>1.25</td>
</tr>
<tr>
<td>17</td>
<td>2.75</td>
<td>2.10</td>
</tr>
<tr>
<td>18</td>
<td>2.55</td>
<td>1.95</td>
</tr>
<tr>
<td>19</td>
<td>2.40</td>
<td>1.85</td>
</tr>
<tr>
<td>17</td>
<td>2.30</td>
<td>1.80</td>
</tr>
<tr>
<td>18</td>
<td>2.15</td>
<td>1.65</td>
</tr>
<tr>
<td>19</td>
<td>2.05</td>
<td>1.55</td>
</tr>
<tr>
<td>17</td>
<td>3.50</td>
<td>2.70</td>
</tr>
<tr>
<td>18</td>
<td>3.30</td>
<td>2.50</td>
</tr>
<tr>
<td>19</td>
<td>3.10</td>
<td>2.30</td>
</tr>
<tr>
<td>17</td>
<td>3.10</td>
<td>2.50</td>
</tr>
<tr>
<td>18</td>
<td>2.90</td>
<td>2.30</td>
</tr>
<tr>
<td>19</td>
<td>2.70</td>
<td>2.15</td>
</tr>
</tbody>
</table>

### BASIC PREMIUMS

<table>
<thead>
<tr>
<th>Bodily-Injury (B.I.)</th>
<th>Property-Damage (P.D.)</th>
<th>Medical Payments (M.P.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15/30</td>
<td>$50</td>
<td>10 $40</td>
</tr>
<tr>
<td>20/40</td>
<td>54</td>
<td>25 $41</td>
</tr>
<tr>
<td>25/50</td>
<td>55</td>
<td>50 $43</td>
</tr>
<tr>
<td>50/100</td>
<td>61</td>
<td>50 $43</td>
</tr>
<tr>
<td>100/300</td>
<td>67</td>
<td>50 $43</td>
</tr>
</tbody>
</table>
### COMPREHENSIVE

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Age Group</th>
<th>Full</th>
<th>$50 Ded.</th>
<th>$100 Ded.</th>
<th>$50 Ded.</th>
<th>$100 Ded.</th>
<th>$50 Ded.</th>
<th>$100 Ded.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2</td>
<td>$17</td>
<td>$9</td>
<td>$8</td>
<td>$9</td>
<td>$7</td>
<td>$5</td>
<td>$4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>12</td>
<td>10</td>
<td>12</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>28</td>
<td>21</td>
<td>15</td>
<td>15</td>
<td>11</td>
<td>8</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>38</td>
<td>28</td>
<td>21</td>
<td>20</td>
<td>15</td>
<td>11</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>49</td>
<td>37</td>
<td>27</td>
<td>26</td>
<td>20</td>
<td>14</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>62</td>
<td>46</td>
<td>34</td>
<td>33</td>
<td>25</td>
<td>18</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>23</td>
<td>45</td>
<td>6</td>
<td>1</td>
<td>23</td>
<td>45</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

### COLLISION

<table>
<thead>
<tr>
<th>$50 Ded.</th>
<th>$100 Ded.</th>
<th>$50 Ded.</th>
<th>$100 Ded.</th>
<th>$50 Ded.</th>
<th>$100 Ded.</th>
<th>$50 Ded.</th>
<th>$100 Ded.</th>
<th>$50 Ded.</th>
<th>$100 Ded.</th>
<th>$50 Ded.</th>
<th>$100 Ded.</th>
<th>$50 Ded.</th>
<th>$100 Ded.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$82</td>
<td>$61</td>
<td>$53</td>
<td>$45</td>
<td>$80</td>
<td>$51</td>
<td>$44</td>
<td>$38</td>
<td>$82</td>
<td>$51</td>
<td>$44</td>
<td>$38</td>
<td>$82</td>
<td>$51</td>
</tr>
<tr>
<td>93</td>
<td>70</td>
<td>60</td>
<td>51</td>
<td>80</td>
<td>60</td>
<td>52</td>
<td>44</td>
<td>82</td>
<td>51</td>
<td>44</td>
<td>38</td>
<td>93</td>
<td>70</td>
</tr>
<tr>
<td>109</td>
<td>82</td>
<td>71</td>
<td>60</td>
<td>96</td>
<td>72</td>
<td>62</td>
<td>53</td>
<td>109</td>
<td>82</td>
<td>71</td>
<td>60</td>
<td>96</td>
<td>72</td>
</tr>
<tr>
<td>131</td>
<td>98</td>
<td>85</td>
<td>72</td>
<td>112</td>
<td>84</td>
<td>73</td>
<td>62</td>
<td>131</td>
<td>98</td>
<td>85</td>
<td>72</td>
<td>112</td>
<td>84</td>
</tr>
<tr>
<td>153</td>
<td>114</td>
<td>99</td>
<td>84</td>
<td>128</td>
<td>96</td>
<td>83</td>
<td>70</td>
<td>153</td>
<td>114</td>
<td>99</td>
<td>84</td>
<td>128</td>
<td>96</td>
</tr>
<tr>
<td>174</td>
<td>131</td>
<td>113</td>
<td>96</td>
<td>1</td>
<td>23</td>
<td>45</td>
<td>6</td>
<td>174</td>
<td>131</td>
<td>113</td>
<td>96</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>1</td>
<td>2,3</td>
<td>4,5</td>
<td>6</td>
<td>1</td>
<td>23</td>
<td>45</td>
<td>6</td>
<td>1</td>
<td>2,3</td>
<td>4,5</td>
<td>6</td>
<td>1</td>
<td>23</td>
</tr>
</tbody>
</table>

### Examples of Other Automobile Symbols

**1971**

- Ford Pinto
- Ford Maverick
- Ford Mustang
- Dodge Dart
- American Hornet
- Buick Skylark
- Chevrolet Impala
- Plymouth Valiant
- Cadillac Fleetwood
- Thunderbird
- Volkswagen

**1970 - 1965**

- Chevrolet Nova
- Plymouth Satellite
- Dodge Polara
- Oldsmobile Delta 88
- Pontiac GTO
- Lincoln Continental
- MGB Roadster
- Volvo
NOTE: Any engine which would make these vehicles "high-performance" would give the car a higher symbol by 1.

EXAMPLE I

same driver
1971 Duster

Coverage:
$50 Ded. Comp.
$50 Ded. Coll.

Premium Calculation
driver factor 3.65
age group 1
symbol 3

(3.65) ($12) = $ 43.80
(3.65) ($93) = 339.45

(3.65) ($12) = $ 43.80
(3.65) ($93) = 339.45

$383.25

TOTAL PREMIUM: $368.65
383.25

$751.90

EXAMPLE II

same driver
1971 Pinto

Coverage:
$50 Ded. Comp.
$50 Ded. Coll.

Premium Calculation
driver factor 1.35
age group 1
symbol 2

(1.35) ($9) = $ 12.15
(1.35) ($82) = 110.70

(1.35) ($9) = $ 12.15
(1.35) ($82) = 110.70

$122.85

TOTAL PREMIUM: $136.35
122.85

$259.20
APPENDIX I

Life Insurance Worksheet and Annual Premiums
LIFE INSURANCE WORKSHEET

<table>
<thead>
<tr>
<th>Insurance</th>
<th>Age</th>
<th>Face Value</th>
<th>Annual Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-yr. term</td>
<td>25</td>
<td>$2,000</td>
<td></td>
</tr>
<tr>
<td>whole-life</td>
<td>35</td>
<td>$4,000</td>
<td></td>
</tr>
<tr>
<td>30-yr. endowment</td>
<td>45</td>
<td>$12,000</td>
<td></td>
</tr>
<tr>
<td>20-yr. lim. pay.</td>
<td>15</td>
<td>$16,000</td>
<td></td>
</tr>
</tbody>
</table>

5. How much will you pay in premiums if you buy a 20-year endowment (face value $1,000) at age 15, and make all 20 payments?

6. The endowment policy in problem 5 will pay back $1,000. How much money did you earn?

7. Suppose you purchase a $1,000 whole-life policy at age 15. If you are still alive after 64 payments (age 79), how much has been paid in premiums?
   Regardless of how many more premium payments you make, how much will be paid to your beneficiary on your death?

8. The annual premium for a $1,000 whole-life policy issued at age 20 is
   Using the figure from the "Periodic Premium" table, find the amount for each of these payment plans:

   SEMIANNUAL: ___________ QUARTERLY: ___________ MONTHLY: ___________

   Using a SEMIANNUAL plan, 2 payments are made during the year. Similarly, a QUARTERLY plan has 4 payments, and a MONTHLY plan has 12 payments. Find out how much you pay in a year's time for each plan.

   TOTAL FOR ONE YEAR
   1 annual payment ___________
   2 semiannual payments ___________
   4 quarterly payments ___________
   12 monthly payments ___________

   Which was the cheapest? ___________ Which was the most expensive? ___________


10. Find the monthly payment for the policy in problem 4.
### ANNUAL PREMIUMS

For $1,000 Worth of Insurance

<table>
<thead>
<tr>
<th>Age at Issue</th>
<th>TERM 10-yr.</th>
<th>TERM 15-yr.</th>
<th>WHOLE-LIFE</th>
<th>LIMITED PAYMENT 20-yr.</th>
<th>LIMITED PAYMENT 30-yr.</th>
<th>ENDOWMENT 20-yr.</th>
<th>ENDOWMENT 30-yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>-</td>
<td>-</td>
<td>$15.78</td>
<td>$28.13</td>
<td>$22.06</td>
<td>$49.44</td>
<td>$31.87</td>
</tr>
<tr>
<td>20</td>
<td>$7.74</td>
<td>$8.11</td>
<td>17.66</td>
<td>30.57</td>
<td>23.99</td>
<td>49.77</td>
<td>32.38</td>
</tr>
<tr>
<td>25</td>
<td>8.52</td>
<td>9.09</td>
<td>19.96</td>
<td>33.34</td>
<td>26.24</td>
<td>50.29</td>
<td>33.16</td>
</tr>
<tr>
<td>30</td>
<td>9.70</td>
<td>10.57</td>
<td>22.82</td>
<td>36.49</td>
<td>28.90</td>
<td>51.08</td>
<td>34.36</td>
</tr>
<tr>
<td>35</td>
<td>11.52</td>
<td>12.83</td>
<td>26.40</td>
<td>40.14</td>
<td>32.15</td>
<td>52.29</td>
<td>36.19</td>
</tr>
<tr>
<td>40</td>
<td>14.29</td>
<td>16.27</td>
<td>30.95</td>
<td>44.46</td>
<td>36.23</td>
<td>54.16</td>
<td>38.98</td>
</tr>
<tr>
<td>45</td>
<td>18.53</td>
<td>21.48</td>
<td>36.79</td>
<td>49.71</td>
<td>41.57</td>
<td>57.05</td>
<td>43.22</td>
</tr>
<tr>
<td>50</td>
<td>24.97</td>
<td>29.32</td>
<td>44.43</td>
<td>56.38</td>
<td>48.77</td>
<td>61.52</td>
<td>49.61</td>
</tr>
<tr>
<td>55</td>
<td>34.75</td>
<td>-</td>
<td>54.56</td>
<td>65.22</td>
<td>58.77</td>
<td>68.48</td>
<td>-</td>
</tr>
<tr>
<td>60</td>
<td>-</td>
<td>-</td>
<td>68.23</td>
<td>77.52</td>
<td>72.80</td>
<td>79.29</td>
<td>-</td>
</tr>
</tbody>
</table>

### PERIODIC PREMIUM

If Period is: Multiply Annual Premium by:

- Semianual: .51
- Quarterly: .26
- Monthly: .087
Answer Key for Worksheets

FIRE INSURANCE

1. $800
2. $12,000
3. $9,000
4. $16,000
5. .076 80 $6.08
6. .122 120 $14.64
7. .136 118 $16.05
8. $10.94 $12.16
9. $51.24 $58.56
10. $43.34 $48.15
11. $9.00

LIFE INSURANCE

1. $17.04
2. $105.60
3. $518.64
4. $450.08
5. $988.80
6. $11.20
7. $1009.92 $1,000
8. $17.66
   $9.01 $4.59 $1.54
   $17.66
   $18.02
   $18.36
   $18.48
   annual monthly
9. $134.85
10. $39.16
APPENDIX K

Post-Test Used in the Pilot Study
* 1. If fewer people have a loss than was figured by the insurance company, the people who were insured will probably get (?).  
   5  A. their entire premium returned  
   7  B. some kind of a refund or credit  
   0  C. a certificate for a stock split  
   2  D. a new, more expensive insurance policy  
   1  E. a bill for additional money  

2. A $4,000 renter's insurance policy was taken out to cover any fire loss. How much would the renter have to pay if a fire destroyed $4,700 worth of his belongings?  
   0  A. $500  
   10 B. $700  
   2  C. nothing; the insurance company would pay it all  
   1  D. $4700  
   2  E. $4000  

3. The financial responsibility required by the State of Ohio is provided by (?).  
   4  A. automobile liability insurance  
   6  B. term life insurance  
   2  C. collision insurance  
   2  D. comprehensive automobile insurance  
   1  E. responsible drivers' insurance  

4. The annual premium for a life insurance policy is $68.48. If the factor for paying every 3 months is .26, what would be the quarterly premium?  
   2  A. $273.92  
   1  B. $17.48  
   2  C. $178.05  
   7  D. $17.80  
   2  E. $17.12  

5. A class of 30 students shares in the expected loss of one bicycle worth $90 during the year. To share in this plan, each student must be charged (?).  
   1  A. $.33  
   3  B. $.30  
   10 C. $3.00  
   0  D. $30.00  
   1  E. $90.00
6. A fire insurance rate is given as $.031 for each $100 of insurance. This rate is the same as (?)

4. A. $8.10 for $10,000 of insurance
1. B. 8.1¢ for $10 of insurance
3. C. $80.10 for $100,000 of insurance
3. D. $8100 for one million dollars of insurance
4. E. $.0081 for $1,000 of insurance

7. It has been estimated that there are (?) drivers in the U.S. who do not have insurance on their automobile.

0. A. only a few
3. B. 500,000
6. C. 10,000,000
0. D. 1,000
5. E. 1,000,000,000

8. The person who receives the face value of a term life insurance policy is called the (?)

0. A. mortuary
0. B. terminative
0. C. ternary
7. D. benefactor
8. E. beneficiary

9. Insurance is (?) to protect ourselves from the expense of replacing objects lost through accidents.

10. A. a cheap way
0. B. the worst way
4. C. the only way
0. D. a bad way
1. E. an expensive way

10. A renter's insurance policy typically covers losses through (?)

2. A. fire
1. B. theft
1. C. heating system damage
9. D. ONLY A. AND B.
2. E. A., B., AND C.

11. Suppose you have 20/40 bodily-injury insurance. In an accident, you injured two people. One files a claim for $16,000; the other claims $30,000. Who will pay ... and how much?

3. A. insurance pays $46,000; you pay nothing
5. B. insurance pays $20,000; you pay $26,000
1. C. insurance pays $36,000; you pay $10,000
5. D. insurance pays $40,000; you pay $6,000
1. E. insurance pays nothing; you pay $46,000
12. A term insurance policy issued at age 40 costs more than the same one issued at age 20 because ( ).

0 A. an older person can afford to pay the higher prices
11 B. the probability of death at age 40 is greater
3 C. the older person will pay premiums for fewer years
1 D. the older person will get more money back
0 E. the insurance company feels that the older person owes them the money

13. The mathematics used in the development of insurance is called ( ).

3 A. calculus
8 B. probability
0 C. geometry
0 D. topology
4 E. NONE OF THESE

14. A $12,000 fire insurance policy was taken out on a home worth $17,500. How much would be paid by the insurance company on a claim for a $15,000 loss?

1 A. $3,000
10 B. $12,000
1 C. $2,500
1 D. $17,500
2 E. $15,000

* 15. Which of these costs following an accident would not be paid by an insurance company?

1 A. wages lost while in the hospital
1 B. repairs to your car
0 C. hospital expenses
0 D. doctor bills
13 E. a $500 gift to the judge

16. Whole-life insurance is more expensive than ( ).

3 A. straight-life insurance
1 B. extended-payment insurance
3 C. endowment insurance
4 D. limited-payment insurance
4 E. term insurance

* 17. Insurance could be bought to provide protection for ( ).

0 A. someone stealing and using your credit cards
0 B. injury to a baseball pitcher’s arm
2 C. the driver of an automobile
1 D. the accidental loss of a farmer’s crops
12 E. ALL OF THESE
18. A brick home has a fire insurance rating of $.076 per $100 of insurance. The premium for $20,000 of insurance would be (?).
   2 A. $7.60
   2 B. $15.20
   1 C. $76.00
   9 D. $152.00
   1 E. $1.52

* 19. The injury you cause to a person in your car will be paid for by the (?) part of your automobile insurance.
   0 A. comprehensive
   2 B. uninsured-hospitalization
   0 C. property-damage
   2 D. medical payments
   11 E. bodily-injury

* 20. It would be possible to pay more than the face value in premiums with a/an (?).
   1 A. limited-payment policy
   1 B. extended-payment policy
   4 C. endowment policy
   7 D. whole-life policy
   1 E. term insurance policy

21. Using insurance as a means of protection began with (?).
   1 A. World War II
   10 B. shipment of goods by boat
   3 C. the creation of economics
   1 D. the invention of the automobile
   0 E. the first airplane crash

22. A renter's living room furniture includes: sofa ($198), 2 chairs ($67 each), and a television ($149). The value of this furniture is (?).
   0 A. $410
   5 B. $414
   0 C. $486
   10 D. $481
   0 E. $494

23. The base premium for property-damage insurance in your territory is $40. If your "driver factor" is 2.4 and your "accident factor" is 0.6, what is your annual premium?
   2 A. $56.40
   3 B. $120
   2 C. $43
   0 D. $94
   8 E. NONE OF THESE
24. The cost for $1,000 worth of term insurance is $18.53. What is the cost of a $12,000 policy?

8 A. $222.36  
3 B. $202.36  
0 C. $212.66  
0 D. $224.63  
4 E. NONE OF THESE

25. The indemnity is defined to be the ( ).

4 A. periodic payment made to the insurance company  
2 B. money paid by the person insured  
5 C. amount of money paid by the insurance company on a claim  
1 D. refund paid on a premium that was too high  
3 E. worth of the policy

26. The total premium for a fire insurance policy covering two years would be found by multiplying the annual rate by (?).

6 A. 2.0  
1 B. 2.2  
3 C. 200 per cent  
3 D. 1.0  
2 E. 1.8

27. In comparing a 100/300 bodily-injury policy to a 10/20 bodily-injury policy which cost $100, you would expect the cost of the 100/300 to be ( ).

0 A. the same  
0 B. less  
12 C. about $1,000  
1 D. about $300  
2 E. about $140

* 28. Which of the following would be a reason for having life insurance?

6 A. financial security for dependents  
0 B. a source of funds when you retire  
0 C. a guarantee that you'll live until age 65  
8 D. BOTH A. AND B.  
1 E. A., B., AND C.

29. Insurance gives us (?) for various kinds of risks.

0 A. free security  
1 B. complete safety  
2 C. an expensive protection  
12 D. financial protection  
0 E. a shield of invulnerability
30. The premium for renter's insurance is not affected by the (?).

8 A. distance to the nearest hospital
3 B. coverage of the policy
2 C. quality of the neighborhood fire department
2 D. distance to the nearest fire hydrant
0 E. construction of the apartment building

31. The premium for a $100-deductible collision policy is (?) the premium of a $50-deductible policy.

1 A. the same as
5 B. twice
2 C. more than
5 D. $50 more than
2 E. less than

32. The policy which does not have a savings or cash-in feature is (?)

1 A. whole-life insurance
2 B. endowment insurance
2 C. limited-payment insurance
5 D. term insurance
5 E. straight-life insurance

33. Cash paid to insurance companies is most likely to be used for (?)

6 A. salary paid to insurance employees
2 B. an investment in U.S. Savings Bonds
1 C. a gift to needy colleges
5 D. an investment in a corporation
1 E. money stored in the company's vault

34. The automobile insurance which pays for the injury you cause to other people is called (?)

2 A. comprehensive insurance
4 B. collision insurance
1 C. uninsured motorist insurance
7 D. liability insurance
1 E. injured facilities insurance

35. The reason for the largest number of deaths among life insurance policy owners has been (?)

0 A. suicide
0 B. cancer
7 C. heart diseases
7 D. automobile crashes
1 E. plane crashes
36. Insurance statistics can state (?) will have a loss during a certain year.
   9 A. approximately how many people in a large group
   1 B. that everyone in a large group
   1 C. approximately how many people in a very small group
   0 D. exactly how many people in a small group
   4 E. NONE OF THESE

37. Which of the following does not affect the cost of your automobile liability insurance?
   1 A. sex of the driver
   14 B. the size of your local hospital
   0 C. the intended use of the car
   0 D. the previous accidents of the driver
   0 E. territory in which the driver lives

38. The $10,000 policy which must pay out $10,000 regardless of the life or death of the insured is the (?).
   1 A. limited-payment insurance
   5 B. endowment insurance
   3 C. whole-life insurance
   5 D. straight-life insurance
   1 E. term insurance

39. The Law of Large Numbers involves (?)...
   3 A. multiplication of millions and billions
   1 B. the values of one person compared with the values of an entire nation
   5 C. using a large group of people or events to make predictions
   0 D. predicting what will happen to a class of 30 students
   6 E. NONE OF THESE

40. If the same automobile policy were taken out in these locations, which would be the most expensive?
   12 A. New York City
   1 B. a town of 100,000 in Montana
   1 C. Albuquerque, New Mexico
   1 D. Columbus, Ohio
   0 E. Worthington, Ohio

* 41. The person listed below that has the greatest need for life insurance is (?)...
   13 A. a man with children in school
   0 B. a hermit
   0 C. a young man who is about to marry a school teacher
   1 D. a high school student
   0 E. a man who has just retired
The part of your automobile insurance which would pay for vandalism to your car is called (\(?\)).

4 A. comprehensive
1 B. bodily-injury
8 C. property-damage
1 D. unpredictable incidents
0 E. refund clause

The probability of your being alive at age 100 is closest to what value?

2 A. 20%
0 B. 60%
1 C. 40%
10 D. 0%
1 E. 100%

Which of these situations would generally make your automobile insurance cheaper?

2 A. insure both of your cars with the same company
1 B. you do not get into accidents
0 C. you trade your car for a more expensive, newer model
8 D. BOTH A. AND B.
2 E. A., B., AND C.

Based on the amount of money paid in during a year, the most expensive payment plan for a life insurance policy is (\(?\)).

0 A. monthly
2 B. semi-annual
5 C. weekly
1 D. quarterly
5 E. annual

Suppose the types of cars listed below all cost the same when new. An automobile insurance policy would be the most expensive when figured for a/an (\(?\)).

12 A. high-performance sports car
0 B. compact car
0 C. foreign sedan
1 D. intermediate car
0 E. station wagon
47. The life insurance purchased for a plane trip is an example of ( ).

6 A. limited-payment life insurance
2 B. endowment insurance
2 C. whole-life insurance
2 D. term insurance
1 E. straight-life insurance

48. Suppose you have $100-deductible comprehensive on your car. If a falling tree causes $846 damage to your car, how much would the insurance company pay?

0 A. $154
3 B. $846
0 C. $100
2 D. $946
8 E. $746

* 49. The fastest way of obtaining $10,000 protection for your family is ( ).

2 A. buying $5,000 worth of corporate stock
0 B. saving $10 every month in the sugar bowl
8 C. buying a $10,000 life insurance policy
0 D. betting $1,000 at the horse races
2 E. saving $100 every month at a bank which gives compound interest

* 50. The minimum financial responsibility required in Ohio for injury to a person while driving is ( ).

3 A. $5,000
4 B. $500
3 C. $12,500
1 D. $100,000
1 E. $1,000,000
APPENDIX L

Summary of Test Statistics for the Pilot Study
Summary of Test Statistics for the Pilot Study

Number of Students Taking Test = 15
Number of Items in the Test = 50

Mean Test Score = 23.33  Standard Deviation = 6.83
Median = 22  Skewness = 0.22
Mode = 20  Kurtosis = -0.67
Maximum = 36  Minimum = 11  Range = 25

GROUP STATISTICS

<table>
<thead>
<tr>
<th>Student Percentage</th>
<th>Number of Students</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>100.00</td>
<td>15</td>
</tr>
<tr>
<td>Upper</td>
<td>33.33</td>
<td>5</td>
</tr>
<tr>
<td>Lower</td>
<td>20.00</td>
<td>3</td>
</tr>
</tbody>
</table>

RELIABILITY ESTIMATES

Kuder-Richardson 20 = 0.808
Kuder-Richardson 21 = 0.748
Standard Error of Measurement = 3.427

ITEM ANALYSIS

Item Difficulty Distribution

<table>
<thead>
<tr>
<th>Range</th>
<th>Number of Items</th>
<th>Item Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>.81-1.00</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>.61-.80</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>.41-.60</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>.21-.40</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>.00-.20</td>
<td>7</td>
<td>14</td>
</tr>
</tbody>
</table>

Mean Item Difficulty = .533

Item Discrimination Distribution

<table>
<thead>
<tr>
<th>Range</th>
<th>Number of Items</th>
<th>Item Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>.81-1.00</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>.61-.80</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>.41-.60</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>.21-.40</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>.00-.20</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>below .00</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>

Mean Item Discrimination = .344
APPENDIX M

Post-Test Used in the Investigation
INSURANCE TEST

MARK YOUR ANSWERS ON THE ANSWER SHEET

PLEASE DO NOT WRITE ON THIS TEST.

1. Suppose a $4,000 renter’s insurance policy was taken out by you to cover any fire loss. A fire destroyed furniture worth $2,000 in the living room, and $2,700 in the other rooms. Who will pay...and how much?

A. Insurance pays $4,700; you pay nothing
B. Insurance pays $4,000; you pay $700
C. Insurance pays $4,000; you pay $200
D. Insurance pays $700; you pay $4,000
E. Insurance pays $2,000; you pay $2,700

2. The financial responsibility required by the State of Ohio is provided by (T).

A. automobile liability insurance
B. term life insurance
C. collision insurance
D. comprehensive automobile insurance
E. responsible driver’s insurance

3. The annual premium for a life insurance policy is $68.48. If the factor for paying every 3 months is .26, what would be the quarterly premium?

A. $273.92
B. $17.48
C. $178.05
D. $17.80
E. $17.12

4. A class of 30 students shares in the expected loss of one bicycle worth $90 during the year. To share in this plan, each student must be charged (T).

A. $3.33
B. $3.30
C. $1.00
D. $3.33
E. $90.00

5. A fire insurance rate is given as $.081 for each $100 of insurance. This rate is the same as (T).

A. $.81 for $10,000 of insurance
B. .81c for $100 of insurance
C. $.080.10 for $100,000 of insurance
D. $810.00 for one million dollars of insurance
E. $.0081 for $1,000 of insurance

6. It has been estimated that there are (T) drivers in the U.S. who do not have insurance on their automobile.

A. only a few
B. 500,000
C. 10,000,000
D. half a million
E. 1,000,000,000
7. The person who receives the face value of a term life insurance policy is called the (7).
   A. rectulisti
   B. terminative
   C. ternary
   D. benefactor
   E. beneficiary

8. Insurance is (?) to protect ourselves from the expense of replacing objects lost through accidents.
   A. a cheap way
   B. the worst way
   C. the only way
   D. a bad way
   E. an expensive way

9. A renter's insurance policy can cover losses through (7).
   A. fire
   B. theft
   C. heating system damage
   D. ONLY A. AND B.
   E. A., B., AND C.

10. Suppose you have 20/60 bodily-injury Insurance. In an accident, you injured two people. One files a claim for $16,000; the other claims $30,000. Who will pay ... and how much?
    A. Insurance pays $46,000; you pay nothing
    B. Insurance pays $20,000; you pay $26,000
    C. Insurance pays $36,000; you pay $10,000
    D. Insurance pays $40,000; you pay $6,000
    E. Insurance pays nothing; you pay $46,000

11. A term insurance policy issued at age 60 costs more than the same one issued at age 20 because (7).
    A. an older person can afford to pay the higher prices
    B. the probability of death at age 40 is greater
    C. the older person will pay premiums for fewer years
    D. the older person will get more money back
    E. the insurance company feels that the older person owes them the money

12. The mathematics used in the development of insurance is called (7).
    A. calculus
    B. probability
    C. logarithms
    D. compound statistics
    E. NONE OF THESE

13. A $12,000 fire insurance policy was taken out on a home worth $17,500. How much would be paid by the insurance company on a claim for a $15,000 loss?
    A. $3,000
    B. $12,000
    C. $2,500
    D. $17,500
    E. $15,000
14. Whole-life insurance is more expensive than (I).
   A. straight-life insurance
   B. extended-payment insurance
   C. endowment insurance
   D. limited-payment insurance
   E. term insurance

15. A brick home has a fire insurance rating of $0.076 per $100 of insurance. The premium for $20,000 of insurance would be (I).
   A. $15.20
   B. $7.60
   C. $76.00
   D. $152.00
   E. $1.52

16. Using insurance as a means of protection began with (I).
   A. World War II
   B. shipment of goods by boat
   C. the creation of economics
   D. the invention of the automobile
   E. transatlantic travel

17. The possessions of a renter are worth the following: living room ($1673), kitchen ($729), master bedroom ($816), second bedroom ($538), and storage area ($576). How much insurance should be carried to protect against a total loss?
   A. $3,000
   B. $3,500
   C. $4,000
   D. $4,500
   E. $5,000

18. The basic premium for property-damage insurance in your territory is $60. If your "driver factor" is 2.4 and your "accident factor" is 0.6, what is your annual premium?
   A. $56.40
   B. $120
   C. $60
   D. $57.60
   E. NONE OF THESE

19. The cost for $1,000 of term insurance is $18.53. What is the cost of a $12,000 policy?
   A. $222.36
   B. $202.36
   C. $212.66
   D. $224.63
   E. NONE OF THESE
20. The indemnity is defined to be the (?) .
   A. periodic payment made to the insurance company
   B. money paid by the person insured
   C. amount of money paid by the insurance company on a claim
   D. refund paid on a premium that was too high
   E. worth of the policy

21. The total premium for a fire insurance policy covering two years would be found by multiplying the annual rate by (?) .
   A. 2.0
   B. 2.2
   C. 200 per cent
   D. 1.0
   E. 1.8

22. In comparing a 100/300 bodily-injury policy to a 10/20 bodily-injury policy which cost $100, you would expect the cost of the 100/300 to be (?) .
   A. the same
   B. less
   C. about $1,000
   D. about $300
   E. about $140

23. Insurance gives us (?) for various kinds of risks.
   A. free security
   B. complete safety
   C. an expensive protection
   D. a shield of invulnerability
   E. financial protection

24. The premium for renter's insurance is not affected by the (?) .
   A. number of windows in the apartment
   B. coverage of the policy
   C. quality of the neighborhood fire department
   D. distance to the nearest fire hydrant
   E. construction of the apartment building

25. The premium for a $100-deductible collision policy is (?) the premium of a $50-deductible policy (on the same car).
   A. the same as
   B. twice
   C. more than
   D. $50 more than
   E. less than

26. The policy which does not have a savings or cash-in feature is (?) .
   A. whole-life insurance
   B. endowment insurance
   C. limited-payment insurance
   D. term insurance
   E. straight-life insurance
27. Cash paid to insurance companies is most likely to be used for (?) .
   76 A. salary paid to insurance employees
   72 B. an investment in U.S. Savings Bonds
   28 C. a gift to needy colleges
   189 D. an investment in a corporation
   64 E. money stored in the company's vault

28. The automobile insurance which pays for the injury you cause to other people
   is called (?) .
   51 A. comprehensive insurance
   91 B. collision insurance
   30 C. uninsured motorist insurance
   213 D. liability insurance
   45 E. injured facilities insurance

29. The reason for the largest number of deaths among life insurance policy owners
   has been (?) .
   28 A. suicide
   62 B. senility (old age)
   124 C. heart ailments
   205 D. automobile crashes
   12 E. plane crashes

30. Which of the following does not affect the cost of your automobile liability
   insurance?
   59 A. sex of the driver
   132 B. the number of cylinders in the car
   55 C. the intended use of the car
   42 D. the previous accidents of the driver
   138 E. territory in which the driver lives

31. The $10,000 policy which must always pay out $10,000 regardless of the life or
   death of the insured is the (?) .
   56 A. limited-payment insurance
   118 B. endowment insurance
   121 C. whole-life insurance
   75 D. straight-life insurance
   53 E. term insurance

32. The Law of Large Numbers involves (?) .
   50 A. multiplication of millions and billions
   68 B. the values of one person compared with the values of an entire nation
   143 C. using a large group of people or events to make predictions
   37 D. using a small group of people or events to make predictions
   122 E. NONE OF THESE

33. If the same automobile policy were taken out in these locations, which would
   be the most expensive?
   310 A. New York City
   37 B. a city of 100,000 in Montana
   33 C. Albuquerque, New Mexico
   31 D. Columbus, Ohio
   14 E. Cincinnati, Ohio
34. The probability of your being alive at age 100 is closest to what value?

A. 20%  
B. 60%  
C. 40%  
D. 0%  
E. 100%

35. Which of these situations would generally make your automobile insurance cheaper?

A. Insure both of your cars with the same company  
B. You do not get into accidents  
C. You trade your car for a more expensive, newer model  
D. Both A. and B.  
E. A., B., and C.

36. Based on the amount paid in during the year, the most expensive payment plan for a life insurance policy is (?) .

A. Monthly  
B. Semiannually  
C. Weekly  
D. Quarterly  
E. Annually

37. Suppose the kinds of cars listed below all cost the same when new. An automobile insurance policy would be most expensive when figured for (?) .

A. A high-performance sports car  
B. A compact car  
C. A foreign car  
D. An intermediate-sized car  
E. A station wagon

38. The life insurance purchased for a plane trip is an example of (?) .

A. Limited-payment life insurance  
B. Endowment insurance  
C. Whole-life insurance  
D. Term insurance  
E. Straight-life insurance

39. Suppose you have $100-deductible comprehensive on your car. If a falling tree causes $846 damage to your car, how much would the insurance company pay?

A. Nothing  
B. $846  
C. $100  
D. $946  
E. $746

40. Suppose you have a $19,000 fire insurance policy on your home. How much will you save on the annual premium if the fire rating on your home changes from $1.14 per $100 to $0.98 per $1,000?

A. $153.14  
B. $15.31  
C. $14.46  
D. $80.50  
E. None of these
APPENDIX N

Summary of Test Statistics for the Post-Test
Summary of Test Statistics for the Post-Test

Number of Students Taking Test = 452
Number of Items in the Test = 40

Mean Test Score = 16.01
Median = 16
Mode = 16
Maximum = 32
Minimum = 0
Range = 32

Mean Item Difficulty = .600
Mean Item Discrimination = .393

<table>
<thead>
<tr>
<th>Item Difficulty Distribution</th>
<th>Item Discrimination Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>Number of Items</td>
</tr>
<tr>
<td>.81-1.00</td>
<td>2</td>
</tr>
<tr>
<td>.61- .80</td>
<td>19</td>
</tr>
<tr>
<td>.41- .60</td>
<td>13</td>
</tr>
<tr>
<td>.21- .40</td>
<td>6</td>
</tr>
<tr>
<td>.00- .20</td>
<td>0</td>
</tr>
<tr>
<td>below .00</td>
<td>1</td>
</tr>
</tbody>
</table>
APPENDIX O

Retention Test
Write in TRUE or FALSE on each line.

( True) 1. The quarterly premium on a life insurance policy is more than one-fourth of the annual premium.

( False) 2. A young man who is about to marry a young school teacher has a great need for life insurance.

( True) 3. There are other reasons for having apartment insurance besides protection against fire and theft.

( True) 4. The type of car you drive has the greatest effect on your collision and comprehensive insurance.

( False) 5. The cost of a 5-year fire insurance policy is the same as the annual cost multiplied by five.

( True) 6. Mortality tables indicate that your chances of still being alive at age 95 are very poor.

( False) 7. A fire insurance rate of $0.676 for $100 of insurance is the same rate as $7.60 for $1,000 of insurance.

( False) 8. Nothing will happen to you if you cause an accident and were driving without insurance or other financial protection.

( False) 9. Everyone in Franklin County has equal neighborhood fire-fighting protection.

( False) 10. You will save money when you change from a $100-deductible collision policy to a $50-deductible.

( False) 11. The property-damage section of your automobile insurance would pay for vandalism done to your car.

( True) 12. One of the reasons that term life insurance is so cheap is that it has no cash value.

( False) 13. Burglaries in Columbus are spread equally throughout the city.

( True) 14. A life insurance policy could be a source of funds for your retirement.

( True) 15. The insurance rate for a high-performance car will generally be higher than that of the model with six cylinders (for the same driver).

( True) 16. If a new fire hydrant were installed in front of your house, where none was before, your fire insurance rates might be lowered.

( False) 17. Insurance companies can predict whose cars will be stolen and who will be involved in accidents.

( True) 18. If equal amounts of money were put into a savings account and paid as premiums, the bank balance would always be higher than the cash value of the life insurance policy.
APPENDIX P

Teacher Questionnaire
<table>
<thead>
<tr>
<th>Concept</th>
<th>Did Not Include</th>
<th>Briefly Mentioned</th>
<th>Discussed Thoroughly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Insurance is a form of financial protection.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. There are alternatives to insurance.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Every person lives with certain risks.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Insurance cannot remove the risks in our life.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Insurance involves sharing the loss with others.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Insurance companies have government regulation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Insurance companies invest their income.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Predictions are more accurate when made from statistics of large groups rather than small groups.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. The insurance of the apartment building owner may not cover the apartment contents.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. The neighborhood fire protection affects the renter's premium.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. A simplified homeowner's policy would only cover fire damage.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. The indemnity is never higher than the face value of the policy.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. A policy covering more than one year has a discount applied to the rate.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>Statement</td>
<td>Did Not Include</td>
<td>Briefly Mentioned</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>-----------------</td>
<td>------------------</td>
</tr>
<tr>
<td>14.</td>
<td>A state law requires a minimum financial responsibility for operators of automobiles.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Accident expenses include repairs, medical costs, lost wages, plus any costs from a liability suit.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Liability insurance includes: bodily-injury, property-damage, and medical payments.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>A small additional premium can more than double the liability policy limits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Factors affecting liability insurance include: territory, driver characteristics, previous accidents, car use, and policy coverage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Rates in an urban area are generally more than rates for a rural area.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Drivers with an accident record are charged higher premiums.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>Collision insurance covers the costs of accident damage to your car, when you are at fault.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Comprehensive insurance covers repairs needed for vandalism, storm damage, theft, fire, and the like.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>It might be wasteful to have collision and comprehensive insurance on an older car.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>Collision and comprehensive policies are generally sold with a &quot;deductible&quot; feature.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>A regular savings plan requires years to reach the same protection level of a life insurance policy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>Life insurance needs vary with age and family situation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>Mortality tables are used to determine the life insurance premiums.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>Term insurance provides protection for a fixed amount of time, and is the cheapest variety.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
29. Term insurance does not have a savings or "cash-in" feature.

30. Term insurance is a good buy when the earning capacity is low.

31. Premiums are paid on a whole-life policy as long as you are alive.

32. The cash value of life insurance can be obtained as a refund or retirement plan.

33. Limited-payment provides coverage for life for a fixed number of premium payments.

34. Endowment insurance pays the face value of the policy to the insured if he is alive at the end of the payment period.

35. Endowment insurance is the most expensive of the four basic types.

36. Policies are more expensive if payments are made more frequently than annually.

---

How many days did you spend with your class on insurance (not including the post-test)? 5 6 7 8 9 10 11 12 13 14

What do you feel were the strengths and weaknesses of the unit?
Please comment on any change or lack of change over the insurance unit in:

a) STUDENT ATTITUDE

b) STUDENT ENTHUSIASM

c) STUDENT ATTENDANCE

d) CLASS DISCUSSION

e) TEACHER ATTITUDE

ADDITIONAL COMMENTS:

*It is very important for the analysis that these be given. Thank you.
APPENDIX Q

Responses Entered on the Teacher Questionnaire
"Slides were very good and sequence was good." ET1

"Information was broken down into only what was necessary for this type of class. Slides were interesting and motivated comments and class discussion." ET2

"The students were particularly motivated when they had examples, e.g., flight insurance as a kind of term insurance. They could relate the situation and the kind of insurance." ET3

"I believe the unit to be well organized and very interesting. The slides were well chosen and were very pertinent to the subject." ET4

"Student interest (practical); good visual aids." ET5

"The slides help keep the students' attention -- but with modified student and their short attention span, it is difficult to keep them going. I have learned quite a bit -- I'm sure some of this has rubbed off on the students. It should help them understand why the cost of insurance (auto) is higher for the young driver." ET6

"The slides were something new and created some interest. Auto insurance is very practical for most students and the unit had a very good presentation on this. The worksheets were profitable as were the vocabulary sheets. The test was very comprehensive." ET7

"Good set of slides made it an attention getter and motivation builder. Particularly useful on car insurance at this age." ET9

"The strengths were the worksheets, especially the one involving auto insurance. Students were interested in the different makes of cars and their rates, which I wrote on the board." CT1

"Type of unit it was. The students seemed to become involved more with this material because it dealt with a topic which they are already or soon will be concerned with. They could relate to it." CT3

"Organization of materials, interesting "sidelight" information, something of value to everyone in class." CT6
"Unit was a little too rapid for my students. Quite a few of the slides demanded lecture rather than discussion. Students tended to lose interest toward end of period. Also we have 55 min. periods, I doubt that we could have covered material in a 40 min. class." ET1

"Slides of charts to be used with auto insurance worksheets were difficult for the students to read. They were confused in determining driver factors, car symbols, and rates for the different types of insurance." ET2

"The test is geared too high for the reading ability of the students. Many know the material in discussion, but cannot chose a correct answer among several others. Some questions were ambiguous. I felt more problems should be included in the worksheets. People in this level of math need drill and repetition. One example of a situation will most generally be forgotten at a later time." ET3

"I think however some more explicit or particular family orientation of the slide would be more effective. That is follow a family through a period of time and relate insurance needs." ET4

"Too much material to cover in 2 weeks." ET5

"The 40 minutes of auto insurance and worksheets was not long enough. Some of the items, e.g., number of drivers uninsured, is not mentioned in a positive manner -- I did not really understand that there are 10,000,000 drivers who are uninsured -- that seems quite a bit high! A longer conference should be given by the writer (you) and the teachers involved." ET6

"Some slides were repetitious. For applied math students many of whom are absent, there is little opportunity to make-up the presentation they missed. Some slides were difficult to read; particularly some of the tables." ET7

"Some of the slides for 1st 3 days repeat too much etc., fire truck, fire house, brick apt's, brick house, frame apt's, frame house. Dealing with this type of group of h.s. students there is a high rate of absence. Those that miss class have little means to catch up and few of these students will come early or late to make up the work. Most slides on red background are hard to see." ET8

"Going through a set of sample problems only one time did not implant the procedure firmly in the students' minds. Had to go over the procedure repeatedly. Some of the charts on models were difficult to use in picking out the proper number." ET9
"The weaknesses were the multitudes of information on different types of insurances which students were expected to learn. (Example) Different types of life insurance." CT1

"Needed more problems which the student could work with. My students are slower or just clumsy with their mathematics and need quite a bit of reinforcement." CT3

"Not enough exercises on worksheets, need more problems, a bit more mathematical involvement:" CT6
"Students were more interested in the beginning but tended to lose interest toward end." ET1

"Attitudes remained about the same." ET2

"Very good the entire time." ET3

"The students were very interested at first and enjoyed this approach. However, they began to ask what should they buy as individuals." ET4

"More class discussion." ET5

"Some students, after 3 days of slides, asked about sleep time, they said it was boring, looking at slides. Others wanted to help set up the projector and to press the button to change slides." ET6

"Overall it improved. But many still seemed disinterested." ET7

"Change in one or two for better. Majority were glad to know we were going to return to book." ET8

"Improved. More awareness of reasons for cost of insurance." ET9

"The attitude of the students did not change. They are generally more attentive with worksheets rather than lectures." CT1

"Very good; seemed to be more involved with this unit. They were very eager to respond with their own experiences on these topics." CT3

"Better." CT5

"Improved, students a bit more involved." CT6
"Generally the students were indifferent but this is attitude we face in every area here." ET1

"Remained the same during the unit. However, there was more discussion toward the end of the unit." ET2

"More initiative was shown in discussing insurance than regular math. Many were talking and not saying much, but for the first time they could feel like a class participant." ET3

"Very good at first. Their enthusiasm began to fade rapidly toward the end of the unit. This is very typical for this group." ET4

"Higher." ET5

"The better students looked forward to the classes and wanted to keep their worksheets, etc., with them so they could study them. The less motivated wanted me to keep their sheets so they wouldn't lose the sheets." ET6

"Overall the enthusiasm raised a little." ET7

"Only change was with car ins. Others leave them cold at this time." ET8

"Improved during the unit in general. Greater during some parts." ET9

"Depending on which type of insurance was being discussed, the enthusiasm changed. There was, of course, more enthusiasm on auto insurance than the other types. Generally, student enthusiasm was better when working on the worksheets." CT1

"I would say they were more enthusiastic than they have been most of the school year so far." CT3

"Greater." CT5

"Improved, students a bit more involved." CT6
"Constant." ET1

"Was not as good during the unit. The number of absences went up during the unit." ET2

"Less cuts during this period than usual." ET3

"Good at first - more noticed at the end. This is very typical for this group." ET4

"Same." ET5

"No change (I counted for the totals 10 days before and the 10 days of the course) in the 8th period class, but more absence in 1st period class. There were several suspensions due to happenings at other locations and times of the school day." ET6

"No change." ET7

"None, usually about 1/4 of class absent." ET8

"No change although there was no "cutting" during this time." ET9

"Attendance did not change. Generally between 12-17 students attend each day." CT1

"About the same as usual. In this school, there has always been a problem with attendance." CT3

"Same." CT5

"About the same." CT6
"Sporadic. Slides on renter's insurance and new cars were best." ET1

"Number of students participating in the discussions increased (of the number that were present)." ET2

"Usually lively and about 90% participation (especially with auto insurance)." ET3

"We had very enjoyable and interesting discussions on auto and term insurance. The others brought average discussion." ET4

"Higher." ET5

"It seemed to improve – in quality and in number of discussions. It also seemed to invoke discussion from more students than in earlier classes, prior to this unit." ET6

"Difficult to get a class discussion going." ET7

"No change – very few will get actively involved in discussion." ET8

"Much improved. Some people entered in that participated very little normally." ET9

"As stated above, there was more class discussion an auto insurance than the others. However, only a few students ever discuss or ask questions, as usual." CT1

"Very good. They were eager to respond with their own experiences or their parents. Also, they had questions which they had been wondering about." CT3

"Greater." CT5

"More opportunity here for discussion than with many other topics. Students liked that." CT6
"I thoroughly enjoyed this unit." ET1

"I was encouraged throughout the unit with student interest in the slides. However, there were problems with the slides of charts." ET2

"I became frustrated by the students' inability to follow directions which is of utmost importance in this unit. Otherwise it was enjoyable to have so much interest in these students. There were some exceptions, of course, but with my guidance they were able to learn much from their own discussions. For a math teacher, it is a good break from the everyday math drill necessary with this kind of student." ET3

"I like the slides very much. I felt that your suggestions for discussion helped a great deal. For the type of class this is used in though, I feel that the use of these slides would be more effective if used one week, skip a week or two, then complete the unit." ET4

"More interest." ET5

"I was glad to help with the project and I hope that the students learned as much as I and that their attitude towards mathematics also improved. At first I felt that I was merely a tool for the person working on his doctorate, but ...." ET6

"My attitude was very positive during the unit as this was a refreshing change to me." ET7

"No change as observed by self." ET8

"Greatly improved. The availability of the visual aids are always a boon." ET9

"My attitude was enthusiastic because I was learning along with the students. I was not familiar with the way insurance worked, so I learned quite a bit -- all of it useful for myself." CT1

"I was very well pleased with this unit. I felt more cooperation out of the students and I seem to respond myself to this and become more involved in discussion than I had in previous units." CT3

"Better." CT5

"I enjoyed the unit and it was nice to have some facts and figures which were current to fit into the discussions." CT6
"I felt that the insurance test was confusing for slow learners since there was so much reading material with vocabulary too advanced in several questions." ET2

"I think the unit should be more family oriented showing a particular family and what some effects could be for not being insured. You need to add hospitalization." ET4

"I enjoyed teaching the unit. Not only did I learn but I realize many different aspects of insurance I didn't realize before." ET5

"I believe that the slides definitely aid the unit and the teacher -- it isn't like the erased problem -- you can flip the carousel back to the proper slide." ET6

"Overall, the unit was very well done." ET7

"Our policy at M-F is that over 6 days absent means failure for 6 weeks. I started ins. unit after 4 wks in grading period so a few students were turned off because they already had failed for 6 wks." ET8

"Auto insurance rated highest in enthusiasm. Fire insurance second. Least interested in life insurance." ET9

"I had the most difficult time with lectures because most students do not listen, whereas, with worksheets they actively participate." CT1

"I enjoyed teaching your unit on insurance. Thanks for including Eastmoor." CT5
APPENDIX R

Letter of Approval from the Assistant Superintendent for Special Services
Mr. Richard Swanson
Mathematics Education Department
College of Education
Ohio State University
1945 N. High Street
Columbus, Ohio 43210

Dear Mr. Swanson:

The Department of Evaluation, Research and Planning of the Columbus Public Schools has completed its customary examination of your research proposal. Based on the report I have received from this department, I find that I am in position to give central-office approval to your proposed study.

Central-office approval attests to the fact that your proposal meets certain standards as for the research design, instrumentation, and methodology are concerned. It still will be necessary for you to secure the approval of the principals of the schools from which you wish to draw your pupil-subjects before proceeding to carry out your study. In approaching principals to secure their approval, I suggest that you show them a copy of this letter.

I am pleased that you have worked cooperatively with the Department of Evaluation, Research and Planning in providing materials that did enable this department to complete the analysis of your proposal.

Sincerely yours,

[Signature]
Joseph L. Davis
Assistant Superintendent
Special Services

cc: Dr. Herriman
Mr. Rodosky
Mr. Tharp
Mr. Mcgee (OSU Student Field Experience Office)
APPENDIX S

Introductory Handout for the Teachers of Applied Mathematics
TO: Teachers of Applied Mathematics, Columbus High Schools

FROM: Richard Swanson, Dept. of Mathematics Education, Ohio State University

RE: The use of slides depicting principles of insurance with students in applied mathematics classes

Introduction: During this 1971-1972 school year, I am working on the dissertation of my Ph.D. in mathematics education at O.S.U. My research is entitled "A Study Of The Use Of Slides With Low-Achieving Consumer Mathematics Students." For this study, I wish to involve a large sample of classes from the 45 Applied Mathematics classes in the Columbus secondary schools. You are being asked to consider this study, and inform me if you would wish to participate. Permission has been given by both the Columbus Public School System and your Principal to work with you in this research.

Description: At least 20 of the 45 existing classes will be needed for this study. Ten of these would be designated as "Experimental" classes and would use the slides during instruction. Another 10 would serve as the "Control" group and would not use slides.

The particular unit chosen for this study involves insurance for the renter or homeowner, automobile insurance, and life insurance. The content of the unit includes both social aspects (e.g., accidents happen to everyone and can not be predicted), and applications of mathematics (e.g., law of large numbers, calculation of insurance premium and payment plans). The material is similar to that presented in secondary school textbooks, such as: Mathematics in Daily Use, Consumer Mathematics, General Business for Everyday Living, and Business Mathematics.

The suggested outline of the teaching unit covers 10 school days, including the post-test on the last day. Individual teachers and classes might need, and will be free to use, a slightly different amount of time. The teaching period may be included at any convenient position in your teaching schedule from this week through March 31, 1972. (It would not necessarily have to begin on a Monday and end on a Friday.)

The post-test is a multiple-choice survey of insurance knowledge and arithmetic ability. It requires one class period for administration. A true-false retention test will be provided for inclusion in your quarterly or monthly examination. This test should take about 5-10 minutes, and should be given a few weeks after the insurance unit has been completed.

All teachers participating in the study will receive:
1. a detailed unit outline, with principles to be discussed, some suggested student questions and assignments
2. vocabulary sheets for your students
3. life insurance rate tables for your students
4. worksheets for your students on fire insurance and life insurance
5. an answer key for the worksheets
6. a teacher questionnaire, to describe: a)the material you included in the teaching of your insurance unit, and b) the reaction to the material by the students
7. post-tests and retention tests

(CONTROL GROUP) The teachers of those classes assigned to the "Control" group will be free to teach their classes in their customary manner. Since the post-test is written over the content of the unit outline, the control group teachers will be asked to use the outline as a guide for their own teaching unit.

(EXPERIMENTAL GROUP) In addition to the list above, teachers having classes assigned to the "Experimental" group will receive:
1. automobile insurance worksheets for your students
2. a set of 142 slides in 2 Kodak "Carousels"
3. a script describing the slides and their use
Each teacher will need to borrow a slide projector (and screen?) from his school's audio-visual equipment area for use during the two-week period.

The following may be kept by you and your students: unit outline, vocabulary sheets, rate tables, worksheets and answer key. I will pick up the remaining items at your school when you are through with them: teacher questionnaire, costs, slides and script.

A pilot study was run during November 1971 with one of Russell Miller's Applied Mathematics classes at Northland High School. Feel free to contact him for his reaction to the materials.

Participation: Please contact me if you need more information before deciding whether or not you wish to participate. My office phone on campus is 422-7282. If I am not there, you can always leave a message with the secretary at 422-6121.

If you do wish to participate, please fill out the form and mail* to:

Richard Swanson  
Dept. of Science and Mathematics Education  
244 Arts  
The Ohio State University  
Columbus, Ohio 43210

*Please phone if you wish to start immediately

I cannot guarantee ahead of time that everyone who mails in the form will be able to participate as he requests. In general, decisions will be made on a "first-come, first-served" basis. However, adjustments might have to be made. If everyone wants to use the slides, some would need to be randomly assigned to the "Control" group in order for a comparison to be made. Since there are only 2 sets of Carousels available for circulation, some juggling of schedules might be necessary so that everyone can share in their use.

Thank you,

Richard Swanson
To: Richard Swanson  
Dept. of Science and Mathematics Education  
244 Arps  
The Ohio State University  
Columbus, Ohio 43210

____ I do wish to participate; "Experimental" group, with slides  
____ I do wish to participate; "Control" group, without slides  
____ I do wish to participate; either group

Teacher ________________________________  
School ________________________________

Period(s) of Applied Math. Class(es) _______ Class Enrollment ________

Periods during which I could meet with you ________________________

Inclusive dates of two-week period(s) during which you could teach the unit:  
first choice ______________________ to ______________________
__________________________ to ______________________
__________________________ to ______________________
APPENDIX T

Response Percentages of the Participating Teachers to the List of Insurance Concepts and Principles
### Response Percentages of the Participating Teachers to the List of Insurance Concepts and Principles

<table>
<thead>
<tr>
<th>Item</th>
<th>Did Not Include</th>
<th>Briefly Mentioned</th>
<th>Discussed Thoroughly</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>100</td>
<td>100</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>2.</td>
<td>67 40</td>
<td>33 60</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>3.</td>
<td>11 80</td>
<td>89 20</td>
<td></td>
<td>Weak</td>
</tr>
<tr>
<td>4.</td>
<td>44 80</td>
<td>56 20</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>5.</td>
<td>22 20</td>
<td>78 80</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>6.</td>
<td>22 20</td>
<td>78 80</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>7.</td>
<td>22 80</td>
<td>78 20</td>
<td></td>
<td>Weak</td>
</tr>
<tr>
<td>8.</td>
<td>11 40</td>
<td>89 60</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>9.</td>
<td>11 20</td>
<td>89 80</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>10.</td>
<td>20</td>
<td>11 20</td>
<td></td>
<td>Weak</td>
</tr>
<tr>
<td>11.</td>
<td>33 20</td>
<td>56 60</td>
<td>11 20</td>
<td>Mixed</td>
</tr>
<tr>
<td>12.</td>
<td>33</td>
<td>67 100</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>13.</td>
<td>11</td>
<td>89 100</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>14.</td>
<td>22 40</td>
<td>78 60</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>15.</td>
<td>11 60</td>
<td>89 40</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>16.</td>
<td>22 20</td>
<td>78 80</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>17.</td>
<td>22</td>
<td>67 100</td>
<td>11</td>
<td>Mixed</td>
</tr>
<tr>
<td>18.</td>
<td>22 20</td>
<td>78 80</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>19.</td>
<td>20</td>
<td>33 60</td>
<td>67 20</td>
<td>Mixed</td>
</tr>
<tr>
<td>20.</td>
<td>11</td>
<td>11 40</td>
<td>78 60</td>
<td>Mixed</td>
</tr>
<tr>
<td>21.</td>
<td>40</td>
<td>100 60</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>22.</td>
<td>20</td>
<td>100 80</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>23.</td>
<td>44 60</td>
<td>56 40</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>24.</td>
<td>33 20</td>
<td>67 80</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>25.</td>
<td>20</td>
<td>67 80</td>
<td>33</td>
<td>Mixed</td>
</tr>
<tr>
<td>26.</td>
<td>11</td>
<td>44 20</td>
<td>44 80</td>
<td>Mixed</td>
</tr>
<tr>
<td>27.</td>
<td>20</td>
<td>67 60</td>
<td>33 20</td>
<td>Mixed</td>
</tr>
<tr>
<td>28.</td>
<td>22 20</td>
<td>78 80</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>29.</td>
<td>56 40</td>
<td>44 60</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>30.</td>
<td>44</td>
<td>33 20</td>
<td>22 80</td>
<td>Weak</td>
</tr>
<tr>
<td>31.</td>
<td>40</td>
<td>100 60</td>
<td></td>
<td>Mixed</td>
</tr>
<tr>
<td>32.</td>
<td>11 20</td>
<td>56 60</td>
<td>33 20</td>
<td>Mixed</td>
</tr>
<tr>
<td>33.</td>
<td>11 20</td>
<td>89 80</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>34.</td>
<td>11 20</td>
<td>89 80</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>35.</td>
<td>22 20</td>
<td>78 80</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>36.</td>
<td>44 40</td>
<td>56 60</td>
<td></td>
<td>Strong</td>
</tr>
</tbody>
</table>
APPENDIX U

Class Means of the Arithmetic Computation, Post-Test, and Retention Test Achievement Measures
Class Means of the Arithmetic Computation, Post-Test, and Retention Test Achievement Measures

<table>
<thead>
<tr>
<th>Class</th>
<th>Arith. Comp.</th>
<th>Total Score</th>
<th>Post-test</th>
<th>Retention Test Total Score</th>
<th>Sub-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>A  B  C  D  E  F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC1</td>
<td>19.8</td>
<td>13.4</td>
<td>3.0  3.9  3.5  3.0  5.1  3.8</td>
<td>11.3</td>
<td>6.5</td>
</tr>
<tr>
<td>EC2</td>
<td>23.2</td>
<td>14.5</td>
<td>3.3  4.8  3.3  3.1  6.3  4.0</td>
<td>10.9</td>
<td>6.2</td>
</tr>
<tr>
<td>EC3</td>
<td>21.2</td>
<td>14.1</td>
<td>3.2  3.6  4.3  3.0  6.2  3.6</td>
<td>11.0</td>
<td>6.6</td>
</tr>
<tr>
<td>EC4</td>
<td>23.3</td>
<td>16.6</td>
<td>3.6  5.0  4.9  3.1  7.3  4.1</td>
<td>12.3</td>
<td>7.3</td>
</tr>
<tr>
<td>EC5</td>
<td>22.6</td>
<td>14.2</td>
<td>3.2  4.5  3.8  2.7  6.1  3.7</td>
<td>11.9</td>
<td>6.8</td>
</tr>
<tr>
<td>EC6</td>
<td>22.5</td>
<td>16.2</td>
<td>3.9  3.8  5.2  3.3  7.1  4.3</td>
<td>11.9</td>
<td>7.5</td>
</tr>
<tr>
<td>EC7</td>
<td>20.6</td>
<td>14.4</td>
<td>3.0  4.3  3.9  3.1  6.6  4.3</td>
<td>10.9</td>
<td>6.8</td>
</tr>
<tr>
<td>EC8</td>
<td>16.0</td>
<td>14.7</td>
<td>3.1  3.9  4.1  3.6  5.8  3.8</td>
<td>12.0</td>
<td>7.4</td>
</tr>
<tr>
<td>EC9</td>
<td>17.3</td>
<td>11.7</td>
<td>3.0  3.0  3.3  2.5  5.3  2.9</td>
<td>10.6</td>
<td>5.3</td>
</tr>
<tr>
<td>EC10</td>
<td>27.2</td>
<td>20.5</td>
<td>3.9  6.2  5.8  4.6  8.8  4.3</td>
<td>12.5</td>
<td>7.4</td>
</tr>
<tr>
<td>EC11</td>
<td>26.0</td>
<td>21.8</td>
<td>4.0  6.8  6.2  4.9  8.5  4.3</td>
<td>12.2</td>
<td>7.5</td>
</tr>
<tr>
<td>EC12</td>
<td>21.3</td>
<td>12.9</td>
<td>3.2  3.3  3.6  2.7  5.6  3.4</td>
<td>11.8</td>
<td>7.1</td>
</tr>
<tr>
<td>EC13</td>
<td>18.3</td>
<td>19.4</td>
<td>4.0  5.4  5.4  4.6  8.8  4.8</td>
<td>12.5</td>
<td>7.2</td>
</tr>
<tr>
<td>EC14</td>
<td>25.0</td>
<td>24.9</td>
<td>5.4  6.3  7.2  5.9  10.4 6.1</td>
<td>13.1</td>
<td>7.3</td>
</tr>
<tr>
<td>EC15</td>
<td>24.7</td>
<td>17.1</td>
<td>4.1  4.5  4.8  3.7  7.0  5.3</td>
<td>11.7</td>
<td>6.9</td>
</tr>
<tr>
<td>EC16</td>
<td>22.5</td>
<td>18.6</td>
<td>4.8  4.9  5.2  3.7  7.8  5.6</td>
<td>12.1</td>
<td>6.9</td>
</tr>
<tr>
<td>CC1</td>
<td>23.4</td>
<td>16.8</td>
<td>3.4  4.4  5.4  3.6  6.7  4.4</td>
<td>12.5</td>
<td>7.0</td>
</tr>
<tr>
<td>CC2</td>
<td>26.8</td>
<td>16.9</td>
<td>4.2  4.0  4.7  3.9  6.9  4.9</td>
<td>10.7</td>
<td>6.4</td>
</tr>
<tr>
<td>CC3</td>
<td>24.0</td>
<td>17.3</td>
<td>3.9  5.5  4.4  3.7  7.3  4.9</td>
<td>11.4</td>
<td>6.9</td>
</tr>
<tr>
<td>CC4</td>
<td>27.0</td>
<td>17.2</td>
<td>4.0  4.2  5.1  3.9  6.9  5.0</td>
<td>12.8</td>
<td>7.6</td>
</tr>
<tr>
<td>CC5</td>
<td>17.1</td>
<td>12.4</td>
<td>2.8  3.9  2.9  2.8  5.1  3.3</td>
<td>11.2</td>
<td>6.4</td>
</tr>
<tr>
<td>CC6</td>
<td>14.3</td>
<td>15.9</td>
<td>3.9  3.2  3.9  2.9  5.3  4.3</td>
<td>12.1</td>
<td>6.5</td>
</tr>
<tr>
<td>CC7</td>
<td>20.7</td>
<td>13.0</td>
<td>3.2  5.1  5.2  3.9  6.9  4.6</td>
<td>11.7</td>
<td>6.5</td>
</tr>
<tr>
<td>CC8</td>
<td>19.4</td>
<td>17.4</td>
<td>3.0  4.0  3.4  2.6  4.9  4.1</td>
<td>10.4</td>
<td>5.2</td>
</tr>
<tr>
<td>CC9</td>
<td>22.0</td>
<td>15.7</td>
<td>3.4  4.6  4.5  3.3  5.8  4.9</td>
<td>12.8</td>
<td>7.6</td>
</tr>
<tr>
<td>CC10</td>
<td>21.8</td>
<td>16.2</td>
<td>3.7  5.3  3.7  3.5  7.3  3.9</td>
<td>10.5</td>
<td>6.7</td>
</tr>
<tr>
<td>CC11</td>
<td>22.6</td>
<td>12.1</td>
<td>3.0  3.1  3.0  3.0  4.7  3.8</td>
<td>10.3</td>
<td>5.7</td>
</tr>
<tr>
<td>CC12</td>
<td>20.6</td>
<td>18.7</td>
<td>3.4  6.8  4.9  3.7  7.3  5.2</td>
<td>12.8</td>
<td>7.3</td>
</tr>
<tr>
<td>CC13</td>
<td>23.3</td>
<td>17.6</td>
<td>4.5  4.6  4.9  3.5  7.3  5.5</td>
<td>12.8</td>
<td>7.5</td>
</tr>
</tbody>
</table>
APPENDIX V

Formulas for F-ratio and t-tests
NOTATION

\(N_1\) - The number of classes in group E
\(N_2\) - The number of classes in group C
\(\bar{X}_1\) - The mean of the test scores of group E
\(\bar{X}_2\) - The mean of the test scores of group C
\(S^2_1\) - The unbiased estimate of the population variance from group E
\(S^2_2\) - The unbiased estimate of the population variance from group C
\(f\) - The degrees of freedom

THE F-RATIO

\[F = \frac{S^2_1}{S^2_2}, \text{ where } f = (N_1 - 1, N_2 - 1) \text{ and } S^2_1 \text{ greater than } S^2_2\]

\[F = \frac{S^2_2}{S^2_1}, \text{ where } f = (N_2 - 1, N_1 - 1) \text{ and } S^2_2 \text{ greater than } S^2_1\]

T-TEST (VARIANCES EQUAL)

\[t = \frac{\bar{X}_1 - \bar{X}_2}{S_p \left( \frac{1}{N_1} - \frac{1}{N_2} \right)^{1/2}}, \text{ where } S_p = \frac{(N_1 - 1)S^2_1 + (N_2 - 1)S^2_2}{N_1 + N_2 - 2} \]

and \(f = N_1 + N_2 - 2\)
T-TEST (VARIANCES UNEQUAL)

\[ t = \frac{\overline{x}_1 - \overline{x}_2}{\left( \frac{s_1^2}{N_1} + \frac{s_2^2}{N_2} \right)^{\frac{1}{2}}} \]

, where \( f = N_1 + N_2 - 2 \)

with:

- \( t_1 \) - the value of \( t \) significant at \( p \) for \( N_1 - 1 \) degrees of freedom

- \( t_2 \) - the value of \( t \) significant at \( p \) for \( N_2 - 1 \) degrees of freedom,

then the critical value of \( t \) at significance \( p \) is:

\[ t_p = \frac{s_1^2 \left( \frac{t_1/N_1}{N_1} \right) + s_2^2 \left( \frac{t_2/N_2}{N_2} \right)}{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}} \]
APPENDIX W

Test Items Included in the Sub-tests
Sub-test A: Insurance for the Renter or Homeowner
    1, 5, 9, 13, 15, 17, 21, 24, 40
Sub-test B: Automobile Insurance
    2, 6, 10, 18, 22, 25, 28, 30, 33, 35, 37, 39
Sub-test C: Life Insurance
    3, 7, 11, 14, 19, 26, 29, 31, 34, 36, 38
Sub-test D: General Principles of Insurance
    4, 8, 12, 16, 20, 23, 27, 32
Sub-test E: Direct Association with a Slide
    4, 9, 11, 14, 24, 26, 27, 29, 30, 31, 33, 34, 35, 37, 38
Sub-test F: Computational
    1, 3, 4, 5, 10, 15, 17, 18, 19, 39, 40

Retention Sub-test: Direct Association with a Slide
    3, 4, 6, 9, 11, 12, 13, 15, 16, 17
APPENDIX X

Letter from the Director of Information of the Ohio Insurance Institute
Mr. Richard Swanson  
Department of Science and Mathematics Education  
244 Arps  
The Ohio State University  
Columbus, Ohio 43210  

Dear Mr. Swanson:

I have just reviewed your research project entitled "A Study Of The Use Of Slides With Low-Achieving Consumer Mathematics Students" and find that it is a very good paper.

In checking the content of the text of the material, I can only find two or three minor errors.

Overall, I feel that you did a very thorough job in gathering the material and assembling it into a very workable program.

We appreciate the information that you included about "The Ohio Insurance Institute". As you already know, I have replaced Mr. Bailey as the Director of Information so any inquiries that you receive should be referred to me.

Thanks for the opportunity of letting me review your project and if I can be of any further help, please let me know.

Very truly yours,

Roger D. Shipe, C.P.C.U.  
Director of Information

RDS:mja
BIBLIOGRAPHY


22. ________. "The Course Content in Commercial Mathematics." School Review, XXXXIX (June, 1941), 436-444.


74. "Improving Attitudes--Film." Review of "The Comparative Effectiveness of Sound Motion Pictures and Printed Communications for the Motivation of High School Students in Mathematics,"


98. McNerney, Charles Robert. "Effects of Relevancy of Content on Attitudes Toward, and Achievement in, Mathematics by Prospective Elementary School Teachers." Unpublished


128. Risinger, Hubert B. "Consumer Education (With Special Emphasis on Its Application to the Field of Mathematics)." New Brunswick, New Jersey: School of Education, Rutgers University, 1941.


