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AN EVALUATION OF THE TIME FORMATS USED IN TEACHING THE MICHIGAN STATE UNIVERSITY HIGHWAY TRAFFIC SAFETY CENTER INTRODUCTORY TRAFFIC ACCIDENT INVESTIGATION COURSE

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AN EVALUATION OF THE TIME FORMATS USED IN TEACHING THE MICHIGAN STATE UNIVERSITY HIGHWAY TRAFFIC SAFETY CENTER INTRODUCTORY TRAFFIC ACCIDENT INVESTIGATION COURSE

By

Terry Miles Nerbonne

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ABSTRACT

AN EVALUATION OF THE TIME FORMATS USED IN TEACHING THE MICHIGAN STATE UNIVERSITY HIGHWAY TRAFFIC SAFETY CENTER INTRODUCTORY TRAFFIC ACCIDENT INVESTIGATION COURSE

By

Terry Miles Nerbonne

The purpose of this study was to evaluate the effectiveness of selected traffic accident investigation course formats offered by the Michigan State University Highway Traffic Safety Center.

The comparison of the traffic accident investigation classes was studied by analyzing the test results of 114 students who received traffic accident investigation training.

Student test scores and student responses to questionnaires from the five traffic accident investigation courses presented in different locations throughout the state of Michigan were analyzed in this study.

All five traffic accident investigation courses were identical with the exception of the format in which they were presented. Students in the schools at Muskegon Community College, Muskegon, Michigan; Lake Superior State College, Sault Ste. Marie, Michigan; and Madonna College, Detroit, Michigan, received instruction seven hours per day for five consecutive days. At Lake Michigan Community College, Benton Harbor, Michigan, instruction was presented seven hours per day for

one day the first week, and seven hours per day for two days a week for two successive weeks. At Jackson Community College, Jackson, Michigan, the instruction was presented seven hours per day for one day a week for five successive weeks.

The methods selected for comparing the three formats were to measure (1) what learning took place by means of a pre-test given at the beginning of the course and a post-test given at the end of the course, (2) how students evaluated the course by means of analyzing the student course evaluation questionnaire, and (3) whether the students were utilizing the knowledge they received and (4) whether their overall performance in traffic accident investigation was increased by analyzing a follow-up questionnaire completed by the students four months after they completed the training.

The following conclusions were reached on the basis of the analyses of students' pre-test scores, post-test scores, student responses on the background questionnaire, student responses on the course evaluation questionnaire, and student responses on the follow-up questionnaire:

1. At the 95% level of confidence, significant differences in mean-gain scores obtained by comparing pre-test and post-test scores were found for all five groups. All five groups had positive gain scores varying from 21.37 points to 27.86 points, with the total mean gain score for all five groups being 24.57 points. It was concluded that learning did take place as measured by these scores.

2. The passing grade established for this course was 70%. The traffic accident investigation courses would be considered to be a

complete success since all 114 students equalled or exceeded the grade of 70% on the post-test.

3. There was evidence that after pre-course effects were removed, the instructional format used did have an effect on the amount of learning that was achieved. It could be concluded that both the one-week format and the three-week format produced significantly greater learning than did the five-week format.

4. There was evidence that the instructional format used had an effect on how the students rated the course. It was concluded that the students who attended the five-week format were significantly less satisfied than those who attended the one-week or the three-week format.

5. Even though there were reported differences between formats of instruction and students' course evaluation ratings, all five groups rated the accident investigation course highly.

6. It was concluded from the analyses of the students' follow-up questionnaires that the students' overall performance in traffic accident investigation was increased, and there was evidence that new accident investigation skills were being utilized.

ACKNOWLEDGMENTS

The writer wishes to express appreciation to a number of individuals without whose assistance this endeavor could not have been completed.

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CHAPTER I

THE PROBLEM

Background Information

All phases of the highway safety effort continue to rely upon accident data to provide the information necessary for planning, operating, and evaluating highway safety programs. Accordingly, it is important that valid and comprehensive traffic accident data be collected for the highway safety management function.

A difficulty in accumulating accurate data has been the variance among state, county, and local law enforcement agencies charged with traffic accident investigations. The officers of these agencies have been trained in varying ways to compile traffic accident statistics. Additionally, the scope of this responsibility became apparent when the 1978 Michigan accident statistics were examined. Michigan had 2,076 traffic deaths in 1978. There were 389,193 reported accidents, of which 112,259 were personal injury and 275,101 were property damage accidents.[1]

Unfortunately, the average police officer in Michigan has not received the training, education, and experience necessary to recognize and collect all necessary and pertinent information when

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[1]Michigan Department of State Police, 1978 Michigan Traffic Accident Facts (East Lansing: Michigan Department of State Police, 1978), p. 5.

conducting an on-scene accident investigation. This lack of preparation exists largely because Michigan's required basic police training programs provide insufficient instruction in traffic accident investigation. The Michigan Law Enforcement Officers Training Council (MLEOTC) requires its academies to provide 12 hours of instruction in accident investigation and reporting. These 12 hours are only a small portion of the required minimum total of 256 hours of police training. Only a few of the 15 regional academies exceed this basic 12-hour minimum. In 12 hours, the academy instructors are typically able to teach the recruit officers little more than how to complete the state's UD-10 accident form. MLEOTC staff have received a number of complaints from academy instructors that 12 hours of instruction is not enough time to provide adequate instruction in traffic accident investigation.[2]

Recent Traffic Accident Investigation Training Efforts

During the past few years, there have been a variety of accident investigation training programs available to Michigan officers. The programs, however, were only offered on a centralized basis.[3] This centralized basis generally served the larger metropolitan areas in which they were conducted, as well as the agencies immediately surrounding the location of the program; but small county, city, and

[2] Statement by William Nash, MLEOTC Training Staff, in a personal interview, Lansing, Michigan, June 18, 1978.

[3] Centralized basis refers to the geographic area of the larger metropolitan population centers in the state of Michigan.

township law enforcement agencies outside the geographical area experienced great difficulty in sending personnel to these training programs. Many small law enforcement agencies could not afford to enroll officers in week-long training programs because of the extensive travel time and/or expenditures involved. This is a serious shortcoming, as approximately two-thirds of Michigan's fatal traffic accidents occur in rural areas served primarily by the small police agencies.

The problem of providing adequate accident investigation training has been a difficult one for all police departments, but particularly for the small departments not situated near urban population centers. In the following examination of several accident investigation training programs, there was a clear indication of these problems.

The Northwestern University Traffic Institute (NUTI) has conducted basic courses in accident investigation in Michigan for several years. The Michigan Office of Highway Safety Planning (MOHSP) generally provided funding to conduct two or three two-week NUTI "On-Scene Accident Investigation Courses" each year. More recently, NUTI has developed a specialized three-week scientific-technical course to supplement its basic course, and MOHSP has funded a number of these courses in Michigan. Training sites for NUTI "On-Scene Courses" were, for the most part, in larger metropolitan areas or in Lansing at the Michigan State Police Academy. Unfortunately, as a result of these locations, only the larger police agencies were able to avail themselves of this training format. It was difficult, in terms of manpower and dollars, for smaller jurisdictions to release a police officer for a two-week period to obtain specialized training.

College and Regional Training Academy Accident Investigation Training Programs have been offered throughout the state. Offerings at colleges were on a tuition and credit basis and enrolled both in-service and pre-service students, creating some limitations on the depth of the course material. Limited offerings at the regional training academies were designed to serve their local police agencies' training needs, but, in both cases, the training was usually limited to surrounding agencies.

Michigan State University (MSU) has conducted periodic one-week courses in accident investigation. However, such short courses have not been conducted for several years. The HTSC proposed to upgrade the quality and amount of training for operational-level law enforcement officers with traffic accident investigation responsibilities in small law enforcement agencies in Michigan. In December 1976, the MOHSP awarded the MSU Highway Traffic Safety Center (HTSC) a grant to conduct two accident investigation training courses in the state of Michigan. The developmental effort, which included a task analysis, curriculum development, instructional media design and development, was performed by the HTSC prior to the grant award from MOHSP. The course was developed by the HTSC with the awareness that there was a need to provide Michigan officers accident investigation training that would exceed the 12 hours required by the MLEOTC.

Through December 1978, the HTSC offered eight traffic accident investigation courses (AI-1) in Michigan. Approximately 200 law enforcement officers attended these eight courses. All of the courses were funded by the MOHSP.

In the area of traffic accident investigation training, there has been a lack of effective evaluation of content, process, format, and materials used in instruction. No evaluation to measure the effectiveness of traffic accident investigation course formats offered by the Michigan State University Highway Traffic Center has been conducted; thus no conclusions can be made as to the overall effectiveness of the training.

Purpose of the Study

The purpose of this study was to evaluate the effectiveness of selected traffic accident investigation course formats offered by the Michigan State University Highway Traffic Safety Center.

Need for the Study

The MOHSP had indicated both an interest in and a need for an evaluation of the effectiveness of the HTSC traffic accident investigation course. Because the MOHSP plans to continue funding traffic accident investigation courses, this study can provide valuable information to the MOHSP and to the law enforcement agencies that plan to have personnel trained in traffic accident investigations. Administrators faced with deciding which course to utilize for training their in-service personnel might benefit from the information developed. Requests for information from concerned administrators had been received by the MOHSP and the HTSC with increasing frequency. The relative merits of the courses were of concern to decision makers who commit personnel to the traffic accident investigation courses.

The HTSC had also expressed a need to determine which training format (e.g., one-week, three-week, or five-week) was most effective in producing higher gain scores. Also, the instructors had expressed interest in obtaining information from on-job performance, specifically determining if the training was being applied and utilized by the officers who had completed the course.

Hypotheses

Research Questions

1. Will students show significant gain scores, as calculated by pre-test and post-test scores, after the completion of the five traffic accident investigation courses?

2. Will there be a significant difference in student entry-level knowledge of traffic accident investigation, as reflected by mean scores on a pre-test, among the five groups receiving traffic accident investigation instruction?

3. Will student entry-level backgrounds, as reflected by variables on the student background questionnaire, show a significant relationship with post-test scores?

4. Will there be a significant difference in student achievement levels, as reflected by mean scores on the post-test, among groups receiving three different formats of instruction?

5. Will there be a significant difference in student evaluations, as reflected by responses on the student course evaluation

questionnaire, among groups receiving three different formats of instruction?

6. Will students utilize the knowledge they receive, and will their overall performance in traffic accident investigation be increased as a result of the traffic accident investigation course?

Research Hypotheses

The following hypotheses were selected for testing in this study:

Hypothesis 1: Students will not show significant gain scores, as calculated by pre-test and post-test scores, after the completion of the five traffic accident investigation courses.

H_0: $\mu_2 - \mu_1 \leqq 0$

H_1: $\mu_2 - \mu_1 > 0$

Where: μ_1 = pre-test scores

μ_2 = post-test scores

Hypothesis 2: Student entry-level knowledge of traffic accident investigation, as reflected by mean scores on a pre-test, will not vary among the five groups receiving traffic accident investigation instruction.

H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

H_1: $\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq \mu_5$

Where μ_1, μ_2, etc. represent the pre-test scores of the groups.

Hypothesis 3: Student entry-level backgrounds, as reflected by variables on the student background questionnaire, will not show a significant relationship with post-test scores.

H_0: $\rho_1 = \rho_2 = \rho_3$

H_1: $\rho_1 \neq \rho_2 \neq \rho_3$

Where ρ_1, ρ_2, ρ_3 represent the frequencies within the three post-test score categories. (Refer to Appendix G.)

Hypothesis 4: Student achievement levels, as reflected by mean scores on the post-test, will not vary among groups receiving three different formats of instruction.

H_0: $\mu_1 = \mu_2 = \mu_3$

H_1: $\mu_1 \neq \mu_2 \neq \mu_3$

Where μ_1, μ_2, μ_3 represent post-test scores of three different formats.

Hypothesis 5: Student evaluations, as reflected by responses on the student course evaluation questionnaire, will not vary among groups receiving three different formats of instruction.

H_0: $\mu_1 = \mu_2 = \mu_3$

H_1: $\mu_1 \neq \mu_2 \neq \mu_3$

Where μ_1, μ_2, μ_3 represent student course evaluation scores of three different formats.

A questionnaire was designed to determine whether the students utilized the knowledge they received and whether their overall performance in traffic accident investigation was increased. This evaluation was made by analyzing a follow-up questionnaire filled out by the students four months after they completed the course. No hypothesis was established for this test of effectiveness of traffic accident investigation courses.

Research Design

This study was designed to evaluate the effectiveness of selected traffic accident investigation course formats. The methods selected for comparing the three formats were to measure (1) what learning took place by means of a pre-test given at the beginning of the course and a post-test given at the end of the course, (2) how students evaluated the course by means of analyzing the student course evaluation questionnaire, and (3) whether the students were utilizing the knowledge they received and (4) whether their overall performance in traffic accident investigation was increased by analyzing a follow-up questionnaire completed by the students four months after they completed the training.

The test items contained in the pre-test and post-test were reviewed by a panel of judges for the purpose of assuring that the test questions actually measured the objectives stated in the subject areas.

Limit and Scope of This Study

The traffic accident investigation courses upon which this study was based were offered in five locations in the state of Michigan: Jackson, Muskegon, Detroit, Sault Ste. Marie, and Benton Harbor. These locations were representative of the state in terms of geography, economic conditions, and population composition (Appendix A).

Those attending the courses were all sworn law enforcement officers from municipal, township, county, and public safety departments, ranging in size from one man to five thousand men. The practitioners were assigned to the particular schools by their respective agencies, so it was not possible to make random assignments to the various schools.

The same two instructors taught the five classes that were used in collecting the data for this study. This had the advantage of eliminating variables that could have arisen from the individual approaches of a variety of instructors.

Definition of Terms

AI-1: This refers to the Police Traffic Accident Training Course that was presented by the Highway Traffic Safety Center of Michigan State University. The course was a 35-hour training program designed to equip the in-service police officer with the capability of conducting comprehensive on-scene traffic accident investigations. Emphasis was placed upon (1) recognizing all pertinent physical evidence about the accident vehicles and scene; (2) collecting and/or recording this information in the form of photographs, sketches, and measurements; and (3) calculating certain pre-collision speeds of accident-involved vehicles.

Accident investigation: A systematic examination and gathering of all of the facts and information about conditions, actions, and physical features connected with and involved in the situation that is commonly called an accident.

Accident reporting: Basic data collection to identify and classify a motor-vehicle traffic accident and the persons, property, and planned movements involved. Only strictly factual information is wanted, not opinions.[4]

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[4] J. Stannard Baker, Traffic Accident Investigation Manual (Evanston, Illinois: Northwestern University, 1975), p. 4.

At-scene investigation: Examining and recording results of the accident and obtaining additional information at the scene of a traffic accident that may not be available later and that supplements data obtained for the accident report. This information is as factual as possible.[5]

Course of study: For purposes of this study, course of study referred to the performance objectives, subject outlines, lectures, problems, and testing used with students who attended one of five Police Traffic Accident Investigation Training courses given in Jackson, Muskegon, Detroit, Sault Ste. Marie, and Benton Harbor, Michigan, by the Highway Traffic Safety Center of Michigan State University during the summer and fall of 1979 (Appendix B).

Entering behavior: For the purposes of this study, entering behavior is that information obtained from students at the first session when attending one of the five AI-1 courses. These were responses to a questionnaire on experience and education (Appendix C).

Format of instruction: For the purpose of this study, format of instruction means the instructional plan that was used to deliver accident investigation training. The following formats were used:

Format #1--Teaching the course seven hours per day for five consecutive days, for a total of 35 hours of instruction (the one-week format).

Format #2--Teaching the course seven hours per day for one day the first week, and seven hours per day for two days a

[5]Ibid.

week for two successive weeks, for a total of 35 hours of instruction (the three-week format).

Format #3--Teaching the course seven hours per day for one day a week for five successive weeks, for a total of 35 hours (the five-week format).

Motor vehicle accident: Any event that results in unintended injury or property damage attributable directly or indirectly to the motion of a motor vehicle or its load.[6]

Motor vehicle traffic accident: Any motor vehicle accident occurring on a traffic way.[7]

Police officer: This term is defined as any sworn full-time uniformed police personnel who is responsible for all basic police functions, which may include enforcement of laws, maintenance of order, prevention of crime, and protection of property. This definition includes officers who respond to calls for assistance and who are responsible for reporting and recording violations of the law.[8]

Police traffic accident investigation:

> Police Traffic Accident Investigation is the part of street or highway traffic supervision performed by police in connection with traffic accidents. This activity includes but is not necessarily limited to accident reporting by police: on-the-scene investigation; follow-up accident investigation; police traffic law enforcement arising from the accident; police traffic direction and other emergency services to prevent

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[6]Ibid., p. 320.

[7]Ibid.

[8]Robert L. Parsons, "Task Analysis of the Physical Performance Requirements Necessary to Perform as a Michigan Police Officer" (Ph.D. dissertation, Michigan State University, 1980).

additional injury, damage or loss; and preparing, in addition to the routine traffic accident report, a traffic citation or special traffic accident investigation report stating conclusions about how and why the accident occurred.[9]

Technical preparation: Delayed traffic accident data collection and organization for study and interpretation. The data collected are essentially factual. Technical preparation includes making additional measurements and photographs, preparing maps and diagrams, simple speed estimates, matching damage areas, and making experiments to obtain specific data.[10]

Organization of the Remaining Chapters

Chapter II contains a review of the literature. Included are a review of current research on intensive scheduling and pertinent or related literature on measurement methods that were used in this study.

Chapter III contains a detailed description of the course of study as well as the techniques used in evaluating the course of study.

Chapter IV includes an analysis and presentation of the data obtained in the study.

Presented in Chapter V are the summary, conclusions, recommendations for further study, and a discussion.

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[9] Highway Safety Policies for Police Executives, annually updated (Gaithersburg, Maryland: International Association of Chiefs of Police).

[10] Baker, p. 4.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter is to present a review of the literature related to the use of time-compressed formats in teaching and the use of assessment instruments for evaluating training programs.

Since a principal purpose of this study was to determine if one of the three training formats (e.g., one-week, three-week, or five-week) was most effective, an extensive search was made of the literature related to the use of intensive scheduling in teaching.

An extensive search was also made of the literature related to assessment instruments for evaluating training programs. Also included was a review of measurement methods used in this study.

Intensive Scheduling

Intensive scheduling refers to an innovative approach to scheduling courses by which students study a particular subject for a concentrated period of time and in which formal classroom contact time between the students and the instructor is limited to a time-compressed format.[11]

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[11] Richard Doyle and John Yantis, Facilitating Non-Traditional Learning: An Update on Research and Evaluation in Intensive Scheduling (Bethesda, Md.: ERIC Document Reproduction Service, ED 144 459, 1977), p. B-227.

Intensive scheduling was found in a wide variety of formats, e.g., seminars, workshops, evening classes, summer sessions, and weekend classes.

The remaining part of this section presents the results of a number of studies that dealt directly or indirectly with various aspects of intensive scheduling.

Retention and Short-Term Cognitive Changes

Research on the long-term retention of material learned in intensive courses was sparse. Powell, who investigated the area of retention as it related to intensive scheduling, concluded that:

> Although students and teachers believe that retention of material improves with concentrated studies, no one has ever done a serious comparative study under intensive and concurrent schedules. Thus, we don't know whether retention is better or worse in intensive learning. This is a major research need.[12]

On the other hand, there were substantial quantitative and qualitative data that suggested that intensive courses were effective in producing short-term cognitive changes.

Scott, in a study comparing the achievement in eleventh grade American history of better-than-average high school students (averaged about the 75th percentile IQ), utilized matched pairs (school, sex, chronological age, mental age, and enrolled for original credit) and concluded that students in summer school intensive courses (seven weeks long, 96 hours of instruction) achieved as well as or better than

[12] B. S. Powell, Intensive Education: The Impact of Time on Teaching (Newton, Mass.: Educational Development Center, 1976), p. 14.

students in similar regular sessions (36 weeks long, 150 hours of instruction).[13]

Wallace reported that an extensive three-week foreign language course produced gains equivalent to that expected in one year (30 weeks) of normal study as measured by the standardized tests of the Modern Language Association.[14]

Two other studies of intensive programs in modern foreign languages reported "substantial" and "measurable" gains in knowledge and understanding of the course material.[15,16] These studies did not use a control group, so no direct comparison could be made to the performance of students with similar abilities in similar courses using different scheduling patterns.

Powell summarized the results of six studies of basic courses at the secondary and post-secondary levels. These studies compared students in intensive courses with "matched" students taking the same courses at the same time during the normal school day. In every case,

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[13]Owen Scott, "A Comparison of Summer School and Regular Session Achievement in 11th Grade American History," Journal of Educational Research 59 (1966): 235-37.

[14]John A. Wallace, "Three Weeks Equals Thirty Weeks?--A Report on an Experimental Intensive January Language Course," Foreign Language Annuals 6 (1972): 88-94.

[15]J. J. Deveny and J. C. Bookout, "The Intensive Language Course, Toward a Successful Approach," Foreign Language Annuals 6 (1976): 58-63.

[16]J. J. Solecki, "An Intensive Method of Language Teaching," Foreign Language Annuals 4 (1971): 278-82.

students in the intensive courses did as well as or better than students in concurrent courses.[17]

Doyle, in a study conducted at Central Michigan University, reported that in general there was no difference in achievement, as measured by the final grade distributions, between students enrolled in an introductory geography course taught under the following three conditions: (1) a three-week intensive format, (2) a six-week intensive format, and (3) a traditional semester (15-week) format.[18]

Mazanec reported similar findings as Doyle in courses taught in English, mathematics, speech, and political science at Delta College, in which 3-, 6-, and 15-week formats were used.[19]

The studies referred to above provided valuable information about cognitive retention in both regular and intensive courses. Such information was also valuable in helping to determine the results of this study in the effectiveness of short-term cognitive changes. Most of the literature on intensive scheduling has been based on opinions, with little reliable statistical data available to verify these opinions.[20]

According to Campbell and Stanley:

> Internal validity is the basic minimum without which any experiment is uninterpretable: Did in fact the experimental

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[17]Powell, p. 231.

[18]Doyle and Yantis, p. B-231.

[19]Joseph Mazanec, "The Effect of Course Intensity on Academic Achievement, Student Attitudes, and Mortality Rate" (Ph.D. dissertation, Michigan State University, 1972).

[20]Doyle and Yantis, p. B-231.

> treatments make a difference in this specific experimental instance? External validity asks the question of generalizability: To what populations, settings, treatment variables, and measurement variables can this effect be generalized?[21]

This selection factor essentially meant that the differences that occurred between study groups could well have come about through the different characteristics of the persons making up the group, rather than the method of scheduling.

Doyle and Yantis, being aware of the possibility of selection bias and other threats to validity enumerated by Campbell and Stanley, designed an experiment in which students who enrolled in a graduate course in industrial psychology were randomly assigned to one of two treatments: a compressed schedule consisting of four weekends of nine hours of classes each, or a more extended format of nine weeks of classes with one four-hour class per week. Students in each treatment used the same text, had the same instructor covering the same material, and had the same examinations. They concluded that there were essentially no differences between the two groups.[22]

Doyle, Moursi, and Wood, in a study comparing students enrolled in a graduate business course, concluded that there was no difference between the performance of a group of students randomly assigned to an intensively scheduled class and their counterparts enrolled in an identical course over the period of a complete semester (15 weeks). In that study, two independent indexes of performance were used:

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[21] Donald Campbell and Julian Stanley, Experimental and Quasi-Experimental Designs for Research (Chicago: Rand McNally & Co., 1966), p. 5.

[22] Doyle and Yantis, p. B-232.

(1) the course grade, which was based on a number of criteria; and (2) a cognitive achievement test of administrative theory.[23]

The above studies demonstrated that students enrolled in intensive courses performed in the cognitive domain at least as well as students who enrolled in extended courses.

Doyle and Yantis have concluded that:

> Although it is clear from all the available evidence that intensive scheduling works at least as well as traditional scheduling, the mechanisms responsible for the success of this approach have not yet clearly been identified. Many aspects of intensive scheduling warrant further investigation.[24]

Massed Versus Distributed Practice

Research on learning has indicated that the introduction of time intervals between periods of practice results in more learning and better retention than the same amount of practice undertaken in one period.[25]

The psychological literature in the area of massed practice (i.e., no rest intervals) versus distributed practice (spaced rest intervals) has a direct bearing on the issue of intensive scheduling.

Hefferlin asserted that although the literature suggested that more learning and better retention took place under conditions of

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[23] R. Doyle, M. Moursi, and D. Wood, The Effects of Intensive Scheduling: A Field Experiment (Mt. Pleasant: Institute for Personal and Career Development, Central Michigan University, 1979).

[24] Doyle and Yantes, p. B-238.

[25] J. B. Lon Hefferlin, "Intensive Courses: An Old Idea Whose Time for Testing Has Come," Journal of Research and Development in Education 6 (1972): 94.

distributed learning, which would favor concurrent courses over intensive courses, the results

> provide no evidence in either direction; for while intensive courses obviously represent more concentrated effort than concurrent ones, they do not constitute massed practice in the sense of most psychological experiments. Instead, they actually illustrate distributed practice, since they employ daily cycles of rest and effort comparable to the 24 hour cycle sometimes used in distributed practice experiments.[26]

Doyle, in his research of laboratory and field studies in the area of massed versus distributed practice, corroborated Hefferlin's findings that the data were inconclusive with respect to intensive scheduling and the area was in need of further study.[27]

Student Attitudes

Another aspect of this study was student attitudes, as reflected by responses on the student course evaluation questionnaire.

Hefferlin, in his research on intensive scheduling, reported that general student and faculty enthusiasm and satisfaction was a consequence of every experience to date with intensive scheduling.[28]

Doyle, in his reviews of the literature on the subject of intensive scheduling, revealed that intensive courses are virtually always marked by faculty and student enthusiasm.[29,30] Doyle reported that:

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[26] Ibid.

[27] Doyle and Yantis, p. B-238.

[28] Hefferlin, p. 96.

[29] Doyle and Yantis, p. B-233.

[30] Doyle, Moursi, and Wood, p. 2.

> Students enrolled in intensive courses have reported that the rapport between students and instructors was superb, that student morale and effort were enhanced, that closer personal relationships developed between faculty and students (and among students), and that intensive scheduling was apparently more conducive to friendly relations with the teachers.[31]

These findings were corroborated by a more recent study conducted by Doyle, Moursi, and Wood, in which they reported the results of an end-of-course attitudinal questionnaire which revealed that there were no "statistical differences" between students in the extensive format and those in the traditional format with respect to their attitudes toward and perceptions about the course.[32]

Evaluation Measures Used in the Evaluation of Training Programs

Both the survey questionnaire and the achievement test have been widely used as a means of collecting necessary data to evaluate training programs.[33,34,35,36]

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[31] Doyle and Yantis, p. B-233.

[32] Doyle, Moursi, and Wood, p. 2.

[33] Kent J. Chabotar and Lawrence J. Lad, Evaluative Guidelines for Training Programs (East Lansing: Public Administration Programs, Department of Political Science, Michigan State University, 1974), pp. 106-24.

[34] Alexander I. Law and William H. Bronson, Program Evaluators Guide (The Evaluation Improvement Program, California State Department of Education, 1977), pp. D-21-D-43.

[35] Gay MacGregor and Arthur St. George, Evaluation of State and Local Programs: A Primer (New Mexico State Planning Office, 1976), p. 92.

[36] Donald L. Kirkpatrick, "Techniques for Evaluating Training Programs," Training and Development Journal (June 1979): 78-92.

As indicated by Good and Scates:

> The questionnaire is a major instrument for data gathering in descriptive survey studies and is used to secure information from varied and widely scattered sources. The questionnaire is particularly useful when one cannot really see personally all of the people from whom he desires responses or where there is no particular reason to see the respondent personally.[37]

In a study to develop and validate an effective method of obtaining post-formal-training feedback information suitable for use throughout the Navy training system, Dyer found that questionnaires provided the most cost-effective means of obtaining the needed information. He also concluded that the questionnaire provided data that were nearly identical to the data obtained from the personal interview method.[38]

Stone concluded that questionnaires are probably the most frequently used data-gathering device in terms of behavioral research in organizations.[39] One need not justify the use of questionnaires any further, for evaluators have frequently used questionnaires to assess opinions or attitudes of participants in numerous training programs and have found the data collected from these questionnaires to be valid and reliable.[40,41]

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[37] Carter Good and Douglass Scates, Methods of Research (New York: Appleton-Century-Crofts, Inc., 1954), p. 606.

[38] Frederick N. Dyer and others, A Method for Obtaining Post Formal Training Feedback: Development and Validation (Bethesda, Md.: ERIC Document Reproduction Service, ED 110 032, 1975), p. 59.

[39] Eugene Stone, Research Methods in Organizational Behavior (Santa Monica, California: Goodyear Publishing Co., Inc., 1978), p. 61.

[40] Law and Bronson, p. D-27.

[41] Kirkpatrick, p. 81.

In justification of the use of the achievement test as an evaluation measure, Chabotar and Lad stated that:

> Tests are widely used by educational institutions, government agencies, and business organizations to assess the talents of their members. Performance and achievement tests are essentially means of sampling what trainees know or can do; they can locate areas in which more information or skill training is needed or can certify when sufficient information or skill has been acquired through training.[42]

Kirkpatrick concluded that the paper-and-pencil test can be used effectively in measuring the learning that takes place in a training program. A comparison of "before" and "after" scores and responses can be made to indicate how much learning has taken place.[43]

Law and Bronson reported that criterion-referenced tests have gained in popularity until today they provide the program evaluator with an alternative to the more traditional norm-referenced tests.[44]

Kerlinger reported:

> Actually, the idea [criterion-referenced tests] appears to be an old one with a new slant. It springs basically from the notion of mastery by the individual of defined instructional goals and the absolute interpretation of test scores. The emphasis is on what is learned by the individual learner, on the criterion of learning set by teacher and pupil, on the goal of instruction.[45]

Some advocates of criterion-referenced tests said there is little need for the traditional norm-referenced test in program

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[42]Chabotar and Lad, p. 120.

[43]Kirkpatrick, p. 85.

[44]Law and Bronson, p. D-21.

[45]Fred M. Kerlinger, Foundations of Behavioral Research (New York: Holt, Rinehart and Winston, 1973), p. 512.

evaluation--that criterion-referenced tests are the only appropriate achievement tests to use.[46]

Chabotar and Lad concluded that:

> In those local training courses where standardized tests are inappropriate for reasons of content or difficulty, the training officer can develop his own custom-made test. A custom-made test can be tailored to fit the course and goal being evaluated; its reliability can be pre-tested on a sample population; its administrative and interpretive procedures will not exceed local capabilities; and local norms or criteria can be derived.[47]

Kirkpatrick also reported that it is an acceptable and widely used practice for the training person to construct his own test to measure learning that takes place in a training program.[48]

<u>Self-Report Studies</u>

This section presents research as it is related to use of self-report surveys as a viable tool in program evaluation.

Much research has been conducted relating to the use of self-report accident surveys as a potential criterion for driver education program evaluation. Whittenburg used self-reporting surveys to evaluate a driver improvement program developed for the United States Coast Guard. Mail questionnaires were used to ascertain accident involvement of the respondents. The returned questionnaires were compared against official driving records and demonstrated substantial agreement. The questionnaire indicated more accident involvement than the official

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[46] Law and Bronson, p. D-22.

[47] Chabotar and Lad, p. 121.

[48] Kirkpatrick, p. 86.

records. Whittenburg concluded that a self-reporting accident survey can provide reliable information for purposes of curriculum evaluation.[49]

Quensel used a student survey questionnaire for evaluation purposes as part of a curriculum development project in Illinois. A three-step verification process was initiated to determine if student responses represented a true record of their driving and collision experiences. The three steps included (1) a visual inspection of the questionnaires returned, (2) personal interviews with students, and (3) comparison of the number of collisions with official driver records files. Quensel found that students tended to report more collisions than the state records could verify and that students did provide accurate information. He concluded that the self-reporting survey technique may be used as a tool for measuring whether or not one driver education program is more effective than another.[50]

Studies conducted by Smith and Witherill have also supported the use of self-reporting surveys as a viable means of obtaining pertinent information that is necessary for program evaluation.[51,52]

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[49] J. A. Whittenburg et al., Driver Improvement Training and Evaluation, Final report PB 234-078 (Springfield, Va.: National Technical Information Service, June 1974).

[50] W. P. Quensel, "How to Measure Program Effectiveness," Journal of Traffic Safety Education (April 1976): 6-7.

[51] D. I. Smith, "Official Driving Records and Self-Reports as Sources of Accident and Conviction Data for Research Purposes," Accident Analysis and Prevention 8 (1976): 207-11.

[52] Jerome W. Witherill, "The Feasibility of Using Selected Student Data Bases for the Assessment and Evaluation of Driver Education Programs in the State of Minnesota" (Ph.D. dissertation, Michigan State University, 1973).

Dyer, who conducted a study evaluating the use of questionnaires and face-to-face interviews, concluded that data received from self-reporting questionnaires were almost identical to the data obtained from more expensive face-to-face interviews.[53]

In a study to determine the extent to which students accurately reported their last year-end or semester-end high school grades when writing the Student Descriptive Questionnaire, Armstrong and Jensen concluded that students did report their grades within an acceptable margin of error.[54]

Walsh, in studies of self-reported grades by college students, reported that students generally provided accurate grades. In his studies Walsh compared three techniques of data collection (personal interview, questionnaire, and personal data blank) and concluded that valid information can be obtained using all three methods.[55,56,57]

Summary

From the information presented above, it can be concluded that both the survey questionnaire and the achievement test have been widely

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[53] Dyer, p. 8.

[54] Robert J. Armstrong and John A. Jensen, The Accuracy of Student-Reported Grades on the ATP Student Descriptive Questionnaire (The College Entrance Examination Board, January 1975), p. 1.

[55] W. B. Walsh, "Validity of Self-Report," Journal of Counseling Psychology 14 (1967): 18-23.

[56] W. B. Walsh, "Validity of Self-Report: Another Look," Journal of Counseling Psychology 15 (1968): 180-86.

[57] W. B. Walsh, "Self-Report Under Socially Undesirable and Distorted Conditions," Journal of Counseling Psychology 16 (1969): 569-74.

used and are accepted means of collecting necessary data to evaluate training programs. Also, it can be concluded that self-reporting surveys represent one viable way of obtaining accurate information that is necessary for program evaluation and program improvement.

These studies will be used as a source of reference for the evaluation of the intensive cognitive changes as the result of the traffic accident investigation course, AI-1.

A detailed description of the course of study as well as the techniques used in evaluating this course of study is presented in Chapter III.

CHAPTER III

RESEARCH METHODOLOGY

The purpose of this study was to evaluate the effectiveness of selected traffic accident investigation course formats offered by the Michigan State University Highway Traffic Safety Center. The subject matter presented in this course was developed by the Michigan State University Highway Traffic Safety Center staff.

In this chapter the content, the instructional methods, the location, and the class schedules of the traffic accident investigation courses are discussed. The selection of the sample of students in the study and the testing method are explained, along with the methods used in tabulating and analyzing the data.

Testable Hypotheses

Five research hypotheses were developed to examine the effectiveness of the courses and any differences among the formats. The hypotheses examined in this study were:

Hypothesis 1: Students will not show significant gain scores, as calculated by pre-test and post-test scores, after the completion of the five traffic accident investigation courses.

$$H_0: \mu_2 - \mu_1 \leq 0$$

$$H_1: \mu_2 - \mu_1 > 0$$

Where: μ_1 = pre-test scores
μ_2 = post-test scores

Hypothesis 2: Student entry-level knowledge of traffic accident investigation, as reflected by mean scores on a pre-test, will not vary among the five groups receiving traffic accident investigation instruction.

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$$

$$H_1: \mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq \mu_5$$

Where μ_1, μ_2, etc. represent the pre-test scores of the groups.

Hypothesis 3: Student entry-level backgrounds, as reflected by variables on the student background questionnaire, will not show a significant relationship with post-test scores.

$$H_0: \rho_1 = \rho_2 = \rho_3$$

$$H_1: \rho_1 \neq \rho_2 \neq \rho_3$$

Where ρ_1, ρ_2, ρ_3 represent the frequencies within the three post-test score categories. (Refer to Appendix G.)

Hypothesis 4: Student achievement levels, as reflected by mean scores on the post-test, will not vary among groups receiving three different formats of instruction.

$$H_0: \mu_1 = \mu_2 = \mu_3$$

$$H_1: \mu_1 \neq \mu_2 \neq \mu_3$$

Where μ_1, μ_2, μ_3 represent post-test scores of three different formats.

Hypothesis 5: Student evaluations, as reflected by responses on the student course evaluation questionnaire, will not vary among groups receiving three different formats of instruction.

$$H_0: \mu_1 = \mu_2 = \mu_3$$

$$H_1: \mu_1 \neq \mu_2 \neq \mu_3$$

Where μ_1, μ_2, μ_3 represent student course evaluation scores of three different formats.

Content of Traffic Accident Investigation Courses

The traffic accident investigation course (AI-1) was divided into six main subject areas. The curriculum outline was as follows:

1. Roadway Evaluation
   a. final position
   b. tire marks
   c. metal scars
   d. debris
   e. fixed objects
   f. falls, flips, and vaults
2. Vehicle Evaluation
   a. types of vehicle damage
   b. thrust and collapse
   c. ground contact
   d. recording damage to vehicle
3. Measuring and Recording
   a. measuring
   b. sketching
   c. photography
4. Speed Determination
   a. symbols and abbreviations
   b. speed and velocity
   c. determining drag factor
   d. determining speed to slide to a stop
   e. determining speed to sideslip
5. Legal
   a. duties required by statute
   b. authority to gather accident information
   c. enforcement authority at accident scenes
6. Elements of Traffic Accidents
   a. multiple causation theory
   b. elements of traffic accidents

Instructional Methods

The traffic accident investigation course was a 35-hour training course designed to prepare the in-service police officer to conduct comprehensive on-scene traffic accident investigations. Emphasis was placed upon (1) recognizing all pertinent physical evidence about the accident vehicles and scene; (2) collecting and/or recording this information in the form of photographs, sketches, and measurements; and (3) calculating certain pre-collision speeds of accident-involved vehicles. Five traffic accident investigation courses were analyzed in this study, which were identical in all aspects with the exception of the format in which they were presented. Three different instructional formats of presenting the material were used, and they are described as follows:

1. Instruction was presented seven hours per day for five consecutive days (the one-week format).
2. Instruction was presented seven hours per day for one day the first week, and seven hours per day for two days a week for two successive weeks (the three-week format).
3. Instruction was presented seven hours per day for one day a week for five successive weeks (the five-week format).

The same instructors presented the material, assuring consistency in methods and delivery of instructional programs. All evaluation instruments were administered to the students by the writer.

Location of Courses

Five different locations throughout the state of Michigan were selected for presentation of the traffic accident investigation training courses. These locations were representative of the state in terms of geography, economic conditions, and population composition (Appendix A). The courses were presented at:

1. Jackson Community College, Jackson, Michigan;
2. Muskegon Community College, Muskegon, Michigan;
3. Madonna College, Detroit, Michigan;
4. Lake Superior State College, Sault Ste. Marie, Michigan; and
5. Lake Michigan Community College, Benton Harbor, Michigan.

Students attending these five locations were designated as the JCC class, the MCC class, the Madonna class, the Soo class, and the LMCC class.

The students at the schools in Muskegon (MCC), Madonna, and the Soo received the one-week format of instruction, Jackson (JCC) students the five-week format of instruction, and Lake Michigan Community College (LMCC) students the three-week format.

Selection of Sample

The traffic accident investigation program was open to all law enforcement officers who were engaged in handling motor vehicle traffic accident investigations or other police-traffic-related services. Subjects selected for testing in this study were all law enforcement officers who attended the traffic accident investigation courses offered at the above-listed locations in the summer and fall of 1979.

The sample consisted of practitioners from municipal, township, county, and public safety agencies ranging in size from one-man police departments to those of five thousand men. The practitioners were assigned to the particular schools by their respective agencies; consequently, it was not possible to make random assignments to the various schools.

Twenty-two persons registered for the course at the Soo, 28 at Madonna, 22 at Muskegon, 24 at Jackson, and 18 at Lake Michigan Community College.

The Procedure

At the first session, after registrations and introductions were completed, each student completed a pre-test. They were instructed to answer all questions on the test, guessing whenever necessary. The pre-test was administered to test the students' entry-level knowledge about traffic accident investigation and to provide data needed to determine if there were differences in knowledge among students in each of the treatment groups.

Upon completion of the pre-test, each student was asked to complete a questionnaire containing questions related to his/her education and experiential background. The background questionnaire was administered to provide data needed to determine whether a significant relationship existed between a particular background variable and post-test score.

At the end of the fifth (and last) session, a post-test was given to each student covering the content of the course. The post-test was administered to obtain data from which to determine if there were differences in post-test scores among the treatment groups.

Upon completion of the post-test, each student was asked to complete a course evaluation questionnaire. This questionnaire was administered to provide data needed to determine if there were differences in students' evaluation of the course among each of the treatment groups and to determine student reactions to the course.

Four months after the completion of the school, each student was requested to fill out a follow-up questionnaire, which was mailed by first-class mail to his/her home address. Included with the questionnaire was a self-addressed, stamped, first-class-mail return envelope. The follow-up questionnaire was administered to determine if the students were utilizing the knowledge they received and if their overall performance in traffic accident investigation had been increased. Those respondents who did not return the completed survey forms within three weeks of the initial mailing date received a follow-up letter requesting the prompt return of the survey form.

Test Development

Objectives to Be Measured

The Traffic Accident Investigation Course AI-1 was divided into six main subject-matter areas. The subject-matter areas and the instructional objectives for that area tested are listed below:

1. Roadway Evaluation
   - Recognize and record all information from the roadway that will explain how the accident took place.

- Recognize and record the final (after-accident) positions of vehicles and bodies to enable pre-accident speed, position, and path-of-travel determinations to be made.
- Recognize and record all tiremarks to determine (1) pre-collision speed, (2) direction of travel, (3) beginning of evasive action (braking), and (4) relationship of tiremarks to vehicle.
- Recognize, record, and classify roadway metal scars to determine pre-accident vehicle position and path of travel.
- Recognize and record debris at accident scenes to help in reconstructing the accident.
- Recognize and record information about fixed objects to help determine the accident vehicles' (1) speed, (2) position, and (3) path of travel.
- Recognize and record flip, fall, and vault data so that pre-flip, fall, and vault speed determinations may be made.

2. Vehicle Evaluation
   - At an accident scene, recognize, classify, and record vehicle damage information that will help explain how the accident took place.
   - Recognize and record the degree of collapse on accident-damaged vehicles so that the direction of thrust and rotation of the vehicles can be determined.
   - Recognize and record accident-related marks on the roadway, matching them with the vehicle causing the marks so that the accident can be reconstructed.

3. Measuring and Recording

   - Make on-scene measurements so precise and complete that the accident scene and results can be accurately reconstructed.
   - Prepare a field sketch of an accident scene accurate and complete enough to permit someone else to use the sketch (and related measurements) to prepare a comprehensive scale diagram.
   - Take accident scene photographs that are (1) accurate representations of circumstances at the scene, (2) useful in accident reconstruction, and (3) admissible in court.

4. Speed Determination

   - Be able to use the appropriate nomographs and formulae to determine vehicle speeds pertinent to accident investigations.

5. Legal

   - Recognize, collect, preserve, and use data from accident investigations in the enforcement process.

6. Elements of Traffic Accidents

   - Recognize that there is no single cause of accidents and identify the many contributive factors that come into play to cause accidents.
   - Recognize and record the elements or events that make up a typical motor vehicle traffic accident.

For the purpose of test analysis, subject five (legal) and subject six (elements of traffic accidents) were combined into one subject area. This was done because of the small number of test items in each of these subject areas. The combination resulted in a content area of 12 items in the pre-test and, similarly, 12 items in the post-test.

Item Development

The first step used by the writer in developing test items was to prepare an item bank of questions that measured an adequate sample of the learning outcomes and subject-matter content included in the instruction. This was done by constructing 216 test items that measured the instructional objectives. Three types of questions were constructed. Two of the types consisted of true-false and multiple-choice items. The third type utilized 35 mm slide photographs of basic accident investigation situations. These were shown to the students, who were then asked to diagnose and classify the items so displayed. This type of question is referred to as mediated testing. Four basic resources were used in the development of the test bank. These were the:

1. Michigan State University Highway Traffic Safety Center's "AI-1" course pre-post test;
2. Northwestern University Traffic Institute's "On Scene Accident Investigation Course" pre-post test;
3. J. Stannard Baker text: Traffic Accident Investigation Manual; and
4. Ferris State College traffic accident investigation course test bank.

The instructional objectives and test items contained in each subject area were reviewed by a panel of judges for the purpose of assuring that the test questions actually measured the objectives stated in the subject areas (content validity). The panel consisted of three traffic accident investigation experts, a testing specialist, a statistician, and a professor of English. Members of the panel were:

1. Lt. Bobbie Oaks, Traffic Expert, Michigan State Police.
2. Lt. Paul Rogers, Traffic Expert, Eaton County Sheriff Department.
3. Capt. Joseph Jager, Traffic Expert, Eaton County Sheriff Department.
4. Dr. James D. Maas, Professor of Statistics, Data Processing Department, Ferris State College.
5. Mr. Manfred E. Swartz, Coordinator of Testing, Ferris State College.
6. Dr. Donald K. Hanzek, Professor of English, Ferris State College.

Item Tryouts

The next step after the test bank construction and evaluation by a panel of experts was to assign matched questions to the pre-test and post-test. Items were paired by similarity of content and then alternately assigned to test one and test two, later to become the pre-test and post-test. The two parallel tests were constructed, each containing 108 questions. Test one consisted of 15 mediated, 28 multiple-choice, and 65 true-false items. Test two consisted of 15 mediated, 36 multiple-choice, and 57 true-false items. At this time the parallel tests were administered to a group of Ferris State College students. The 71 students who took the test were all juniors in the

Criminal Justice Program at Ferris State College in Big Rapids, Michigan. The students came from all parts of the state of Michigan, with the majority having earned Associate Degrees in Law Enforcement or Criminal Justice programs from community colleges throughout the state. The majority of the students tested had not received instruction in traffic investigation. Six students stated that they had received training in traffic accident investigation. Test one was administered on April 9, 1979, and test two was administered one week later, on April 16, 1979. The tests were administered in a classroom environment at Ferris State College. The students were told that they were being tested in order to determine their entry-level knowledge about traffic accident investigation for a course in traffic accident investigation they would be taking in their senior year. This particular group was chosen to pilot test test one and test two because they had all received instruction in some aspects of law enforcement but had not, as yet, received any traffic accident investigation instruction. The mean test one score for the pilot test group was 63.7, and the mean test two score was 63.9. Since the mean scores were almost identical, it was decided to use test one as the basis for developing the pretest and test two as the basis for developing the post-test.

Item Selection and Revision

An item analysis was performed for both test one and test two taken by the pilot test group of students. The Ferris State College statistical test analysis package was used to analyze the data on the IBM 370-145 computer. All test items with an index of difficulty over .80 and an index of discrimination under .20 were analyzed. Ninety-four items were subsequently revised. This was done by analyzing the answer selections and then making revisions. Also, an attempt was made to maintain the content balance, difficulty of discrimination on the revision of items between pre- and post-test. Thirty-four items were deleted when it was determined they were not discriminatory in nature.

The final pre- and post-tests, after the item revision, consisted of 95 questions each. The pre-test consisted of 15 mediated, 26 multiple-choice, and 54 true-false items. The post-test consisted of 15 mediated, 34 multiple-choice, and 46 true-false items. A copy of both the pre- and post-tests can be found in Appendix D.

Test Administration

The pre-test was administered at the following dates and locations:

1. May 1, 1979 — Jackson Community College
2. June 11, 1979 — Muskegon Community College
3. August 6, 1979 — Madonna College
4. September 24, 1979 — Lake Superior College
5. December 3, 1979 — Lake Michigan Community College

The writer served as the examiner.

The post-test was administered by the writer at the following dates and locations:

1. May 29, 1979 — Jackson Community College
2. June 15, 1979 — Muskegon Community College

3. August 10, 1979 Madonna College
4. September 28, 1979 Lake Superior College
5. December 18, 1979 Lake Michigan Community College

All students answered questions on IBM 1230 answer sheets. All scoring was done by IBM equipment at the Ferris State College Testing Center.

Test Analysis

An item analysis was performed on the results of the pre-test and post-test. Reliability coefficients were computed and a chi-square goodness-of-fit test was performed to test the score distributions for normality. Further analysis was performed on each content area within the test. Item difficulty (proportion answering correctly), item discrimination (point-biserial correlation), and various indices of reliability are shown in Tables 3.1 through 3.11.

Since the subtests were relatively short, 12 to 29 items, additional information about test reliability was developed. Ebel stated that the coefficient of reliability of a set of test scores is related to the number of test items on the test. Typically, the reliability coefficient will be greater for scores from a longer test than from a shorter test.[58] Consequently, reliability coefficients for expanded subtests were computed using the Spearman-Brown formula. Reliability coefficients are reported in Tables 3.2 through 3.11 for subtests of double and triple length.

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[58]Robert L. Ebel, Essentials of Educational Measurement (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972), p. 427.

As reported in Table 3.1, the KR-20 reliability formula revealed a coefficient of .67 for the pre-test and .65 for the post-test. The odd-even correlation coefficient was .44 for the pre-test and .53 for the post-test. When the latter was corrected to the original length test, the coefficient became .61 for the pre-test and .69 for the post-test. Using the Spearman-Brown formula to predict coefficients for pre-tests and post-tests of double and triple lengths, the reliabilities were increased to .76 and .82, respectively, for the pre-test and .82 and .87, respectively, for the post-test.

Table 3.1.--Reliability coefficients for the pre-test and post-test.

	Mean	S.D.	KR-20	Odd-Even	Corrected Odd-Even	Spearman-Brown Double Length	Spearman-Brown Triple Length
Pre-test	54.93	7.47	.67	.44	.61	.76	.82
Post-test	79.50	5.60	.65	.53	.69	.82	.87

The Chi-square goodness-of-fit test for the pre-test (χ^2 = 11.36, df = 9, $p > .05$) and the post-test (χ^2 = 2.60, df = 5, $p > .05$) revealed that the score distribution for both tests was a normal distribution.

Pre-Test Content Analysis

The content of section one of the pre-test centered on Roadway Evaluation. The 29 items dealt with the learning outcomes and subject-matter content of the seven instructional objectives listed in the

Roadway Evaluation unit. Nine items were mediated, 5 were multiple choice, and 15 were true-false. As shown in Table 3.2, the average difficulty level was .56. Two of the 29 items were answered correctly by more than .90 (or 90%) of the students. Ten items had point-biserial correlations with the subtest scores of .30 or greater. In most cases, 25 of 29, the correlations with the subtest scores were higher than correlations with the total test scores, which is an indicator of internal test validity. The KR-20 reliability formula revealed a coefficient of .34, while the odd-even correlation coefficient was .25. When the latter was corrected to the original length test, the coefficient became .40. Using the Spearman-Brown formula to predict coefficients for subtests of double and triple length, the reliabilities were increased to .57 and .66, respectively. The Chi-square goodness-of-fit test ($\chi^2 = 5.46$, df = 6, $p > .05$) revealed that the score distribution for this section was a normal distribution.

The content of section two of the pre-test centered on Vehicle Evaluation. The 14 items dealt with the learning outcomes and subject-matter content of the three instructional objectives listed in the Vehicle Evaluation unit. Four items were mediated, two were multiple choice, and eight were true-false. As shown in Table 3.3, the average difficulty level was .68. Two of the 14 items were answered correctly by more than .90 (or 90%) of the students. Seven items had point-biserial correlations with the subtest scores of .30 or greater. In all cases, the correlations with the subtest score were higher than correlations with the total test score. The KR-20 reliability formula revealed a coefficient of .15, while the odd-even correlation coefficient

Table 3.2.--Pre-test content analysis for the 29 Roadway Evaluation unit questions.

	Pre-Test Question Numbers														
	1	3	5	7	8	9	10	13	14	16	17	19	20	41	42
Proportion right answer	.77	.47	.61	.54	.38	.65	.67	.66	.12	.91	.04	.61	.42	.48	.54
Correlation with subtest score	.28	.19	.12	.35	.36	.31	.31	.15	-.05	.07	.11	.20	.29	.40	.32
Correlation with total score	.12	.03	.02	.28	.22	.16	.25	-.09	-.10	-.13	.01	.11	.14	.34	-.06

	Pre-Test Question Numbers													
	43	44	45	46	47	48	49	50	51	52	53	54	55	56
Proportion right answer	.37	.14	.85	.94	.65	.74	.73	.69	.04	.64	.69	.23	.86	.75
Correlation with subtest score	.30	.25	.22	.16	.36	.15	.06	.31	-.08	.04	.24	.24	.32	.26
Correlation with test score	.08	.17	.36	.20	.31	.14	.02	.20	-.08	.08	.18	.21	.26	.24

Subtest Reliability

KR-20 = .337

Odd-Even = .248

Corrected Odd-Even = .397

Spearman-Brown Predicted Reliability

Doubled Length: r = .569

Tripled Length: r = .664

Average Difficulty Level

.56

Table 3.3.--Pre-test content analysis for the 14 Vehicle Evaluation unit questions.

	Pre-Test Question Numbers													
	4	11	12	15	21	22	57	58	59	60	61	62	63	64
Proportion right answer	.76	.48	.46	.50	.62	.81	.34	.76	.93	.64	.54	.89	.85	.94
Correlation with subtest score	.28	.26	.39	.24	.41	.33	.32	.30	.15	.35	.24	.12	.29	.33
Correlation with total score	.14	.06	.12	.19	.11	.13	.29	.18	.06	.26	.07	.10	.13	.15

Subtest Reliability

KR-20 = .153

Odd-Even = -.026

Corrected Odd-Even = -.053

Spearman-Brown Predicted Reliability

Doubled Length	Tripled Length
(not computed)	(not computed)

Average Difficulty Level

.68

was -.03. When the latter was corrected to the original length test, the coefficient became -.05. Since the odd-even correlation was negative, the Spearman-Brown formula was not applied. The negative coefficients emphasize the magnitude of guessing on the pre-test. The Chi-square goodness-of-fit test ($\chi^2 = 8.91$, df = 4, $p > .05$) revealed that the score distribution for this section was a normal distribution.

The content of section three of the pre-test centered on Measuring and Recording. The 20 items dealt with the learning outcomes and subject-matter content of the three instructional objectives listed in the Measuring and Recording unit. Two items were mediated, 8 were multiple choice, and 10 were true-false. As shown in Table 3.4, the average difficulty level was .59. No item was answered correctly by more than .90 (or 90%) of the students. Seven items had point-biserial correlations with the subtest scores of .30 or greater. In most cases, 19 of 20, the correlations with the subtest score were higher than correlations with the total test score. The KR-20 reliability formula revealed a coefficient of .31, while the odd-even correlation coefficient was .15. When the latter was corrected to the original length test, the coefficient became .26. Using the Spearman-Brown formula to predict coefficients for subtests of double and triple length, the reliabilities were increased to .41 and .51, respectively. The Chi-square goodness-of-fit test ($\chi^2 = 5.68$, df = 5, $p > .05$) revealed that the score distribution for this section was a normal distribution.

The content of section four of the pre-test centered on Speed Determination. The 20 items dealt with the learning outcomes and

Table 3.4.--Pre-test content analysis for the 20 Measuring and Recording unit questions.

	Pre-Test Question Numbers																			
	2	6	18	23	24	25	26	27	28	29	65	66	67	68	69	70	71	72	73	74
Proportion right answer	.42	.46	.40	.61	.51	.44	.77	.35	.64	.88	.66	.66	.88	.43	.61	.82	.47	.32	.89	.65
Correlation with subtest score	.24	.31	.29	.18	.26	.20	.35	.24	.21	.33	.36	.23	.04	.22	.46	.21	.40	.26	.11	.34
Correlation with total score	.12	.14	.19	.13	.14	.14	.21	.16	.08	.28	.12	.16	.08	.28	.37	.13	.34	.23	-.08	.20

Subtest Reliability	Spearman-Brown Predicted Reliability		Average Difficulty Level
	Doubled Length	Tripled Length	.59
KR-20 = .305	r = .410	r = .510	
Odd-Even = .148			
Corrected Odd-Even = .258			

and subject-matter content of the instructional objectives listed in the Speed Determination unit. Eight items were multiple choice, and 12 were true-false. As shown in Table 3.5, the average difficulty level was .50. None of the 20 items was answered correctly by more than .90 (or 90%) of the students. Eleven items had point-biserial correlations with the subtest scores of .30 or greater. In most cases, 17 of 20, the correlations with the subtest score were higher than correlations with the total test score. The KR-20 reliability formula revealed a coefficient of .54, while the odd-even correlation coefficient was .34. When the latter was corrected to the original length test, the coefficient became .50. Using the Spearman-Brown formula to predict coefficients for subtests of double and triple length, the reliabilities were increased to .67 and .75, respectively. The Chi-square goodness-of-fit test ($\chi^2 = 3.94$, df = 6, $p > .05$) revealed that the score distribution for this section was a normal distribution.

The content of section five of the pre-test centered on Legal Aspects and Elements of Traffic Accidents. The 12 items dealt with the learning outcomes and subject-matter content of the three instructional objectives listed in the Legal Aspects and Elements of Traffic Accidents unit. Three items were multiple choice and nine true-false. As shown in Table 3.6, the average difficulty level was .62. One of the 12 items was answered correctly by more than .90 (90%) of the students. Ten items had correlations with the subtest scores of .30 or greater. In all cases, 12 of 12, the correlations with the subtest score were higher than correlations with the total test score. The KR-20 reliability formula revealed a coefficient of .36, while the

Table 3.5.--Pre-test content analysis for the 20 Speed Determination unit questions.

	Pre-Test Question Number																			
	30	31	32	33	34	35	36	37	75	76	77	78	79	80	81	82	83	84	85	86
Proportion right answer	.67	.33	.27	.40	.46	.16	.31	.32	.60	.82	.67	.54	.63	.78	.14	.62	.39	.46	.68	.74
Correlation with subtest score	.57	.46	.36	.37	.34	.20	.14	.31	.50	.30	.18	.24	.28	.42	.11	.22	.24	.39	.45	.23
Correlation with total score	.46	.32	.25	.28	.18	.11	.16	.30	.36	.23	.14	.24	.22	.40	.10	.17	.12	.19	.34	.27

Subtest Reliability

KR-20 = .535

Odd-Even = .337

Corrected Odd-Even = .504

Spearman-Brown Predicted Reliability

Doubled Length: r = .671

Tripled Length: r = .753

Average Difficulty Level

.50

Table 3.6.--Pre-test content analysis for the 12 Legal Aspects and Elements of Traffic Accidents unit questions.

	Pre-Test Question Number											
	38	39	40	87	88	89	90	91	92	93	94	95
Proportion right answer	.75	.50	.41	.96	.40	.38	.29	.89	.70	.66	.68	.78
Correlation with subtest score	.36	.31	.34	.16	.42	.40	.13	.34	.39	.30	.49	.58
Correlation with total score	.35	.14	.25	.02	.26	.21	.01	.09	.31	.14	.21	.47

Subtest Reliability	Spearman-Brown Predicted Reliability		Average Difficulty Level
	Doubled Length	Tripled Length	
KR-20 = .361	4 = .317	r = .411	.62
Odd-Even = .104			
Corrected Odd-Even = .188			

odd-even correlation coefficient was .10. When the latter was corrected to the original length test, the coefficient became .19. Using the Spearman-Brown formula to predict coefficients for subtests of double and triple length, the reliabilities were increased to .32 and .41, respectively. The Chi-square goodness-of-fit test ($\chi^2 = 7.23$, df = 4, $p > .05$) revealed that the score distribution for this section was a normal distribution.

Post-Test Content Analysis

The content of section one of the post-test centered on Roadway Evaluation. The 29 items dealt with the learning outcomes and subject-matter content of the seven instructional objectives listed in the Roadway Evaluation unit. Nine items were mediated, 5 multiple-choice, and 15 true-false. As shown in Table 3.7, the average difficulty level was .80. Eleven of the 29 items were answered correctly by more than .90 (or 90%) of the students. Twelve items had point-biserial correlations with the subtest scores of .30 or greater. In most cases, 17 or 29, the correlations with the subtest score were higher than correlations with the total test score. The KR-20 reliability formula revealed a coefficient of .39, while the odd-even correlation coefficient was .38. When the latter was corrected to the original length test, the coefficient became .55. Using the Spearman-Brown formula to predict coefficients for subtests of double and triple length, the reliabilities were increased to .71 and .78, respectively. The Chi-square goodness-of-fit test ($\chi^2 = 9.14$, df = 5, $p > .05$) revealed that the score distribution for this section was a normal distribution.

Table 3.7.--Post-test content analysis for the 29 Roadway Evaluation unit questions.

	Post-Test Question Numbers														
	1	3	5	7	8	9	10	13	14	16	17	18	19	20	50
Proportion right answer	.88	.97	.71	.82	.62	.93	.91	.93	.93	.79	.76	.75	.81	.81	.21
Correlation with subtest score	.30	.06	-.02	.25	.43	.10	.10	.24	.06	.32	.41	.22	.41	.34	.27
Correlation with total score	.19	.07	.00	.07	.25	.01	.07	.31	.16	.17	.41	.10	.38	.26	.15

	Post-Test Question Numbers													
	51	52	53	54	55	56	57	58	59	60	61	62	63	93
Proportion right answer	.92	.89	.77	.98	.96	.96	.95	.70	.63	.58	.42	.74	.87	.96
Correlation with subtest score	.34	.40	.05	.17	.09	.17	.30	.32	.22	.34	.49	.15	.00	.03
Correlation with total score	.34	.39	.07	.18	.01	.10	.25	.23	.08	.28	.35	.04	.03	.07

Subtest Reliability

KR-20 = .388

Odd-Even = .375

Corrected Odd-Even = .545

Spearman-Brown Predicted Reliability

Doubled Length: r = .706

Tripled Length: r = .783

Average Difficulty Level

.80

The content of section two of the post-test centered on Vehicle Evaluation. The 14 items dealt with the learning outcomes and subject-matter content of the three instructional objectives listed in the Venicle Evaluation unit. Four items were mediated, four were multiple choice, and six were true-false. As shown in Table 3.8, the average difficulty level was .88. Eight of the 14 items were answered correctly by more than .90 (or 90%) of the students. Five items had point-biserial correlations with the subtest scores of .30 or greater. In most cases, 13 of 14, the correlations with the subtest score were higher than correlations with the total test scores. The KR-20 reliability formula revealed a coefficient of .15, while the odd-even correlation coefficient was .05. When the latter was corrected to the original length test, the coefficient became .10. Using the Spearman-Brown formula to predict coefficients for subtests of double and triple length, the reliabilities were increased to .19 and .26, respectively. The Chi-square goodness-of-fit test ($\chi^2 = 24.78$, df = 5, $p > .01$) revealed that the score distribution for this section was not a normal distribution. The lack of normality may have been the result of student mastery of the test content.

The content of section three of the post-test centered on Measuring and Recording. The 20 items dealt with the learning outcomes and subject-matter content of the three instructional objectives listed in the Measuring and Recording unit. Two items were mediated, 10 were multiple choice, and 8 were true-false. As shown in Table 3.9, the average difficulty level was .86. Eight of the 20 items were answered correctly by more than .90 (or 90%) of the students. Nine items had

Table 3.8.--Post-test content analysis for the 14 Vehicle Evaluation unit questions.

	Post-Test Question Numbers													
	4	11	12	15	21	22	23	24	64	65	66	67	68	69
Proportion right answer	.97	.82	.93	.80	.96	.85	.98	.94	.75	.98	.82	.94	.64	.91
Correlation with subtest score	.00	.42	.28	.17	.19	.33	.14	.26	.38	.19	.50	.26	.48	.15
Correlation with total score	.03	.12	.21	-.25	-.03	.23	.01	.25	.36	.18	.42	.19	.35	-.08

Subtest Reliability

KR-20 = .148

Odd-Even = .054

Corrected Odd-Even = .102

Spearman-Brown Predicted Reliability

Doubled Length: r = .186

Tripled Length: r = .255

Average Difficulty Level

.88

Table 3.9.--Post-test content analysis for the 20 Measuring and Recording unit questions.

	Post-Test Question Numbers																			
	2	6	25	26	27	28	29	30	31	32	33	34	70	71	72	73	74	75	76	77
Proportion right answer	.83	.96	.93	.87	.87	.95	.68	.88	.80	.96	.99	.88	.86	.66	.97	1.00	.85	.98	.72	.65
Correlation with subtest score	.33	.16	.25	.40	.32	.10	.32	.24	.32	.20	-.04	.25	.37	.35	.09	.00	.20	.21	.44	.47
Correlation with total score	.27	.10	.15	.33	.27	.15	.17	.18	.30	.17	-.13	.13	.20	.27	.01	.00	.12	.23	.23	.28

Subtest Reliability

KR-20 = .365

Odd-Even = .278

Corrected Odd-Even = .435

Spearman-Brown Predicted Reliability

Doubled Length: r = .606

Tripled Length: r = .698

Average Difficulty Level

.86

point-biserial correlations with the subtest scores of .30 or greater. In most cases, 17 of 20, the correlations with the subtest score were higher than correlations with the total test score. The KR-20 reliability formula revealed a coefficient of .37, while the odd-even correlation coefficient was .28. When the latter was corrected to the original length test, the coefficient became .44. Using the Spearman-Brown formula to predict coefficients for subtests of double and triple length, the reliabilities were increased to .61 and .70, respectively. The Chi-square goodness-of-fit test ($\chi^2 = 23.75$, df = 7, $p > .01$) revealed that the score distribution for this section was not a normal distribution.

The content of section four of the post-test centered on Speed Determination. The 20 items dealt with the learning outcomes and subject-matter content of instructional objectives listed in the Speed Determination unit. Twelve items were multiple choice and eight were true-false. As shown in Table 3.10, the average difficulty level was .84. Ten of the 20 items were answered correctly by more than .90 (or 90%) of the students. Nine items had point-biserial correlations with the subtest scores of .30 or greater. In most cases, 16 of 20, the correlations with the subtest score were higher than correlations with the total test score. The KR-20 reliability formula revealed a coefficient of .45, while the odd-even correlation coefficient was .33. When the latter was corrected to the original length test, the coefficient became .50. Using the Spearman-Brown formula to predict coefficients for subtests of double and triple length, the reliabilities were increased to .66 and .75, respectively. The Chi-square

Table 3.10.--Post-test content analysis for the 20 Speed Determination unit questions.

	Post-Test Question Numbers																			
	35	36	37	38	39	40	41	42	43	44	45	46	78	79	80	81	82	83	84	85
Proportion right answer	.98	.95	.82	.64	.97	.75	.96	.99	.69	.60	.98	.65	.82	.74	.99	.87	1.00	.94	.97	.54
Correlation with subtest score	.06	.25	.18	.48	.07	.56	.35	.04	.48	.32	.16	.42	.45	.34	-.05	.24	.00	.45	.27	.26
Correlation with total score	.12	.11	.11	.33	.11	.46	.13	.01	.37	.11	.08	.41	.28	.40	-.11	.04	.00	.25	.15	.10

Subtest Reliability

KR-20 = .454

Odd-Even = .330

Corrected Odd-Even = .496

Spearman-Brown Predicted Reliability

Doubled Length: r = .663

Tripled Length: r = .747

Average Difficulty Level

.84

goodness-of-fit test (χ^2 = 24.17, df = 7, p > .01) revealed that the score distribution for this section was not a normal distribution.

The content of section five of the post-test centered on Legal Aspects and Elements of Traffic Accidents. The 12 items dealt with the learning outcomes and subject-matter content of the three instructional objectives listed in the Legal Aspects and Elements of Traffic Accidents unit. Three items were multiple choice and nine were true-false. As shown in Table 3.11, the average difficulty level was .82. Three of the 12 items were answered correctly by more than .90 (or 90%) of the students. Six items had point-biserial correlations with the subtest scores of .30 or greater. In all cases, 12 of 12, the correlations with the subtest score were higher than correlations with the total test score. The KR-20 reliability formula revealed a coefficient of .09, while the odd-even correlation coefficient was .08. When the latter was corrected to the original length test, the coefficient became .15. Using the Spearman-Brown formula to predict coefficients for subtests of double and triple length, the reliabilities were increased to .26 and .34, respectively. The Chi-square goodness-of-fit test (χ^2 = 20.36, df = 5, p > .01) revealed that the score distribution for this section was not a normal distribution.

Summary of Test Development

The purpose of developing the Traffic Accident Investigation tests was to evaluate the effectiveness of the Michigan State University Highway Traffic Safety Center's AI-1 course formats. Emphasis was placed on developing and using test items that were highly relevant to

Table 3.11.--Post-test content analysis for the 12 Legal Aspects and Elements of Traffic Accidents unit questions.

	Post-Test Question Number											
	47	48	49	86	87	88	89	90	91	92	94	95
Proportion right answer	.38	.73	.80	.97	.89	.97	.81	.89	.78	.88	.92	.82
Correlation with subtest score	.29	.51	.28	.15	.32	.15	.35	.19	.21	.38	.35	.39
Correlation with total score	.15	.26	.15	-.05	.23	-.07	.07	-.01	.03	.09	.13	.28

Subtest Reliability

KR-20 = .089

Odd-Even = .080

Corrected Odd-Even = .148

Spearman-Brown Predicted Reliability

Doubled Length: r = .258

Tripled Length: r = .343

Average Difficulty Level

.82

the objectives of instruction. The validity of item content was ascertained by the judges. Although such matters as the shape of score distributions, the indices of difficulty and discrimination, and the reliability coefficients were of secondary importance, these data were presented on each content area for both the pre-test and the post-test.

The following observations can be made:

1. The pre-test scores for the total test and each content area were normally distributed.

2. The post-test distributions of four content areas deviated from normality, showing the students' mastery of course content. One content area of five was normally distributed. However, the post-test total score distribution retained normality.

3. The reliability coefficients on the post-test were higher than the corresponding coefficients on the pre-test. The pre-test scores included a large guessing factor. The actual reliability coefficients of the post-test might be higher than those reported, since mastery of items leads to an underestimate of test reliability. Ebel stated that if a test includes many items on which the average score is near 100%, the underestimate of reliability could be quite large.[59]

The data presented support the adequacy of the tests for the purpose they served.

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[59] Ibid., p. 415.

Questionnaire Development

Student Questionnaire Forms

Before designing the questionnaires, an extensive search was conducted on the methods of instrument design and survey questionnaire development.

Three student questionnaire forms were developed for this study: the student background questionnaire, the student course evaluation questionnaire, and the student follow-up questionnaire. Each is discussed below.

Student background questionnaire.--The questionnaire was developed by revising the background information form used by the AI-1 course instructors. The student background questionnaire contained questions that related to the student's educational and experiential background. From these questions 12 variables were identified and analyzed: age of the student, type of department, size of department, years worked in law enforcement, educational level, primary assignment in department, number of fatal (K) accidents investigated in the past 12 months, number of personal injury (PI) accidents investigated in the past 12 months, number of property damage (PD) accidents investigated in the past 12 months, total hours of training in traffic accident investigation, motivation to attend school, and interest level to attend school. A copy of the student background questionnaire can be found in Appendix C.

Student course evaluation questionnaire. The student course evaluation questionnaire was developed from the publication, Student Reactions to Instruction, published by the Center for Research on

Learning and Testing, The University of Michigan.[60] The questionnaire contained 15 questions that related to the training format, instructional media, student manual, text, individual field exercises, instructors, and general observations about the course. A copy of the student course evaluation questionnaire can be found in Appendix E.

Student follow-up questionnaire. The student follow-up questionnaire was designed to determine whether the students utilized the knowledge they received and whether their overall performance in traffic accident investigation had increased. This questionnaire was developed by revising a questionnaire used by the AI-1 course instructors to pilot test the original AI-1 course. This evaluation was made by analyzing a follow-up questionnaire filled out by the students four months after they completed the course. The follow-up questionnaire was designed for the purpose of:

1. Determining the most effective training delivery format.
2. Determining if AI-1 fulfills student needs.
3. Determining how the AI-1 training is being utilized.
4. Determining officer AI performance since completion of AI-1.
5. Improving future offerings of AI-1.

A copy of the student follow-up questionnaire along with the initial introduction letter and follow-up letter can be found in Appendix F. The three questionnaires were reviewed by the testing office at Ferris State College. A number of additions and deletions

[60]The Center for Research on Training and Teaching, The University of Michigan, Student Reactions to Instruction (Ann Arbor: The University of Michigan, 1976).

were made, based on several suggestions. Following this revision, the questionnaires were administered to a group of police officers in the Big Rapids area. They officers were asked to make comments in regard to the questionnaires and to indicate whether any of the questions seemed ambiguous to them. A number of changes were made based on the officers' suggestions.

Tabulation and Analysis of Data

A computer data card was prepared for each of the 114 students attending the five traffic accident investigation courses. The following information was entered on this card for each of the students in the study:

1. Location where the student attended the course.
2. Age of student.
3. Agency employing the student.
4. Total number of sworn police personnel in student's agency.
5. Number of years student has spent in law enforcement.
6. Education level of student.
7. Primary assignment of student in agency.
8. Primary duty of student in agency.
9. Assignment of student to a traffic unit.
10. Total number of fatal, personal injury, and property damage accidents investigated by student in the last 12 months.
11. Previous training received by student in traffic accident investigation.
12. Motivational level of student to attend school.

13. Interest level of student to attend school.
14. Pre-test score.
15. Post-test score.
16. Gain score.

Computer data control cards were then punched for programs, using the BMDP statistical package, which would produce analysis of variance, analysis of covariance, Pearson Chi-squares, and t-tests on the IBM 370-145 computer at Ferris State College.

The one-way analysis of variance procedure was used to compare differences in pre-test scores among the five groups. The differences in learning, as measured by gain scores obtained from comparing pre-test to post-test, were analyzed through the use of t-tests. The Pearson Chi-square statistic was applied to determine if there were relationships between variables related to students' background and the post-test scores. The analysis of covariance procedure was used to compare differences in learning among the three different formats of instruction. Background variables that were found to be related to post-tests, along with pre-test scores, were used as the covariates.

To analyze the student evaluation questionnaire, another set of computer data cards were prepared for the initial 114 students. The responses to the 15 questions were entered on computer cards for each student. Computer data control cards were then punched for programs that would produce one-way analysis of variance and the Pearson Chi-square statistic on the IBM 370-145 computer. To determine whether there were differences in total evaluation mean scores between the three different formats of instruction, the analysis of variance procedure was used. The Pearson Chi-square statistic was used to determine if there were significant differences between the five schools on each evaluation question.

A final set of computer data cards was prepared for the 95 students who returned the follow-up questionnaire. The responses to the questionnaire were entered on computer cards for each student. Computer control cards were then punched for programs that would produce frequency tables on the IBM 370-145 computer. Frequency distributions were constructed to analyze these data.

Validity Concerns

Since subjects were not randomly assigned, selection was considered a threat to internal validity. Because of this, an analysis of covariance was used to control for initial differences such as experience, accident investigation training, age, education, motivational level, and entry-level knowledge about traffic accident investigation that were expected to cause differences in group performance.[61]

Another concern for internal validity arises from the multiple testing of the subjects. The effects of taking a pre-test may have influenced the scores of the later test. Two different but parallel tests were developed to reduce the effects of this concern.

Experimental mortality or the differential loss of respondents from comparison groups was another concern for internal validity.

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[61]William L. Hays, Statistics for the Social Services (New York: Holt, Rinehart and Winston, 1973), p. 655.

Those subjects who missed any part of the course were not used in this study.

Maturation could also be a factor affecting internal validity in this study. Specifically, the effects of forgetting instructional items could have impacted the longer (five-week) instructional program and had an effect on the post-test score.

Summary

In this chapter the methods and procedures used in presenting the five traffic accident investigation courses were discussed. The basis for sample selection, testing of students, and the tabulating and analyzing of data were explained.

An analysis of the data and statistical results of the study are presented in Chapter IV.

CHAPTER IV

ANALYSIS OF RESULTS

The study was designed to evaluate the effectiveness of selected traffic accident investigation course formats offered by the Michigan State University Highway Traffic Safety Center. The methodology for this comparison was described in Chapter III.

The analyses of the data presented in this chapter include the following: (1) the differences in learning as measured by comparisons of pre-test and post-test scores of students in selected traffic accident investigation courses, (2) the differences in students' entry-level knowledge about traffic accident investigation as measured by comparisons of pre-test scores among groups receiving traffic accident investigation instruction, (3) the differences in learning as measured by post-test scores resulting from differences in students' educational and experiential backgrounds, (4) the differences in learning as measured by comparisons of post-test scores among students receiving three different formats of instruction, (5) the differences in course evaluations as measured by comparisons of student course evaluation questionnaires among groups receiving three different formats of instruction, and (6) the differences in reported student accident investigation performances as measured by a follow-up questionnaire.

The total number of subjects in the final statistical analysis was 114; 22 at Lake Superior State College (Soo), 28 at Madonna College, 22 at Muskegon Community College (MCC), 24 at Jackson Community College (JCC), and 18 at Lake Michigan Community College (LMCC).

The data collected from the subjects included pre-test and post-test scores, age, type and size of employing department, educational level, primary assignment, accident investigation experience, accident investigation training, motivation level to attend school, and the nature of the subjects' traffic accident investigation performance since completion of the accident investigation course.

Data Preparation and Analysis

Computer data cards were punched for each of the 114 subjects who attended the traffic accident investigation courses. The data were analyzed using the BMDP statistical package on the Ferris State College IBM 370-145 computer. The differences in learning as measured by gain scores were examined through the use of t-tests. The analysis of variance procedure was used to compare differences in pre-test scores among the five groups. The Pearson Chi-square statistic was applied to determine if there were relationships between variables related to students' backgrounds and post-test scores. The analysis of covariance procedure was used to compare differences in learning among the three different formats used for instruction. Both the analysis of variance method and Pearson Chi-square test were used to analyze the student course evaluations. Frequency distributions were used to analyze the follow-up questionnaire to determine if the students reported utilizing the knowledge they received and if their overall performance in traffic accident investigation was increased.

Differences Between Mean Pre-Test and Post-Test Scores

The following null hypothesis was tested for each of the five study groups:

> Hypothesis 1: Students will not show significant gain scores, as calculated by pre-test and post-test scores, after the completion of the five traffic accident investigation courses.

$$H_0: \mu_2 - \mu_1 \leqq 0$$

$$H_1: \mu_2 - \mu_1 > 0$$

Where μ_1 = pre-test scores, μ_2 = post-test scores.

At the beginning of each school session, a pre-test was completed by each student. At the end of the school session, the students also completed a post-test. The maximum possible score on both tests was 95. The mean pre-test, mean post-test, and mean gain scores of the five groups are presented in Table 4.1. All five groups had positive gain scores varying from 21.37 points to 27.86 points, with the total mean gain score for all five groups being 24.57 points.

To determine whether the gain scores were significantly above zero, they were examined through the use of t-tests. The .05 level of significance was selected as the basis for accepting or rejecting the null hypothesis. The critical value of the t-statistic in this test at the .05 significance level and the calculated t-statistic are shown in Table 4.2 for each of the schools.

Since, for each school, the calculated t-value was above the critical t-value, the null hypothesis that there was no significant gain score was rejected for each school.

Table 4.1.--Mean test scores and standard deviations of the five groups who took the traffic accident investigation course.

Group	n	Mean Test Scores and Standard Deviations					
		Pre-Test	S.D.	Post-Test	S.D.	Gain	S.D.
Soo (1 wk)	22	57.23	6.98	82.09	4.03	24.86	6.92
Madonna (1 wk)	28	54.43	7.74	79.57	5.02	25.14	7.55
MCC (1 wk)	22	50.59	8.16	78.45	6.75	27.86	8.13
JCC (5 wk)	24	56.25	4.88	77.62	5.30	21.37	5.97
LMCC (3 wk)	18	56.44	8.03	80.00	6.22	23.56	6.22

Note: The scores in the table are numerical, based on a possible point score of 95. Gain score represents the difference between the pre-test and the post-test score.

Table 4.2.--The critical value of the t-statistic and the calculated t-statistic for the five schools' mean gain scores.

Group	df	Critical t	Calculated t
Soo (1 wk)	21	1.721	16.85
Madonna (1 wk)	27	1.703	17.30
MCC (1 wk)	21	1.721	16.07
JCC (5 wk)	23	1.714	17.17
LMCC (3 wk)	17	1.740	15.62

Note: Critical t includes only the upper tail.

Difference Among Groups on Pre-Test Scores

The following null hypothesis was tested for the five study groups:

Hypothesis 2: Students' entry-level knowledge of traffic accident investigation, as reflected by mean scores on a pre-test, will not vary among the five groups receiving traffic accident investigation instruction.

H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

H_1: $\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq \mu_5$

Where μ_1, μ_2, etc. represent the pre-test scores of the groups.

To determine whether the differences in the mean pre-test scores were significant, they were examined through the use of analysis of variance. The .05 level of significance was selected as the basis for accepting or rejecting the null hypothesis. The critical value of the F-statistic at the .05 significance level with 4 and 109 degrees of freedom was 2.49. The F-statistic computed from the analysis of variance was 2.97, with an associated significance level of less than 0.023. These data are shown in Table 4.3.

Table 4.3.--Analysis of variance of pre-test scores of five groups who took the traffic accident investigation courses.

Source of Variance	df	Sum of Squares	Mean Square	Computed Value of F	Tail Area Probability
Equality of all means	4	620.46	155.11	2.97	0.023
Error	109	5684.98	52.16		

Note: The critical value of F at the .05 significance level is 2.49.

The null hypothesis of no significant difference in mean pre-test scores of the five groups was rejected.

To determine the source of the significant differences in the mean pre-test scores, post-hoc t-tests statistics were computed on all pairwise comparisons, and the results are presented in Tables 4.4, 4.5, and 4.6.

Table 4.4.--t-test matrix for group means on 109 degrees of freedom.

Group	Soo	Madonna	MCC	JCC	LMCC
Soo (1 wk)	0.0				
Madonna (1 wk)	-1.36	0.0			
MCC (1 wk)	-3.05	-1.87	0.0		
JCC 95 wk)	-0.46	0.91	2.65	0.0	
LMCC (3 wk)	-0.34	0.92	2.55	0.09	0.0

Note: The critical value of t with 109 degrees of freedom at the .05 significance level is ± 1.99.

Table 4.5.--Probabilities for the t-values in Table 4.4.

Group	Soo	Madonna	MCC	JCC	LMCC
Soo (1 wk)	1.000				
Madonna (1 wk)	0.177	1.000			
MCC (1 wk)	0.003	0.065	1.000		
JCC (5 wk)	0.648	0.367	0.009	1.000	
LMCC (3 wk)	0.734	0.358	0.012	0.931	1.000

When the probabilities for the t-values given in Table 4.5 were examined, the conclusion at the .05 significance level was that there were significant differences between the group MCC as compared with Soo, JCC, and LMCC. The MCC group had significantly lower pre-test scores than did the Soo, JCC, and LMCC groups.

To determine if there were significant differences in mean pre-test scores between the three formats of instruction, three contrasts were set up. Contrast 1 contrasted groups Soo, Madonna, and MCC (the one-week format) with JCC (the five-week format). Contrast 2 contrasted groups Soo, Madonna, and MCC with LMCC (the three-week format). Contrast 3 contrasted JCC with LMCC.

The t-values for contrasts in group means are shown in Table 4.6. The conclusion at the .05 significance level was that no significant differences in pre-test mean scores existed between the three formats of instruction.

Table 4.6.--Contrast coefficients and t-values for contrasts in group means.

Contrast Number	Contrast Coefficients					t	p(t)
	Soo	Madonna	MCC	JCC	LMCC		
1 (1 wk vs 5 wk)	1	1	1	-3	0	-1.27	0.206
2 (1 wk vs 3 wk)	1	1	1	0	-3	-1.24	0.218
3 (5 wk vs 3 wk)	0	0	0	1	-1	-0.09	0.931

Note: t = computed t-value p(t) = significance of t-value

Differences in Learning Compared to Educational and Experiential Backgrounds

Following is the null hypothesis that was tested for the five study groups:

> Hypothesis 3: Student entry-level background, as reflected by variables on the student background questionnaire, will not show a significant relationship with post-test scores.

H_0: $\rho_1 = \rho_2 = \rho_3$

H_1: $\rho_1 \neq \rho_2 \neq \rho_3$

where ρ_1, ρ_2, ρ_3 represent frequencies within three post-test score categories. (Refer to Appendix G.)

Each of the students who attended the traffic accident investigation schools answered a questionnaire containing questions related to his/her education and experiential background. From these questions 12 variables were identified to be analyzed. The 12 variables chosen were age of the student, type of department, size of department, years worked in law enforcement, education level, primary assignment in department, number of fatal (K) accidents investigated in the past 12 months, number of personal injury (PI) accidents investigated in the past 12 months, number of property damage (PD) accidents investigated in the past 12 months, total hours of training in traffic accident investigation, motivation to attend school, and interest level to attend school.

To determine whether a significant relationship existed between these variables and post-test scores, the Pearson Chi-square test was applied. The .05 level of significance was selected as the basis for accepting or rejecting the null hypothesis. The degrees of freedom were based on 2 by 3 (df = 2) and 3 by 3 (df = 4) tables. The critical value of the chi-square statistic with 2 degrees of freedom was 5.99 and with 4 degrees of freedom, 9.49. The results are presented in Table 4.7. For a detailed analysis of the Chi-square frequency counts for the 12 background variables versus post-test, refer to Appendix G.

Table 4.7.--A comparison of selected student background variables with post-test scores using the Pearson Chi-square test.

Variable	Computed Chi-Square Value	df	Probability
1. Age of student	5.91	4	.206
2. Type of department	2.69	2	.261
3. Size of department	3.29	4	.510
4. Years worked in law enforcement	2.70	4	.609
5. Education level	12.44	4	.014
6. Primary assignment	11.86	2	.003
7. Number of K investigated	2.25	2	.324
8. Number of PI investigated	10.30	4	.036
9. Number of PD investigated	8.75	4	.068
10. Total training	10.71	2	.005
11. Motivation level	14.01	4	.007
12. Interest level	2.42	2	.297

Note: At the .05 level of significance, the critical value of Chi-squares with 2 degrees of freedom is 5.99 and with 4 degrees of freedom is 9.49.

When the probabilities for the Pearson Chi-square test were analyzed, the conclusion at the .05 significance level was that there were significant relationships between post-test scores and the student's education level, primary assignment, number of personal injury (PI) accidents investigated, total hours of traffic accident investigation training, and motivation level. For these background variables, the null hypothesis was rejected. The null hypothesis was not rejected for the following student background variables: age, department type, department size, number of years worked in law enforcement, number of fatal (K) accidents investigated, number of property damage (PD) accidents investigated, and interest level.

Differences Among Groups on Post-Test Scores

The following is the null hypothesis that was tested for the five study groups who received instruction in the accident investigation courses.

Hypothesis 4: Student achievement levels, as reflected by mean scores on the post-test, will not vary among groups receiving three different formats of instruction.

$$H_0: \mu_1 = \mu_2 = \mu_3$$

$$H_1: \mu_1 \neq \mu_2 \neq \mu_3$$

Where μ_1, μ_2, μ_3 represent post-test scores of three different formats.

To determine whether the differences in the mean post-test scores were significant, they were examined through the use of analysis of covariance. The .05 level of significance was selected as the basis for accepting or rejecting the null hypothesis. Pre-test scores along with the student background variables of education, primary assignment, number of personal injury (PI) accidents investigated, total hours of traffic accident investigation training, and motivational level, which had been found to be related to post-test scores, were used as covariates. The adjusted group means after the above-listed confounding effects were removed are shown in Table 4.8. The critical value of the F-statistic in the analysis of covariance test at the .05 significance level with 4 and 102 degrees of freedom was 2.50. The F-statistic computed from the analysis of covariance was 2.53, with an associated significance level of less than 0.045. These data are presented in Table 4.9.

Table 4.8.--Adjusted group post-test means after the effects of the six covariates have been removed.

Group	n	Group Mean	Adjusted Group Mean	Standard Error
Soo (1 wk)	22	82.09	81.45	0.99
Madonna (1 wk)	28	79.57	79.93	0.92
MCC (1 wk)	22	78.45	78.48	1.05
JCC (5 wk)	24	77.62	77.46	0.94
LMCC (3 wk)	18	80.00	80.41	1.11

To determine if there were significant differences in mean post-test scores between the three formats of instruction, post-hoc t-test statistics were computed on all contrasts. Contrast 1 contrasted groups Soo, Madonna, and MCC (the one-week format) with JCC (the five-week format). Contrast 2 contrasted groups Soo, Madonna, and MCC with LMCC (the three-week format). Contrast 3 contrasted JCC with LMCC. The results are presented in Table 4.10.

Table 4.9.--Analysis of covariance of adjusted post-test mean scores of five groups who took the traffic accident investigation courses.

Source of Variance	df	Sum of Squares	Mean Square	Computed Value of F	Tail Area Probability
Equality of adjusted cell means	4	205.56	51.39	2.53	0.045
Zero slope	7	1212.49	173.21	8.53	0.000
Error	102	2071.25	20.31		
Equality of slopes	28	725.86	25.92	1.43	0.115
Error	74	1345.39	18.18		

Note: Critical F-statistic = 2.50.

Table 4.10.--Contrast coefficients and t-values for contrasts in adjusted group means.

Contrast Number	Contrast Coefficients					t	p(t)
	Soo	Madonna	MCC	JCC	LMCC		
1 (1 wk vs 5 wk)	1	1	1	-3	0	2.26	0.026
2 (1 wk vs 3 wk)	1	1	1	0	-3	-0.37	0.714
3 (5 wk vs 3 wk)	0	0	0	1	-1	-2.04	0.044

Note: t = computed t-value p(t) = significance of t-value

The t-values for contrasts in group means indicate that there was a significant difference at the .05 significance level in the three formats of instruction. The JCC five-week format was significantly lower than both the Soo, Madonna, and MCC one-week format and the LMCC three-week format. Therefore, the null hypothesis of no significant difference in mean post-test scores among groups receiving three different formats of instruction was rejected.

Differences Among Groups on Student Evaluation Questionnaire

The following is the null hypothesis that was tested for the three formats of instruction used in the traffic accident investigation courses:

Hypothesis 5: Student evaluations, as reflected by responses on the student course evaluation questionnaire, will not vary among groups receiving three different formats of instruction.

H_0: $\mu_1 = \mu_2 = \mu_3$

H_1: $\mu_1 \neq \mu_2 \neq \mu_3$

Where μ_1, μ_2, μ_3 represent student course evaluation mean scores of three different formats.

Each of the 114 students who attended one of the five traffic accident investigation courses answered an evaluation questionnaire containing 15 questions that related to the training format, instructional media, student manual, text, individual field exercises, instructors, and general observations about the course. Written comments about various aspects of the training program can be found in Appendix H. An overall picture of the data is summarized in Table 4.11.

Table 4.11.--Summary data for the 114 students who answered the student course evaluation questionnaire.

Question	Mean[a]	S.D.	Percent of Response Given[b]				
			SD	D	N	A	SA
1. Generally, my knowledge of traffic accident investigation was increased.	4.65	0.58	.88	..	..	31.58	67.54
2. I developed my ability to conduct comprehensive on-scene traffic accident investigations.	4.26	0.60	..	.88	5.26	60.53	33.33
3. I would recommend this course to someone else.	4.64	0.63	.88	..	2.63	27.19	69.30
4. I was interested in learning the course material.	4.48	0.65	.88	.88	.88	43.86	53.51
5. This course was very well organized.	4.44	0.67	..	..	7.02	39.47	52.63
6. The objectives of the course were clearly explained.	4.40	0.63	..	..	7.89	43.86	48.25
7. The amount of material covered in the course is reasonable.	3.39	0.90	1.75	7.02	12.28	54.39	25.56
8. The instructors stressed important points in lectures or discussions.	4.47	0.65	..	1.75	3.51	40.35	54.39
9. The instructors put material across in an intesting way.	4.29	0.78	..	3.51	9.65	41.23	45.61
10. I generally found the coverage of topics in the assigned readings not too difficult.	3.85	0.80	.88	3.51	24.56	51.75	19.30
11. The instructions given prior to the field exercises were clear and precise.	4.32	0.70	..	2.63	5.26	49.12	42.98
12. The field exercises were worthwhile in terms of time spent and information gained.	4.32	0.79	..	4.39	7.02	41.23	47.37
13. I would encourage the continuance of application exercises in future offerings of the course.	4.55	0.74	1.75	..	4.39	28.95	64.91
14. The media presented was well organized and related to the lecture material.	4.46	0.65	..	1.75	3.51	41.23	53.51
15. The student manual will be useful as a future reference.	4.76	0.50	..	.88	.88	19.30	78.95

Note: The student course evaluation questionnaire can be found in Appendix E.

[a]The values in this column are the average for the respondents, based on the assigned values shown below.

[b]Response Categories	Assigned Value
SD = Strongly disagree	1
D = Disagree	2
N = No opinion	3
A = Agree	4
SA = Strongly agree	5

To determine whether the differences in the total evaluation mean scores were significant, they were examined through the use of analysis of variance. The .05 level of significance was selected as the basis for accepting or rejecting the null hypothesis. The total evaluation score was obtained by totaling up each student's responses to the 15 questions. The total evaluation mean scores for each of the five schools are given in Table 4.12. The critical value of the F-statistic in the analysis of variance test on the total evaluation mean scores at the .05 significance level with 4 and 109 degrees of freedom was 2.49. The F-statistic computed from the analysis of variance was 5.25 with an associated significance level of less than 0.0007 (Table 4.13.) It was concluded that there were significant differences in the total evaluation mean scores of the five groups.

Table 4.12.--Total evaluation mean scores of five groups who evaluated the traffic accident investigation courses.

Group	Total Evaluation Mean Scores
Soo (1 wk)	67.73
Madonna (1 wk)	67.57
MCC (1 wk)	63.82
JCC (5 wk)	61.71
LMCC (3 wk)	68.83
Total	65.84

Note: The scores in the table are numerical, based on a possible point score of 75.

Table 4.13.--Analysis of variance of total evaluation mean scores of five groups who took the traffic accident investigation course.

Source of Variance	Sum of Squares	df	Mean Square	Computed Value of F	Tail Area Probability
Equality of all means	823.20	4	205.80	5.25	0.0007
Error	4271.94	109	39.19		

Note: The critical value of F at the .05 significance level was 2.49.

To determine if there were significant differences in the total evaluation mean scores between the three formats of instruction, post-hoc t-test statistics were computed on all contrasts. Contrast 1 contrasted groups Soo, Madonna, and MCC (the one-week format) with JCC (the five-week format). Contrast 2 contrasted groups Soo, Madonna, and MCC with LMCC (the three-week format). Contrast 3 contrasted JCC with LMCC. The results are presented in Table 4.14.

Table 4.14.--Contrast coefficients and t-values for contrasts in group means.

Contrast Number	Contrast Coefficients					t	p(t)
	Soo	Madonna	MCC	JCC	LMCC		
1 (1 wk vs 5 wk)	1	1	1	-3	0	-3.16	0.002
2 (1 wk vs 3 wk)	1	1	1	0	-3	-1.49	0.139
3 (5 wk vs 3 wk)	0	0	0	1	-1	-3.65	0.0004

Note: t = computed t-value p(t) = significance of t-value

The t-values for contrasts in group means indicate that there was a significant difference at the .05 significance level in student total evaluations between the three formats of instruction. The JCC five-week format was significantly lower than both the Soo, Madonna, and MCC one-week format and the LMCC three-week format. Therefore, the null hypothesis of no significant differences in total student course evaluation mean scores among groups receiving three different formats of instruction was rejected.

Since it was determined that there were differences in the student evaluation between the three format groups, each of the 15 questions was analyzed to determine whether a significant relationship existed between that question and school. The Pearson Chi-square test was selected to analyze the data. The .05 level of significance was selected as the basis for determining if a significant relationship existed. The degrees of freedom were based on 5 by 2 (df = 4) and 5 by 3 (df = 8) tables. The critical value of the Chi-square statistic with 4 degrees of freedom was 9.49, and with 8 degrees of freedom was 15.51. The results are presented in Table 4.15.

The probabilities for the Pearson Chi-square test examined at the .05 significance level indicated that significant relationships existed between school and questions 6, 8, 9, 11, and 13.

In order to determine where the differences existed between school and questions 6, 8, 9, 11, and 13, the response percentages are presented for each school on each of these questions in Tables 4.16 through 4.20.

Table 4.15.--A comparison of student course evaluation questions with school, using the Pearson Chi-square test.

Question	Computed Chi-Square Value	df	Probability
1	5.53	4	0.237
2	2.73	4	0.605
3	5.56	4	0.234
4	5.89	4	0.208
5	9.23	4	0.056
6	15.77	4	0.003
7	8.82	8	0.358
8	11.14	4	0.025
9	9.66	4	0.047
10	13.39	8	0.099
11	12.00	4	0.017
12	8.99	4	0.061
13	9.73	4	0.045
14	8.21	4	0.084
15	5.53	4	0.237

Note: At the .05 level of significance, the critical value of Chi-square with 4 degrees of freedom was 9.49 and with 8 degrees of freedom was 15.51.

Table 4.16.--Percentages of the school totals for question 6: The objectives of the course were clearly explained.

School	Percentages of the School Totals	
	Strongly Agree	Other Responses
MCC (5 wk)	20.83	79.17
MCC (1 wk)	31.82	68.18
Madonna (1 wk)	64.29	35.71
Soo (1 wk)	63.64	36.36
LMCC (3 wk)	61.11	38.89
Total	48.25	51.75

Table 4.17.--Percentages of the school totals for question 8: The instructors stressed important points in lectures or discussions.

School	Percentages of the School Totals	
	Strongly Agree	Other Responses
JCC (5 wk)	29.17	70.80
MCC (1 wk)	50.00	50.00
Madonna (1 wk)	57.14	42.86
Soo (1 wk)	63.64	36.36
LMCC (3 wk)	77.78	22.22
Total	54.39	45.61

Table 4.18.--Percentages of the school totals for question 9: The instructors put material across in an interesting way.

School	Percentages of the School Totals	
	Strongly Agree	Other Responses
JCC (5 wk)	25.00	75.00
MCC (1 wk)	40.91	59.09
Madonna (1 wk)	50.00	50.00
Soo (1 wk)	45.45	54.55
LMCC (3 wk)	72.22	27.78
Total	45.61	54.39

Table 4.19.--Percentages of the school totals for question 11: The instructions given prior to the field exercises were clear and precise.

School	Percentages of the School Totals	
	Strongly Agree	Other Responses
JCC (5 wk)	25.00	75.00
MCC (1 wk)	22.73	77.27
Madonna (1 wk)	57.14	42.86
Soo (1 wk)	50.00	50.00
LMCC (3 wk)	61.11	38.89
Total	42.98	57.02

Table 4.20.--Percentages of the school totals for question 13: I would encourage the continuance of application exercises in future offerings of the course.

School	Percentages of the School Totals	
	Strongly Agree	Other Responses
JCC (5 wk)	41.67	58.33
MCC (1 wk)	59.09	40.91
Madonna (1 wk)	71.43	28.57
Soo (1 wk)	81.82	18.18
LMCC (3 wk)	72.22	27.78
Total	64.91	35.09

Upon analyzing the preceding tables, it was concluded that JCC and MCC had a higher percentage of lower ratings on questions 6, 8, 9, 11, and 13 than did Madonna, Soo, and LMCC.

Analysis of Student Follow-Up Questionnaire

Tables 4.21 through 4.33 contain the tabulation of responses provided by students who attended the five AI-1 courses. This particular set of responses was obtained four months after completion of the training. One hundred fourteen questionnaires were distributed. Five questionnaires were returned marked "addressee moved--not forwardable." Ninety-five completed questionnaires were returned, which represented a response rate of 83%.

The number and percentage of respondents who attended the various AI-1 course formats are reported in Table 4.21.

Table 4.21.--Question I.A: Number and percentage of students attending the various AI-1 course formats.

Format	Number	Percent
5 week	20	21
3 week	22	23
1 week	53	56
Total	95	100

The data relating to student satisfaction with the time structure of the courses are presented in Table 4.22. As indicated in the table, over 90% of the students were well satisfied with the time structure of the courses in terms of time of year, day(s) of week, and time to complete assignments.

Table 4.22.--Question I.B: Student satisfaction with time structure of the courses.

	Satisfied		Not Satisfied	
	Number	Percent	Number	Percent
Time of year	91	96	4	7
Day(s) of week	94	99	1	1
Time to complete assignments	88	93	7	7

The number and percentage of accidents investigated by the students since AI-1 course completion are presented in Table 4.23. Thirty-eight percent of the students had investigated fatal accidents. Also, 60% of the students had investigated 16 or more property damage accidents.

The data relating to source of feedback indicating student improvement in the quality of their work since the completion of AI-1 are presented in Table 4.24. As indicated in the table, many students received feedback about the quality of their accident investigations from a variety of sources. Sixty-eight percent of the students reported that they received positive feedback from other police officers about their investigations. Also, 46% reported receiving positive comments from their supervisors. It is noteworthy that all (100%) thought that their accident investigation work had improved.

Table 4.23.--Question II.A: Number and percentage of accidents investigated since AI-1 course completion, categorized by accident types.

	Number of Accidents							
	(0-15)		(16-30)		(31-60)		(Over 60)	
	No.	%	No.	%	No.	%	No.	%
Property damage (PD)	38	40	38	40	13	14	6	6
	(0-10)		(11-20)		(21-40)		(Over 40)	
	No.	%	No.	%	No.	%	No.	%
Personal injury (PI)	64	68	21	22	3	3	7	7
	(0)		(1-2)		(Over 2)			
	No.	%	No.	%	No.	%		
Fatal (K)	59	62	27	28	9	10		

Table 4.24.--Question II.B and II.C: Source of feedback indicating student improvement in accident investigation.

Source of Feedback	Number	Percent
Other officers	65	68
Supervisors	44	46
Chief/sheriff	8	8
Prosecutor	10	11
Insurance representative	5	5
Media representative	1	1
Courts	3	3
Drivers	10	11
General public	7	7
Other	1	1
Self-evaluation	95	100

The data pertaining to self-report on improved competence in accident investigation following AI-1 training are presented in Table 4.25. The data indicate that over 90% of the students believed they are now more competent to reconstruct the accident scene, determine fault, determine specific violations, and present more effective evidence in court.

Table 4.25.--Question II.D: Self-report on improved competence in accident investigation following AI-1 training.

Competence Factors	Improvement		No Improvement	
	Number	Percent	Number	Percent
Reconstruct accident scene	92	97	3	3
Determine fault	93	98	2	2
Determine specific violation	86	91	9	9
Present effective evidence in court	90	95	5	5

The number and percentage of students using various accident investigation techniques and equipment since AI-1 course completion are presented in Table 4.26. As indicated in the table, many students are making use of the AI-1 technique of recording feet and inches, and many students are using the traffic template.

The data relating to time spent and results gained from accident investigations since the completion of the AI-1 course are presented in Table 4.27. As indicated in the table, over 99% of the students reported they were getting better results for the time they spent investigating accidents since the completion of AI-1.

Table 4.26.--Question II.E: Number and percentage of students using various techniques and equipment since AI-1 course completion.

	Number	Percent
Determining grade or superelevation	16	17
AI-1 technique of recording feet and inches	70	74
Photolog	19	20
Damage record form	21	22
Nomograph	42	44
Traffic template	83	87
Requisition of equipment	45	47
Improved equipment availability	31	33

Table 4.27.--Question II.F: Time spent and results gained from accident investigation since AI-1 course completion.

	Less		Same		More	
	Number	Percent	Number	Percent	Number	Percent
Time spent	9	2	31	33	55	58
Results for time spent	0	0	1	2	94	99

The number and percentage of students reporting time limitation policies for conducting on-scene accident investigations are reported in Table 4.28. The data indicate that very few departments limit the time that an officer has to conduct on-scene accident investigations.

Table 4.28.--Question II.G: Number and percentage reporting time limitation policies for conducting on-scene accident investigations.

Type of Accident	Time Limitations		No Time Limitations	
	Number	Percent	Number	Percent
Property damage (PD)	4	4	91	96
Personal injury (PI)	3	3	92	97
Fatal (K)	1	1	94	99

The data related to sources of time limitations in conducting accident investigations are presented in Table 4.29. The data indicate that the major time limitations are attributed to individual officer discretion.

The number and percentage of students reporting work assignment changes since AI-1 course completion are reported in Table 4.30. As indicated in the table, only 3% of the officers had their work assignment changed since the completion of AI-1.

Data pertaining to future needs for training are presented in Tables 4.31 and 4.32. As indicated in Table 4.31, 92% of the students would have an interest in taking part in future accident investigation courses (AI-2), if offered. Over half of the respondents (Table 4.32) were interested in all of the possible topics except photography.

Table 4.29.--Question II.H: Sources of time limitations in accident investigation work.

Source	Number	Percent
Formal/written policy	0	0
Informal/unwritten policy	3	3
Supervisory discretion	3	3
Investigating-officer discretion	52	55
None	39	41

Table 4.30.--Question II.I: Number and percentage reporting work assignment changes since AI-1 course completion.

	Number	Percent
Changed assignment	3	3
No assignment change	97	92

Table 4.31.--Question III.A.1: Student interest in taking part in future accident investigation courses (AI-2).

	Number	Percent
Prefer another course	87	92
Prefer no additional courses	8	8

Table 4.32.--Question III.A.2: Preferred topics for future accident investigation course offerings.

Topic	Number	Percent
Preparation of scale diagrams	58	71
Speed determination	60	63
Photography	39	41
Tire evaluation	54	57
Lamp analysis	53	56
Scientific reconstruction	57	60
Case studies	57	60
Other	8	8

The final portion of the follow-up questionnaire completed by the students was to determine if AI-1 training had been utilized. The data about utilization are presented in Table 4.33. As indicated in the table, the majority of the students did not use the skills prior to attending AI-1. In contrast, the majority indicated that they had used the skills since completion of AI-1 and that they used the skills more often. Also, over 97% reported that their abilities improved in these skills as a result of AI-1.

The summary, findings, conclusions, recommendations, recommendations for further research, and a discussion are presented in Chapter V.

Table 4.33.--Question IV: Percentage of respondents reporting the use of accident investigation skills before and after the AI-1 course, and frequency of use and improvement of skills since course completion.

Skill	Percentages			
	Used Before Course	Used After Course	More Frequent Use	Improved Ability
1. Coordinate measurements	26	69	68	99
2. Triangulation measurements	72	67	48	100
3. Symbols and abbreviations	42	82	74	100
4. Table of measurements	31	75	68	98
5. Photography	66	65	52	99
6. Sketching accident scene	66	86	77	98
7. Measuring tiremarks	68	83	76	99
8. Controlled & uncontrolled position of vehicles & bodies	21	65	64	97
9. Sketching damage to vehicle	11	42	43	98
10. Determining type of vehicle damage	26	76	75	99
11. Determining direction of thrust	19	67	71	98
12. Determining direction of rotation	23	65	62	98
13. Identifying metal scars	16	63	59	97
14. Collecting physical evidence	81	91	76	99
15. Determining type of tiremark	13	79	78	98
16. Conducting test skids	12	49	51	98
17. Determining radius of curve	2	29	26	100
18. Determining speed from tiremarks	19	67	62	100

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, RECOMMENDATIONS, RECOMMENDATIONS FOR FURTHER RESEARCH, AND DISCUSSION

The preceding chapter contained the findings based on the data obtained in the study of traffic accident investigation courses. Analyses of data were presented for the following:

1. The differences in learning among five groups who received traffic accident investigation instruction;
2. The differences in students' entry-level knowledge about traffic accident investigation;
3. The differences in learning associated with differences in education and work experience;
4. The differences in learning associated with three different instructional formats, after controlling for preexisting differences;
5. The differences in responses to the course evaluation questionnaires among groups receiving instruction in three different instructional formats;
6. The differences in student accident investigation performance after they received traffic accident investigation instruction.

This chapter contains the summary, findings, conclusions, recommendations, recommendations for further research, and discussion.

Summary

Purpose of the Study

The purpose of this study was to evaluate the effectiveness of selected traffic accident investigation course formats offered by the Michigan State University Highway Traffic Safety Center.

Methodology

The comparison of traffic accident investigation classes was studied by analyzing the test results of 114 students who received traffic accident investigation training.

Student test scores and student responses to questionnaires from the five traffic accident investigation courses presented in different locations throughout the state of Michigan were analyzed in this study. The courses were presented at Jackson Community College in Jackson, Muskegon Community College in Muskegon, Madonna College in Detroit, Lake Superior State College in Sault Ste. Marie, and Lake Michigan Community College in Benton Harbor.

All five traffic accident investigation courses were identical, with the exception of the format in which they were presented. The students in the schools at Muskegon, Soo, and Madonna received instruction seven hours per day for five consecutive days. At Lake Michigan Community College, instruction was presented seven hours per day for one day the first week, and seven hours a day for two days a week for two successive weeks. At Jackson, the instruction was presented seven hours per day for one day a week for five successive weeks.

A pre-test was administered to all students at the first class session to determine if there were differences in student entry-level knowledge about traffic accident investigation. The analysis of variance procedure was used to compare differences in pre-test scores among the five groups.

A post-test was given at the end of each course. The differences in learning, as measured by gain scores obtained from comparing pre-test to post-test, were analyzed through the use of t-tests.

Each student in the five classes completed a questionnaire on his/her educational and work experience. The Pearson Chi-square statistic was applied to determine if there were relationships between variables related to each student's backgrounds and his/her respective post-test scores.

The analysis of covariance procedure was used to compare differences in learning among the three different formats of instruction in order to control for pre-existing differences.

A student course evaluation questionnaire was filled out by each student at the end of the course. Both the analysis of variance method and Pearson Chi-square test were used to analyze these data.

A follow-up questionnaire, to determine if the students were utilizing the knowledge they received and if their overall performance in traffic accident investigation was increased, was sent to all students four months after they completed the course. Frequency distributions were used to analyze the data.

Findings

At the 95% level of confidence, significant differences in mean-gain scores obtained by comparing pre-test and post-test scores were found for all five groups. All five groups had positive gain scores varying from 21.37 points to 27.86 points, with the total mean gain score for all five groups being 24.57 points. Since, for each school, the calculated t-value was far above the critical t-value, the null hypothesis that there was no significant difference in mean test gain scores for all schools was rejected (Hypothesis 1).

Significant differences were found among the five groups at the .05 significance level in pre-test scores. There were significant differences at the .05 significance level between the group MCC as compared with Soo, JCC, and LMCC. Muskegon Community College had significantly lower pre-test scores than did the Soo, JCC, and LMCC.

The null hypothesis of no significant differences in pre-test scores among the five groups was rejected (Hypothesis 2).

Further analysis of mean pre-test scores showed no significant differences at the .05 significance level in pre-test scores when the three one-week schools were combined, and compared to the others.

Significant relationships between post-test scores and variables related to student's educational and experiential backgrounds were found for 5 of the 12 variables studied. At the .05 significance level, there were significant relationships between post-test scores and the student's educational level, primary assignment, number of personal injury accidents investigated, total hours of traffic investigation training, and motivational level. For the five above-mentioned background variables, the null hypothesis that student background, as reflected by variables on the student background questionnaire, will not show a significant relationship with post-test scores was rejected (Hypothesis 3). The null hypothesis for the following student background variables--age, department type, department size, number of years worked in law enforcement, number of fatal accidents investigated, number of property damage accidents investigated, and interest level--was not rejected.

Significant differences were found among the five groups at the .05 significance level in mean post-test scores when both pretest scores and student background effects that were related to the post-test were removed. At the .05 significance level, there was a significant difference in the three formats of instruction. The JCC five-week format was significantly lower than either the Soo, Madonna, and MCC one-week format or the LMCC three-week format.

The null hypothesis of no significant difference in post-test scores among groups receiving three different formats of instruction was rejected (Hypothesis 4).

Significant differences were found among the five groups at the .05 significance level in total student course evaluation mean scores. At the .05 significance level, there was a significant difference in student total course evaluations between the three formats of instruction. The JCC five-week format was significantly lower than the Soo, Madonna, and MCC one-week format and the LMCC three-week format.

The null hypothesis of no significant differences in student course evaluations among the groups receiving three different formats of instruction was rejected (Hypothesis 5).

Further analysis of student course evaluations found that significant relationships existed between schools and 5 of the 15 questions on the student course evaluation questionnaire. Both the JCC group and the MCC group had a higher percentage of lower ratings on each of the five questions as compared to Madonna, Soo, and LMCC.

Upon reviewing the results of the student responses, it could be seen that a large majority of the responses fell into the "strongly agree" and "agree" categories for all five schools.

Analysis of the student follow-up questionnaire revealed that over 90% of the students were well-satisfied with the course format in terms of time of year, day(s) of week, and time to complete assignments.

Further analysis of the questionnaire revealed that each student's performance in traffic accident investigation had been increased. One hundred percent of the students felt that the quality of their accident investigation work had improved since completion of AI-1. The majority of the students also reported that they had received favorable comments from other people in regard to the quality of their accident investigations. Also, 99% of the students reported that they were getting better results for the time they spent investigating accidents since the completion of AI-1. Further analysis of the follow-up questionnaire revealed that new accident investigation skills were learned and that skills previously attained were now utilized with a greater degree of frequency and effectiveness.

Conclusions

The following conclusions were reached on the basis of the analyses of students' pre-test scores, post-test scores, student responses on the course evaluation questionnaire, and student responses on the follow-up questionnaire:

1. The mean grade scores achieved by each of the five classes on the pre-tests and post-tests were given in Table 4.1. The maximum number of points on the tests was 95. All five groups had positive gain scores varying from 21.37 points to 27.86 points, with the total mean gain score of all five groups being 24.57 points. It was concluded that learning did take place as measured by these scores.

2. The passing grade established for this course was 66 points or 70%. Seventy percent is the minimum score that MLEOTC uses in all of its sponsored training programs throughout the state to determine whether a student has passed or failed that course. The traffic accident investigation courses were considered to be a success since all 114 students equalled or exceeded the grade of 70% on the post-test.

3. There was evidence that after pre-course effects were removed, the instructional format used did have an effect on the amount of learning that was achieved. It was concluded that both the one-week format and the three-week format produced significantly greater learning than the five-week format.

4. It was concluded from the analysis of the student course evaluation ratings that all groups rated the accident investigation course highly.

5. It was concluded from the analysis of the student follow-up questionnaire that the students' overall performance in traffic accident investigation has increased.

Recommendations

Based on this study, the following recommendations can be made:

1. The traffic accident course (AI-1) should continue to be offered on a regional basis throughout the state of Michigan, with emphasis on making the training available to the smaller police agencies.

2. If feasible, the five-week format should be retained as an option in order that those smaller departments that have less flexibility in scheduling personnel can benefit from the training.

3. If the five-week format is maintained, the instructional staff should consider ways of increasing student retention to produce achievement levels similar to the other formats.

4. The course should retain the same teaching strategy with practical exercises included with each major unit of instruction.

5. The development and refinement of advanced accident investigation courses that build on what was taught in AI-1 is needed.

Recommendations for Further Research

Further research should be done on the effectiveness of traffic accident investigation courses; such research should be directed at the following:

1. Determining the effectiveness of the AI-1 courses that are presently being offered by Michigan State University.

2. Comparing the effectiveness of accident investigation training courses offered by other institutions with Michigan State University's AI-1 course.

3. The HTSC staff should conduct a feasibility study to determine if the five-week format should be retained as an option.

4. Determining the effectiveness of time-compressed formats in other courses.

Discussion

This study revealed that both the one-week format and the three-week format produced significantly greater learning than did the five-week format. The difference between the Soo and its one-week format, which had the highest adjusted group mean, and JCC's five-week format, which had the lowest adjusted group mean, was a significant four points. Decision makers who will have to determine if the five-week format should be retained as an option should remain cognizant of the fact that there were significant gains in knowledge observed even in the least-effective format (five weeks). Special attention should be given to the smaller departments, which have less flexibility in scheduling personnel and which benefit the most from the five-week format when making any decision to retain or drop this format. It should also be remembered that one of the main purposes of the AI-1 course is to upgrade the quality and amount of training for officers in small law enforcement agencies.

The test item bank that was used in the test development phase of this study may be an area for improvement. Most of the items assess the retention of knowledge taught in the course. Very few test items, which called for problem-solving thought processes on the part of the examinees, were available. Special attention might be given to writing and collecting test items that require the examinee to solve problems similar to those found in on-the-scene investigations. Item banks could be purchased from or exchanged with other accident investigation education programs.

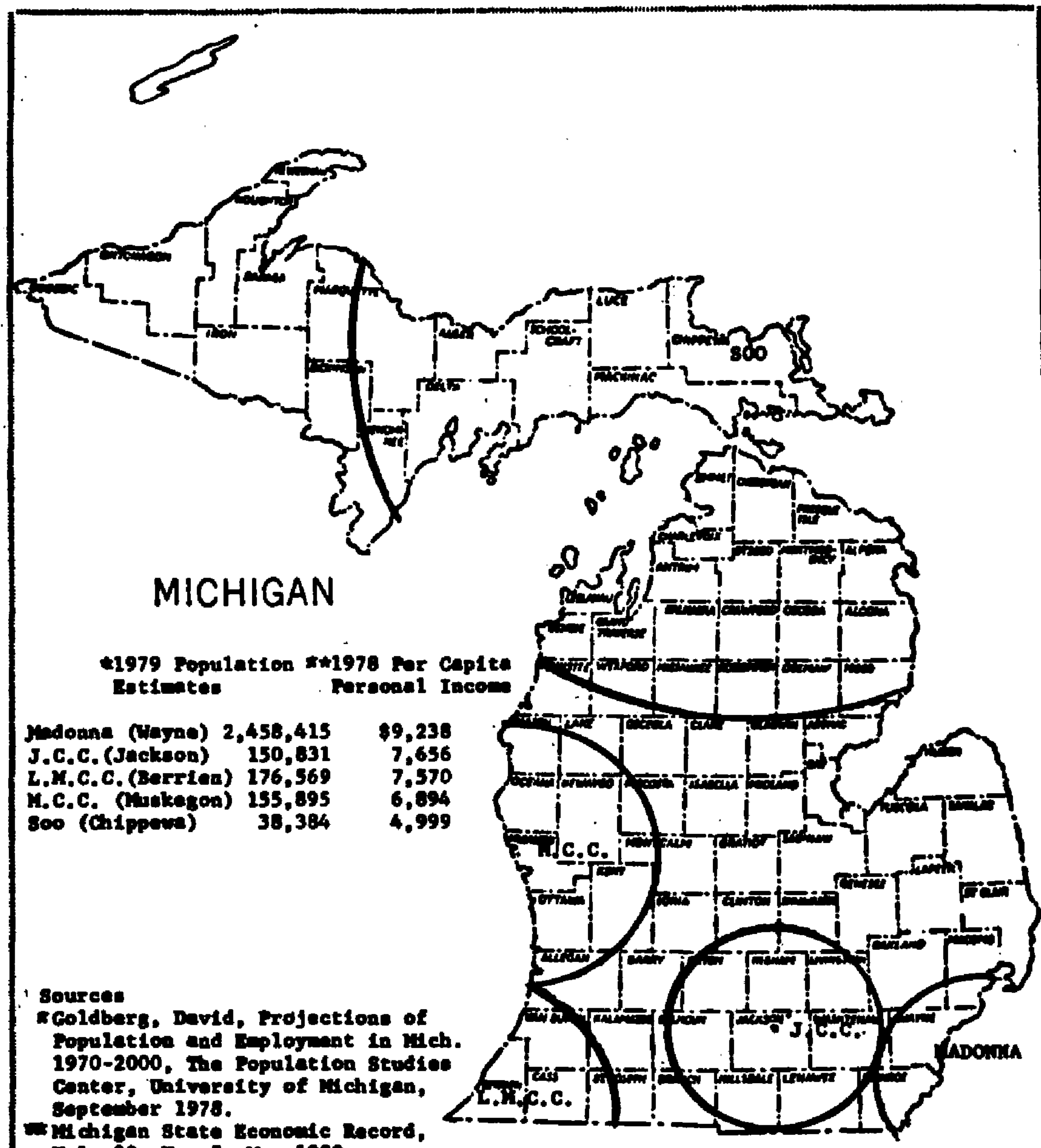
The availability of an expanded pool of acceptable test items would permit a greater use of assessment in the instructional process. Survey tests could be interspersed with instruction to improve the student's on-going evaluation of his learning. Feedback from the tests could be used to alter instruction to meet the student's needs, thereby personalizing the instructional process.

In addition, consideration should be given to computerizing an extended test-item bank. Computerization would facilitate the retrieval of test items for various purposes. In addition to the items, coefficients that describe item quality could be retained. The creation of a statewide and/or nationwide computerized item bank is a possibility.

APPENDICES

APPENDIX A

GEOGRAPHICAL LOCATION, ECONOMIC CONDITION, AND POPULATION COMPOSITION OF THE FIVE AI-1 COURSE LOCATIONS



	*1979 Population Estimates	**1978 Per Capita Personal Income
Madonna (Wayne)	2,458,415	$9,238
J.C.C. (Jackson)	150,831	7,656
L.M.C.C. (Berrien)	176,569	7,570
M.C.C. (Muskegon)	155,895	6,894
Soo (Chippewa)	38,384	4,999

Sources

*Goldberg, David, Projections of Population and Employment in Mich. 1970-2000, The Population Studies Center, University of Michigan, September 1978.

**Michigan State Economic Record, Vol. 22, No. 5, May 1980. Division of Research, Graduate School of Business Administration, Michigan State University.

APPENDIX B

TRAFFIC ACCIDENT INVESTIGATION

COURSE AI-1 CURRICULUM OUTLINE

APPENDIX B

HIGHWAY TRAFFIC SAFETY CENTER
Continuing Education Service
Michigan State University

Traffic Accident Investigation I

Curriculum Outline

1. Orientation
   1.1 Introduction
   1.2 Student Assessment (Pre-test)

2. Legal
   2.1 Duties Required by Statute
   2.2 Authority to Gather Accident Information
   2.3 Enforcement Authority at Accident Scenes

3. Elements of Traffic Accidents
   3.1 Multiple Causation Theory
   3.2 Elements of Traffic Accidents

4. Measuring & Recording
   4.1 Measuring
   4.2 Sketching
   4.3 Photography
   4.4 Field Exercise #1

5. Roadway Evaluation
   5.1 Final Position
   5.2 Tire Marks
   5.3 Metal Scars
   5.4 Debris
   5.5 Fixed Objects
   5.6 Falls, Flips & Vaults
   5.7 Field Exercise #2

6. Vehicle Evaluation
   6.1 Types of Vehicle Damage
   6.2 Thrust & Collapse
   6.3 Ground Contact
   6.4 Recording Damage to Vehicle
   6.5 Field Exercise #3

7. Speed Determination

    7.1 Symbols & Abbreviations
    7.2 Speed & Velocity
    7.3 Determining Drag Factor
    7.4 Field Exercise #4
    7.5 Determining Speed to Slide to a Stop
    7.6 Determining Speed to Slideslip

8. Variable (depending upon length of course--used for optional sixth day)

9. Course Review

    9.1 Review of Course Instruction and Materials

10. Course & Student Evaluation

    10.1 Student Evaluation (Post-test)
    10.2 Course Evaluation

APPENDIX C

STUDENT BACKGROUND QUESTIONNAIRE

APPENDIX C

Traffic Accident Investigation Training

Course location______________________________

Name____ Age___________________

Home address____

Home phone____

Employing agency____

Check which type of department you are presently employed in:

____1. Municipal	____4. State
____2. Township	____5. Other_____________________________
____3. County	

List the total number of sworn police personnel in your agency:________

List the total number of years you have worked in law enforcement: __________

Present rank:____

Education: (Circle highest grade or level.)

High School				College				Graduate			
09	10	11	12	13	14	15	16	17	18	19	20

Primary assignment is:	Primary function is:	Primary duty is:
__1. Patrol division	__1. General patrol	__1. Administrative
__2. Traffic unit	__2. Traffic specialist	__2. Supervisory
__3. Training division	__3. Training	__3. "Line" operations
__4. Other:__________	__4. Other:_________	__4. Other:__________

Are you assigned to a traffic division or traffic unit?

_____1. Yes _____2. No

List the approximate number of traffic accidents investigated by you in the last 12 months:

Fatal_____ Personal injury_____ Property damage____

Check only one of the following:

____1. I work major accidents but assist with minor accidents during peak hours.

____2. I work minor accidents but assist with major accidents during peak hours.

____3. I work both major and minor accidents any time.

Have you attended a traffic accident investigation course beyond the basic recruit course?

____1. Yes (If yes, where?)________________________________

____2. No

Previous training in accident investigation:

	Where	When	No. of Hours
1. Academy (basic recruit training)	______	______	______
2. Department in-service training	______	______	______
3. Specialized schools	______	______	______
4. College courses	______	______	______
5. Other:________________	______	______	______

Other types of specialized training related to traffic and/or investigation:

Type	Where	When	Length
______	______	______	______

Check only one of the following:

____1. I made a request to attend this school.

____2. I was given an option about attending this school.

____3. I was required to attend this school.

How do you feel about attending this school?

____1. Extremely interested

____2. Interested

____3. So-so

____4. Not so interested

____5. Extremely disinterested

APPENDIX D

PRE-TEST AND POST-TEST

APPENDIX D

Traffic Accident Investigation I

Pre-Test

I. Response to Media Items:

Instructions: As you view a media presentation of the items in this section of the test, choose the most correct answer and mark it on the answer sheet by darkening the selected alternative. There is only one correct answer.

1.	1. Acceleration	2. Braking	
2.	1. Triangulation	2. Coordinate	3. Offset
3.	1. Gap skid	2. Skip skid	3. Tire mark
4.	1. Rub-off	2. Imprint	3. Superimposed contact
5.	1. Furrow	2. Imprint	3. Tire print
6.	1. Coordinate	2. Offset	3. Triangulation
7.	1. Yaw mark	2. Tire print	3. Skid mark
8.	1. Tire grinding	2. Pavement grinding	3. Scratch
9.	1. Acceleration	2. Braking	
10.	1. Furrow	2. Rut	3. Tire print
11.	1. Contact	2. Induced	3. Both
12.	1. Contact	2. Induced	3. Both
13.	1. Controlled	2. Uncontrolled	
14.	1. Straight	2. Curved	3. Overlapping
15.	1. Left rotation	2. Right rotation	3. No rotation

II. Multiple Choice Questions:

Instructions: Choose the most correct answer and mark it on the answer sheet by darkening the selected alternative. There is only one correct answer.

16. Which of the following is the best statement concerning the importance of having investigators look for and analyze marks on the road at the accident scene?

    1. Marks are of little value unless there are concurring statements from unbiased witnesses.
    2. Marks on the road offer little proof of how the accident really happened.
    3. Marks on the road will help determine what happened.
    4. Marks cannot be used to assist in determining what happened unless the vehicle that made them can be identified.

17. Which of the following factors has the least influence on the distance a vehicle will skid?

    1. Wind resistance
    2. The pavement surface
    3. The weight of the vehicle
    4. The grade or slope of the road

18. Accurate measurements require that the accident investigator determine the distance between?

    1. The point where the shadow becomes visible to the terminal point of the black smear.
    2. The beginning of the shadow to the start of the black smear.
    3. The start of the smear to its point of termination.
    4. The estimated start of the skid and the end of the shadow.

19. Many factors influence the credibility of skidmark evidence. Which of the following would be considered the most important:

    1. The high visibility of the marks.
    2. Whether or not the officer had witnessed and accident.
    3. Associating the accident vehicle to the skid marks.
    4. The time elapsing between the accident and the investigation.

20. When the skidmarks left by a car are curved:

    1. Each should be measured in a straight line from one end to the other.
    2. Each should be measured along the curve.
    3. The distance should be measured from the center point of the car where it began to slide to the center point where it stopped sliding
    4. The longest skidmark should be measured along the curve.

21. A dent pressed into vehicle body parts by some stronger object which clearly shows its shape is called:

    1. Superimposed contact damage
    2. Collapse
    3. Imprint
    4. Intent

22. There are two types of damage to vehicles as a result of an accident. They are:

    1. Contact and direct
    2. Direct and induced
    3. Initial and direct
    4. Contact and induced

23. Which is the better measuring method to use when locating spots that are more than 30 feet from the roadway?

    1. Coordinate
    2. Triangulation
    3. Off set
    4. Angulation

24. When using the triangulation method of measuring to locate vehicles, objects, etc., all but one of the following apply. Identify that one.

    1. Select temporary points for two locations and a fixed object at the third.
    2. Measure one triangle to locate each spot.
    3. Select fixed points for two corners and a temporary object at the third.
    4. Avoid flat or skinny triangles whenever possible.

25. What is the minimum number of spots you must measure in locating an automobile?

    1. One
    2. Two
    3. Three
    4. Four

26. Measurements which should be taken first at the scene of an accident are:

    1. Certain marks or residues of a temporary nature.
    2. The point of impact.
    3. The greatest distances which have to be measured.
    4. The "framework" of streets and fixed objects into which all accident measurements will fit.

27. An investigator paced a distance as 66 paces. Later, to convert this measurement to feet, the investigator should:

    1. Multiply 66 by three feet.
    2. Step off 66 paces from a mark and tape the distance.
    3. Measure one of his paces and multiply this by 66.
    4. Multiply 66 by the average length of his pace.

28. All but one of the following should appear on the field sketch. Identify that one.

    1. Date of the accident.
    2. Scale of the sketch.
    3. Direction of north.
    4. Name of person(s) making sketch.

29. Photos are of great assistance to the accident investigator for which of the following reasons:

    a. They can describe vehicle damage which would take much time to describe in words.
    b. They can verify facts about an accident which may be in question.
    c. They help us remember, in greater detail, things we did see.

    1. A only
    2. B only
    3. C only
    4. A and B
    5. A, B, and C

30. When estimating speed from skidmark evidence, it is important to remember that the speed computed represents the:

    1. Minimum speed of the vehicle prior to the accident.
    2. Maximum speed of the vehicle prior to the accident.
    3. Exact speed of the vehicle prior to the accident.
    4. Actual speed of the vehicle at time of collision.

31. On a road surface with a drag factor of .60, the minimum speed of a vehicle which laid down 90 feed of skidmark is:

    1. 40 MPH
    2. 45 MPH
    3. 50 MPH
    4. 55 MPH

32. An investigator measured accident skidmarks and found the average length to be 155 feet. The accident vehicle was traveling up a 5 percent grade when it laid down the skidmarks. The investigator laid down a set of test skids on a level stretch of road with the same type of surface and conditions as the accident location. Speed for the test skid was 30 MPH and "d" was 50 feet. What was the minimum speed of the accident vehicle?

    1. 45 MPH
    2. 50 MPH
    3. 55 MPH
    4. 60 MPH

33. Using a computed drag factor of .63, compute the minimum speed of a vehicle which laid down a 65-foot skidmark.

    1. 30 MPH
    2. 35 MPH
    3. 38 MPH
    4. 42 MPH

34. What is the drag factor of a road surface when a test skid at 25 MPH produced a skidmark of 34 feet?

    1. .55
    2. .61
    3. .65
    4. .70

35. An investigator measured a set of yaw marks at an accident scene which produced the following data: R=200 feet, M= +.03. Test skids were made on a level stretch of road with the same surface conditions as the accident location. Test skid speed was 30 MPH, "d" was 50 feet. What was the slideslip speed of the accident vehicle?

    1. 43 MPH
    2. 38 MPH
    3. 50 MPH
    4. 53 MPH

36. An investigator measured a set of straight accident skidmarks on a level road surface with the following results: RF 112º, RR 106º, LF = 0º, LR = 124º. Which of the following properly represents the average sliding distance of the accident vehicle?

    1. 116 feet
    2. 224 feet
    3. 85.5 feet
    4. 124 feet

37. If a driver has a reaction time of 1.5 seconds, what is his reaction distance when his speed is 40 MPH?

    1. 88 feet
    2. 59 feet
    3. 95 feet
    4. 54.2 feet

38. The driver of every motor vehicle shall report forthwith to the nearest or most convenient police station:

    1. An accident resulting in injury or death of any person, or total damage to any one vehicle to an apparent extent of $200 or more that occurred only on private property.
    2. Any accident involving two or more motor vehicles.
    3. An accident resulting in injury or death of any person or total damage to all property to an apparent extent of $200 or more.
    4. Any accident on a highway or private property when such property is open to the general use of the public.

39. An inherent characteristic of an automobile which affects the probability of an accident is properly identified as:

    1. An attribute
    2. A remote factor
    3. A modifier
    4. A hazard

40. The event which finalizes the forces of an accident situation is:

    1. First harmful event
    2. Stabilization or stopping
    3. Disengagement
    4. Last contact

41. Skidmarks at the scene of an accident may show all but one of the following. Identify that one:

    1. Position of the vehicle on the road.
    2. Point of initial contact.
    3. The exact speed that the vehicle was traveling at the time of the accident.
    4. Evasive actions of the driver.

III. <u>True or False Questions</u>:

<u>Instructions</u>: Darken the "T" or "F" alternative, depending on whether you believe the answer to be true or false.

42. Skidmarks at an accident scene indicate that only two wheels locked and the two remaining wheels continued to roll free. If the two rear wheels locked and the two front wheels remained free-rolling, the vehicle would slide straight.

43. Controlled final positions should be noted but are less significant than uncontrolled final positions.

44. When measuring for total lengths of skidmarks, investigators should include any and all "gaps" in their measurements.

45. Black skidmark "smears" left on a roadway surface indicate the entire distance it takes a car to stop.

46. The shadow or polishing effect preceding black skidmark smears should be included in skidmark measurement.

47. Front wheel marks are usually somewhat narrower and less distinct than back wheel marks.

48. "Skips" in a skidmark can indicate that the non-rotating tire has passed over something, causing the tire to become airborne momentarily.

49. The temporary nature of skidmarks demands that they be given immediate attention.

50. Chips and chops are nearly always made during maximum engagement and mark a spot on the road where the corresponding part of the vehicle was when maximum engagement occurred.

51. From close examination of the grooves, you can usually determine the direction of motion of the part making the groove.

52. An accurate reconstruction of the accident can be made using the location of the debris.

53. A well-defined heap of underbody debris may indicate little or no movement of the vehicle after impact.

54. The primary reason an investigator should examine debris at an accident scene is to determine the point of initial contact.

55. Bent and broken guardrails, posts, and other fixed objects can be quite significant in revealing how an accident happened.

56. It is usually impossible to determine speed estimates from flips or falls.

57. Ragged tears in sheet metal are a characteristic of induced damage.

58. Damage to a windshield which produces parallel or cross-hatched cracks is properly identified as induced rather than contact damage.

59. During your investigation of an accident, you learn that an unidentified vehicle forced vehicle #1 off the road. There was no collision between the unidentified vehicle and vehicle #1. The unidentified vehicle is referred to as a non-contact unit.

60. Clear, unsmeared imprints would indicate a partial impact rather than full impact.

61. Overlap is the contact damage shown on two vehicles indicating how far each extended across the other during collision.

62. The nature and extent of collapse can indicate direction of travel and position at collision.

63. The force against a traffic unit considered to be concentrated on a particular point at any time during a collision is known as thrust.

64. If we know the direction of thrust against each vehicle, we can determine the angle of the vehicles to each other.

65. When using the triangulation method, you should measure two triangles for every spot you want to locate.

66. Superelevation is the measurement of rise per foot of width of the roadway on a curve.

67. The object in making urgent measurement is simply to locate temporary and short-lived positions with respect to objects or landmarks which will be permanent and which can, therefore, be located much later if necessary.

68. The radius of a curve will be approximately 36 feet when the chord length is 42 feet and the middle ordinate is 6 feet.

69. The point of impact is an adequate spot to make measurements from.

70. Reconstruction of the accident (to find out how it happened) is usually based upon measurements made at the accident scene.

71. In determining the radius of a curve, the entire length of the curve needs to be measured.

72. According to the text, a measurement of 5 feet and 6 inches should be recorded on the field sketch as 5' 6".

73. In court, it is important that the investigating officer be able to diagram the accident on a blackboard.

74. Photographs are admissible in evidence only when no one objects at the trial to their introduction into evidence.

75. Skidmark evidence found at the scene of a traffic accident may be used to determine the maximum speed of a vehicle prior to the collision.

76. The coefficient of friction is the amount of friction generated between the brake shoes and the brake drums.

77. To compute the "coefficient of friction," the investigation requires that test skid be made at a controlled speed in the vicinity of the accident scene.

78. Test skids have no validity unless the test skids are made at the same location as that of the accident.

79. To properly compute the minimum initial speed of a vehicle which laid down skidmarks on two different surfaces, it is necessary to compute the minimum speed for each surface and add the two speeds together.

80. When calculating the speed of a vehicle that slid down a road with a 6% downgrade, the 6% is not considered as that variable is already compensated for in the basic speed formula.

81. A velocity above which a particular highway curve cannot be negotiated by a motor vehicle without yaw is called traction instability.

82. A car and driver together weigh 3,000 pounds and give a test skid 30 feet long from a known speed. If six additional passengers weighing a total of 1,000 pounds are added to the car, and all other conditions remain the same, the test skid would be approximately 40 feet long.

83. A six-tire two-axle truck (dual wheels on rear axle) will skid approximately two-thirds the distance the same truck would skid if it were equipped with single tires on the rear axle.

84. A vehicle traveling at 65 MPH on a surface with a drag factor of .55 will leave approximately 210 feet of skidmarks.

85. A test skid made at 30 MPH on a surface with a drag factor of .67 will produce a skidmark approximately 45 feet long.

86. A vehicle traveling at a speed of 62 MPH will have a velocity of approximately 92 feet per second.

87. A police officer may issue a citation to any driver of a motor vehicle involved in an accident when, based upon personal investigation, the officer has reasonable grounds to believe that an offense has been committed under the Motor Vehicle Code in connection with the accident.

88. The "single-cause concept" is usually a reliable analysis of a one-car accident.

89. If unfavorable weather conditions existed at the time of the accident, the investigator may assume that they materially contributed to the accident.

90. Attributes are permanent or temporary changes of the inherent characteristics of the trafficway, traffic unit, or person making a trip on a trafficway.

91. The inferences and conclusions of the accident investigator as to the "causes" of an accident are important and should be recorded.

92. Pedestrians cannot encroach on the path assigned to vehicles because vehicles are always required to yield the right-of-way to pedestrians.

93. The "point of perception" may follow the "point of no escape" in an accident situation.

94. Generally, in accidents involving two or more vehicles, the links in the chain of events are the same for each of the traffic units.

95. An accident begins to happen at the instant of impact or upset.

Traffic Accident Investigation I

Post-Test

I. Response to Media Items:

Instructions: As you view a media presentation of the items in this section of the test, choose the most correct answer and mark it on the answer sheet by darkening the selected alternative. There is only one correct answer.

1.	1. Acceleration	2. Braking	
2.	1. Triangulation	2. Coordinate	3. Offset
3.	1. Gap skid	2. Skip skid	3. Tire mark
4.	1. Rub-off	2. Imprint	3. Superimposed contact
5.	1. Furrow	2. Imprint	3. Tire print
6.	1. Coordinate	2. Offset	3. Triangulation
7.	1. Yaw mark	2. Tire print	3. Skid mark
8.	1. Tire grinding	2. Pavement grinding	3. Scratch
9.	1. Acceleration	2. Braking	
10.	1. Furrow	2. Rut	3. Tire print
11.	1. Contact	2. Induced	3. Both
12.	1. Contact	2. Induced	3. Both
13.	1. Controlled	2. Uncontrolled	
14.	1. Straight	2. Curved	3. Overlapping
15.	1. Left rotation	2. Right rotation	3. No rotation

II. Multiple Choice Questions:

Instructions: Choose the most correct answer and mark it on the answer sheet by darkening the selected alternative. There is only one correct answer.

16. Which of the following is the best statement concerning the importance of having investigators look for and analyze marks on the road at the accident scene?
    1. Marks are of little value unless there are concurring statements from unbiased witnesses.
    2. Marks on the road offer little proof of how the accident really happened.
    3. Marks on the road will help determine what happened.
    4. Marks cannot be used to assist in determining what happened unless the vehicle that made them can be identified.

17. Skidmarks at the scene of an accident:

    1. Can only be used if the vehicle that slid is found at rest on those skids.
    2. Can be used to show the exact speed that the vehicle was traveling at the time of the accident.
    3. Are useless unless there are four identifiable marks.
    4. Can be useful in determining initial position of vehicles.

18. The "shadow" of a skidmark is:

    1. The part of a skidmark in which a locked wheel loses contact with the ground when it bounces or skips.
    2. The indistinct part of a skidmark left before a tire becomes hot enough to smear.
    3. The distance through which brakes are slowing the vehicle before they are applied hard enough to lock the wheels.
    4. The superimposing of one skidmark on another.

19. Accurate measurements require that the accident investigator determine the distance between:

    1. The point where the shadow becomes visible to the terminal part of the black smear.
    2. The beginning of the shadow to the start of the black smear.
    3. The start of the smear to its point of termination.
    4. The estimated start of the skid and the end of the shadow.

20. When the skidmarks left by a car are curved,

    1. Each should be measured in a straight line from one end to the other.
    2. Each should be measured along the curve.
    3. The distance should be measured from the center point of the car where it began to slide to the center point where it stopped sliding.
    4. The longest skidmark should be measured along the curve.

21. During your investigation of an accident, you learn that an unidentified vehicle forced vehicle #1 off the road. There was no collision between the unidentified vehicle and vehicle #1. The unidentified vehicle is properly referred to as:

    1. A hit-and-run vehicle.
    2. A disengaged unit.
    3. An evasive action unit.
    4. A non-contact unit.

22. A dent pressed into vehicle body parts by some stronger object which clearly shows its shape is called:

    1. Superimposed contact damage
    2. Collapse
    3. Imprint
    4. Intent

23. There are two types of damage to vehicles as a result of an accident. They are:

    1. Contact and direct
    2. Direct and induced
    3. Initial and direct
    4. Contact and induced

24. The force against a traffic unit considered to be concentrated on a particular point at any time during a collision is known as:

    1. Thrust
    2. Collapse
    3. Velocity
    4. Momentum

25. When the accident scene is blanketed with heavy snow, the measuring method you are most likely to use is the ___________ method.

    1. Triangulation
    2. Coordinate
    3. Offset
    4. Angulation

26. "Super-elevation" is:

    1. A raised stretch of road over a railroad track.
    2. Slope measured across the road on a curve.
    3. A measure of the sharpness of a curve.
    4. Number of feet a road rises for each 100 level feet along the road.

27. Three or more spots are required to locate adequately:

    1. A human body
    2. Vehicles
    3. Curved tire marks (yaw mark)
    4. Gouges less than three feet long

28. When taking measurements at the scene of an accident, certain measurement priorities must be established. Of the following, which should be measured first?

    1. The "framework" of streets and location of fixed objects into which other measurements will fit.
    2. The greatest distances which will have to be measured.
    3. The point of impact.
    4. Certain marks or objects of a temporary nature.

29. Determine the radius of a curve when the chord is 50 feet and the middle ordinate is 6 feet. Compute to closest whole number.

    1. 55 feet
    2. 50 feet
    3. 45 feet
    4. 40 feet

30. Which one of the below would not be adequate to make measurements from?

    1. Roadway edges
    2. Point of impact
    3. Manhole covers
    4. Curbs

31. When "pacing" a distance, the investigator should try to maintain a pace of:

    1. 12 inches
    2. 30 inches
    3. 36 inches
    4. No predetermined measure

32. All but one of the following should appear on the field sketch. Identify that one.

    1. Date of the accident
    2. Scale of the sketch
    3. Direction of north
    4. Name of person(s) making sketch

33. According to the text, how should a measurement of 5 feet and 6 inches be written on a field sketch?

    1. 5' 6"
    2. 5½ feet
    3. $5 \underline{6}$
    4. 66"

34. Photographs are admissible in evidence only when:

    1. The photographer is first called to testify.
    2. They are not gruesome or bloody.
    3. They are material and relevant to the issues in the case, and a proper foundation is laid for their introduction.
    4. No one objects at trial to their introduction into evidence.

35. In estimating speed from skidmarks, it is important to remember that you are determining the:

    1. Exact speed of the vehicle prior to the accident.
    2. Maximum speed of the vehicle prior to the accident.
    3. Minimum speed the vehicle would have to be traveling to result in the skidmarks observed.
    4. Actual crash speed.

36. The coefficient of friction is:

    1. The ratio of force necessary to slide an object at uniform speed on a surface to the pressure of the object against that surface.
    2. The amount of friction generated between the brake shoes and the brake drums.
    3. The amount of grade, either plus or minus.
    4. The amount of buckling that occurs when objects collide.

37. When accident skidmarks transverse two or more kinds of road surface, the investigator must measure and record skidmark lengths on each surface because:

    1. The "combined speed" formula uses the average drag factor of the two surfaces.
    2. Knowledge of how far the vehicle slid on each surface is needed in order to make a reasonably accurate estimate of minimum speed.
    3. It preserves continuity of skidmark evidence.
    4. Such measurements are necessary to show path of vehicle travel.

38. When calculating the speed of a vehicle that slid down a road with a 6% downgrade:

    1. .06 is added to the coefficient of friction.
    2. The 6% is not considered as that variable is already compensated for in the basic speed formula.
    3. .06 is subtracted from the measured skid distance.
    4. The 6% is not considered if, to determine the coefficient of friction, the test skid is made down the same grade.

39. A velocity above which a particular highway curve cannot be negotiated by a motor vehicle without yaw is called:

    1. Traction instability
    2. Grade and/or slope
    3. Crucial event
    4. Critical speed

40. An investigator measured a set of accident skidmarks and computed "d" to be 175 feet. The accident vehicle was traveling up a 10% grade when it laid down the skidmarks. The investigator conducted a set of test skids at the same location and in the same direction as the accident skidmarks. Speed of the test skid was 30 MPH, and "d" was 40 feet. The minimum speed of the accident vehicle was:

    1. 48 MPH
    2. 52 MPH
    3. 58 MPH
    4. 63 MPH

41. Compute the minimum initial speed of a vehicle that laid down 90 feet of locked wheel skidmarks on a pavement surface having a coefficient of friction of .72.

    1. 37 MPH
    2. 40 MPH
    3. 44 MPH
    4. 54 MPH

42. What is the drag factor of a road surface when a test skid of 30 MPH produces a skidmark of 49 feet?

    1. .75
    2. .68
    3. .61
    4. .54

43. An investigator measured a set of yaw marks at an accident scene which produced the following data: R = 300 feet, M = +.05. Test skids were made on a level stretch of road with the same surface conditions as the accident location. Test skid speed was 35 MPH, "d" was 59 feet. What was the sideslip speed of the accident vehicle?

    1. 48 MPH
    2. 52 MPH
    3. 57 MPH
    4. 62 MPH

44. An investigator measured a set of straight accident skidmarks on a level road surface with the following results: RF = $110^{\underline{8}}$, RR = $106^{\underline{0}}$, LF = $122^{\underline{4}}$, LR = $0^{\underline{0}}$. Which of the following properly represents the average sliding distance of the accident vehicle?

    1. 112.66 feet
    2. 84.75 feet
    3. 84.50 feet
    4. 113.00 feet

45. A vehicle with a speed of 45 MPH is traveling at a speed of ____ feet per second (FPS).

    1. 38 FPS
    2. 45 FPS
    3. 54 FPS
    4. 66 FPS

46. If a driver has a reaction time of 1.2 second, what is his reaction distance when his speed is 30 MPH?

    1. 36 feet
    2. 52.8 feet
    3. 25.6 feet
    4. 0.48 feet

47. A driver of a motor vehicle collides with another vehicle in the yard of a private residence not open to the public. The driver:
    1. Must report the accident to the police if the owner cannot be located.
    2. Must report the accident to the police even if the owner is located if there is over $200 damage.
    3. Has no obligation to report it to the police under any circumstances because the accident occurred on private property.
    4. None of the above.

48. The event in the accident which stabilizes the accident situation is:
    1. The first harmful event
    2. Initial contact
    3. Disengagement
    4. Stopping

49. When one vehicle crosses over into the wrong side of the road and occupies the path assigned to another vehicle, this is referred to as:
    1. Encroachment
    2. Maximum engagement
    3. First harmful event
    4. Point of no return

III. True or False Questions:

Instructions: Darken the "T" or "F" alternative, depending on whether you believe the answer to be true or false.

50. It is very important at the scene of the accident to determine exactly how all marks on the road were made.

51. It is important to determine if the final position is uncontrolled or controlled, because an uncontrolled final position after the accident will indicate more about how the accident happened than a controlled final position.

52. To determine minimum initial speed, the officer should include any and all gaps in his measurements as part of the overall skid.

53. Skidmarks at an accident scene indicate that only one wheel locked and the other three remained free-rolling. If only the right front wheel remained locked, the vehicle would turn clockwise.

54. The character of the road surface has more effect on the length of a skidmark than does the tread pattern of the tire.

55. The essential difference between tire prints and skidmarks exists because the tire prints are made by rolling wheels while skidmarks are caused by sliding wheels.

56. Skidmarks at the scene of an accident are not useful unless the vehicle which made them is found at rest at the end of those skidmarks.

57. Gaps in skidmarks are generally 10 feet or longer.

58. Scratches and scrapes are made with such great pressure that the depressions can easily be felt with the fingers.

59. From chop gouges it is generally impossible to determine the direction of motion of the part making the chop.

60. The location of debris is a good indicator of where the collision took place.

61. The primary reason an investigator should examine debris at an accident scene is to determine the point of initial contact.

62. For speed estimation the officer must note how many times a vehicle has flipped.

63. It is usually impossible to determine speed estimates from flips and falls.

64. Induced damage is indicated by closely compacted, crumpled body parts with fine hard scratches in the surface of the metal.

65. Contact damage usually makes "spider-web" or circular cracks in windshields.

66. A partial impact between two vehicles can result in very clear and distinct imprints.

67. When two or more separate collisions cause damage on the same area on the same vehicle, it is known as superimposed contact damage.

68. Eccentric force on a vehicle is force directed toward the center of mass which will not cause the vehicle to rotate.

69. Grass pinched between the tire and wheel would indicate that the vehicle moved violently sideways.

70. When using the coordinate method, measurements should be at right angles from the reference point to the object being located.

71. When using triangulation to locate points on an accident diagram, the investigator should select permanent points for two corners and a temporary object for the third corner.

72. The prime purpose of measurement is to be able to relocate the position of the cars and bodies on the road at a later date.

73. The objective in making urgent measurements is simply to locate temporary and short-lived positions with respect to landmarks which will be permanent and which can, therefore, be located later.

74. Reconstruction of the accident (to find out how it happened) is nearly always based upon measurements made at the accident scene.

75. In determining the radius of a curve, the entire length of the curve needs to be measured.

76. The principal value of a photograph taken in an accident investigation is in helping to prove a point which may be open to question.

77. When photographing final positions at an accident scene, it is important to include some of the roadway and recognizable landmarks in the vicinity.

78. The speed computed from accident skidmarks represents only a part of the actual speed of the vehicle just before the brakes were applied.

79. The drag factor (coefficient of friction) of a road surface can best be established by consulting the table of drag factors in J. S. Baker's text, Traffic Accident Investigation Manual.

80. The accident investigator must know the reaction time of the driver involved to accurately estimate speed from skidmarks.

81. A test skid made with only one person in a car will produce a skidmark about 30% shorter than one with six people in the car.

82. Unless there are four distinctive marks, skids are of no value as evidence.

83. The minimum speed of a vehicle which laid down a skidmark of 125 feet in length on a surface with a drag factor of .60 would be approximately 52 MPH.

84. At a speed of 30 MPH on a surface with a drag factor of .75, the sliding distance will be approximately 47 feet.

85. With drag factor of .75 and a speed of 40 MPH, the skidding distance of a vehicle would be approximately 67 feet.

86. A police officer may issue a citation to any driver of a motor vehicle involved in an accident when, based upon personal investigation, the officer has reasonable grounds to believe that an offense has been committed under the Motor Vehicle Code in connection with the accident.

87. The "single cause" concept in traffic accidents is valid if its use is restricted to one-vehicle accidents.

88. The chain of events for each traffic unit involved must be studied if the "causes" of the accident are to be determined.

89. When determining "causes" of a traffic accident, the investigator should not be primarily concerned with whether or not a violation can be proved.

90. Any circumstance contributing to an accident can be spoken of properly as a "cause" or one of the "causes" of an accident.

91. Operational factors often explain the "how" of the accident, while condition factors will frequently explain the "why."

92. A modifier is of permanent nature only, so the investigator should not devote time to looking for temporary modifiers when determining condition factors.

93. "Non-contact" traffic units contributing to an accident situation must be considered when determining "causes."

94. There must be proper evasive action in order to avoid expected or unexpected hazards.

95. An accident begins to happen at the instant of impact or upset.

APPENDIX E

STUDENT COURSE EVALUATION QUESTIONNAIRE

APPENDIX E

Traffic Accident Investigation Training

Student Course Evaluation

Please be frank and honest in your answers. Please answer every item.

Scale being used is: 5--If you strongly agree with the statement
4--If you agree with the statement
3--If you neither agree nor disagree
2--If you disagree with the statement
1--If you strongly disagree with the statement

Please mark the position on the answer sheet that most closely reflects your answer.

		SD	D	N	A	SA
1.	Generally, my knowledge of traffic accident investigation was increased.	1	2	3	4	5
2.	I developed my ability to conduct comprehensive on-scene traffic accident investigations.	1	2	3	4	5
3.	I would recommend this course to someone else.	1	2	3	4	5
4.	I was interested in learning the course material.	1	2	3	4	5
5.	This course was very well organized.	1	2	3	4	5
6.	The objectives of the course were clearly explained.	1	2	3	4	5
7.	The amount of material covered in the course is reasonable.	1	2	3	4	5
8.	The instructors stressed important points in lectures or discussions.	1	2	3	4	5
9.	The instructors put material across in an interesting way.	1	2	3	4	5
10.	I generally found the coverage of topics in the assigned readings not too difficult.	1	2	3	4	5
11.	The instructions given prior to the field exercises were clear and precise.	1	2	3	4	5

		SD	D	N	A	SA
12.	The field exercises were worthwhile in terms of time spent and information gained.	1	2	3	4	5
13.	I would encourage the continuance of application exercises in future offerings of the course.	1	2	3	4	5
14.	The media presented was well organized and related to the lecture material.	1	2	3	4	5
15.	The student manual will be useful as a future reference.	1	2	3	4	5

Comments: ____

____

____

____

____

____

APPENDIX F

STUDENT FOLLOW-UP QUESTIONNAIRE

APPENDIX F

Dear Officer:

Approximately four months ago you completed a traffic accident investigation course entitled AI-1, which was offered by the Highway Traffic Safety Center, Michigan State University. The Center, in its effort to improve upon its services, needs to obtain some follow-up information from you and the others who have been through the program. A questionnaire which asks about material that we think important has been enclosed. The questions deal with the experiences you have had since the AI-1 training.

Please give us your help by taking a few minutes to respond and mail back this form in the stamped, self-addressed envelope. It will only take about 10 minutes. Add any comments that you would like. I look forward to hearing from you soon.

Sincerely,

Terry M. Nerbonne

TMN:BB

Enclosures

Dear Officer:

I recently sent you a questionnaire relating to the Traffic Accident Investigation Course AI-1, which you completed a few months ago.

Since I have not received your response, I am again asking your cooperation. It is imperative that we receive as much follow-up information as possible so that we can make improvements upon our services and future course offerings.

I have enclosed another questionnaire and a self-addressed envelope for your convenience. Please give us a few minutes of your time by filling it out and sending it on its way. Any additional comments will be appreciated.

Thank you again for your cooperation.

Sincerely,

Terry M. Nerbonne

tmn:bb

enclosure

Traffic Accident Investigation I

This evaluation instrument is for the purpose of:

1. Determining the most effective training delivery format.
2. Determining if AI-1 fulfills officer needs.
3. Determining how the AI-1 training is being utilized.
4. Determining officer AI performance since completion of AI-1.
5. Improving future offerings of AI-1.

Instructions:

1. Please write your name, your title/position, department name, and date in the spaces provided below.
2. Please answer all questions.
3. When answering specific questions, place a check (✓) in the appropriate box and when asked to explain please be as specific as possible.
4. Any additional comments you wish to make about the course, instructors, training format, or this evaluation questionnaire are welcome and may be written on the insert page titled "Additional Comments."
5. When you have completed this "Questionnaire" and "Additional Comments" sheet, please return them by mail in the enclosed self-addressed, stamped envelope.

Your name ______________________________

Department name ______________________________

Title/position ______________________________

Today's date ______________________________

AI-1 course location ______________________________

Course date ______________________________

I. Information Regarding Course Format

A. Which format of the AI-1 training did you attend?

____ 1. 1 day a week for 5 weeks
____ 2. 2 days a week for 3 weeks
____ 3. 5 consecutive days

B. Was the format satisfactory in terms of:

1.	Time of year	___ Yes	___ No
2.	Day(s) of week	___ Yes	___ No
3.	Time to complete assignments	___ Yes	___ No

C. Is there a training delivery format that would better meet your needs? ___ Yes ___ No

If yes, explain:

II. Information Regarding Accident Investigation Performance

A. List the approximate number of accidents you have investigated since completing AI-1.

Property damage __________
Personal injury __________
Fatal __________

B. Have you received any feedback that would indicate that the quality of <u>your</u> accident investigations has improved, since the completion of AI-1, such as comments from:

___ Other officers	___ Your supervisors	___ Drivers
___ Prosecuting attorneys	___ Insurance reps.	___ Courts
___ General public	___ Other __________	___ Media reps.
___ Your chief/sheriff		

C. Do you believe the quality of your accident investigation work has improved since completion of AI-1? ___ Yes ___ No

If no, explain:

D. Do you feel that due to the AI-1 training you are now more competent to:

1.	Reconstruct the accident scene	___ Yes	___ No
2.	Determine fault	___ Yes	___ No
3.	Determine specific violations	___ Yes	___ No
4.	Present more effective evidence in court	___ Yes	___ No

E. Since completion of AI-1 have you:

1. Determined grade or superelevation? ___Yes ___No
2. Used the AI-1 technique of recording feet and inches? ___Yes ___No
3. Used a photolog? ___Yes ___No
4. Completed a vehicle damage record form? ___Yes ___No
5. Used a nomograph to determine speed? ___Yes ___No
6. Used the traffic template? ___Yes ___No
7. Requested additional accident investigation information? ___Yes ___No
8. Obtained additional accident investigation information? ___Yes ___No

F. Since the completion of AI-1, on the average do you spend:

___ less time ___ the same time ___ more time

investigating accidents, and the results that you get for the time that you spend are:

___ less ___ the same ___ more/better

G. Does your department limit the amount of time (e.g., 30 minutes for a property damage accident) the investigating officer has to conduct on-scene investigations of:

1. Property damage accidents ___Yes ___No
2. Personal injury accidents ___Yes ___No
3. Fatal accidents ___Yes ___No

If yes, please state the maximum time allotment for each.

H. How are time limitations for the purpose of accident investigation (PD-PI-F) determined?

___ Formal/written policy
___ Supervisory discretion
___ None
___ Informal/unwritten policy
___ Investigating officer discretion

I. Has your work assignment been changed following successful completion of AI-1? ___Yes ___No

If yes, explain:

III. Information Regarding Future Needs for Training

A. Would you have an interest in taking part in future accident investigation courses (AI-2) if offered? ___Yes ___No

If yes, check what types of subjects you would like to see included in future courses:

___ Preparation of scale diagrams
___ Speed determination
___ Photography
___ Tire evaluation
___ Lamp analysis
___ Scientific reconstruction
___ Case studies
___ Other, explain ________
____

IV. Instructions for Completion of Page 5

When responding to page 5, read Column A first; then proceed to move down the row beginning with #1 until completing #18. Now proceed to Column B. Read the question in Column B. Proceed to move down the row, checking the appropriate box until you have responded to all 18 row items. Then proceed to Column C and then Column D.

Row	Column A (Before) Did you use this skill prior to AI-1?		Column B (After) Have you used this skill since completion of AI-1?		Column C (Frequency) Do you use this skill more often since completion of AI-1?		Column D (Improvement) Have your abilities improved in this skill as a result of AI-1?	
	Yes	No	Yes	No	Yes	No	Yes	No
1. Coordinate measurements								
2. Triangulation measurements								
3. Symbols and abbreviations								
4. Table of measurements								
5. Photography								
6. Sketching accident scene								
7. Measuring tiremarks								
8. Controlled and uncontrolled position of vehicles and bodies								
9. Sketching damage to vehicle								
10. Determining type of vehicle damage								
11. Determining direction of thrust								
12. Determining direction of rotation								
13. Identifying metal scars								
14. Collecting physical evidence								
15. Determining type of tiremark								
16. Conducting test skids (drag factor)								
17. Determining radius of curve								
18. Determining speed from tiremarks								

APPENDIX G

CONTINGENCY TABLES COMPARING EACH OF THE TWELVE BACKGROUND VARIABLES WITH POST-TEST SCORES

APPENDIX G

Table G.1.--Age vs. post-test.

Age	Post-Test Categories[a]			Total
	Low (77 or less)	Medium (78 to 82)	High (83 or more)	
27 and below	8[b]	16	12	36
28 to 34	16	13	15	44
35 and above	15	13	6	34
Total	39	42	33	114

[a]Throughout Appendix G, the post-test score range was divided into three categories. Students scoring 77 and below were classified as low. Those scoring from 77 to 82, inclusively, were assigned to the medium category. All others scoring 83 and above were classified as high.

[b]The values in the tables are the number of students in each table cell based on the two-way classification.

Table G.2.--Department type vs. post-test.

Type of Department	Post-Test Categories			Total
	Low (77 or less)	Medium (78 to 82)	High (83 or more)	
Municipal	13	21	16	50
Non-municipal	26	21	17	64
Total	39	42	33	114

Table G.3.--Department size vs. post-test.

Size of Department	Post-Test Categories			Total
	Low (77 or less)	Medium (78 to 82)	High (83 or more)	
50 or less	15	15	18	48
51 to 100	13	15	7	35
101 or more	11	12	8	31
Total	39	42	33	114

Table G.4.--Years worked in law enforcement vs. post-test.

Years Worked	Post-Test Categories			Total
	Low (77 or less)	Medium (78 to 82)	High (83 or more)	
4 or less	10	10	13	33
5 to 8	14	16	11	41
9 or more	15	16	9	40
Total	39	42	33	114

Table G.5.--Education level vs. post-test.

Education	Post-Test Categories			Total
	Low (77 or less)	Medium (78 to 82)	High (83 or more)	
High school	11	10	10	31
Some college	24	22	9	55
Baccalaureate +	4	10	14	28
Total	39	42	33	114

Table G.6.--Primary assignment vs. post-test.

Assignment	Post-Test Categories Low (77 or less)	Medium (78 to 82)	High (83 or more)	Total
Patrol	15	24	26	65
Non-patrol	24	18	7	49
Total	39	42	33	114

Table G.7.--Number of fatal accidents investigated vs. post-test.

K	Post-Test Categories Low (77 or less)	Medium (78 to 82)	High (83 or more)	Total
Zero	23	18	18	59
Some	16	24	15	55
Total	39	42	33	114

Table G.8.--Number of personal injury accidents investigated vs. post-test.

PI	Post-Test Categories Low (77 or less)	Medium (78 to 82)	High (83 or more)	Total
8 or less	16	8	11	35
9 to 20	11	20	6	37
21 or more	12	14	16	42
Total	39	42	33	114

Table G.9.--Number of property damage accidents investigated vs. post-test.

PD	Post-Test Categories Low (77 or less)	Medium (78 to 82)	High (83 or more)	Total
24 or less	17	10	10	37
25 to 70	12	19	7	38
71 or more	10	13	16	39
Total	39	42	33	114

Table G.10.--Total amount of training in traffic accident investigation vs. post-test.

Total Training	Post-Test Categories Low (77 or less)	Medium (78 to 82)	High (83 or more)	Total
Zero to 12	34	23	20	77
12 plus	5	19	13	37
Total	39	42	33	114

Table G.11.--Motivational level vs. post-test.

Motivation	Post-Test Categories Low (77 or less)	Medium (78 to 82)	High (83 or more)	Total
Request	17	15	9	41
Option	10	20	22	52
Required	12	7	2	21
Total	39	42	33	114

Table G12.--Interest level vs. post-test.

Interest	Post-Test Categories Low (77 or less)	Medium (78 to 82)	High (83 or more)	Total
Extreme	17	20	10	47
Less	22	22	23	67
Total	39	42	33	114

APPENDIX H

WRITTEN COMMENTS ON THE STUDENT

COURSE EVALUATION QUESTIONNAIRE

APPENDIX H

School 1--Jackson Community College

1. I would like to see more time for field exercises. Further, I would prefer a course of continuous days rather than five in one month.

2. More wet, less dry.

3. Don and Dan did a very good job, considering the class makeup.

4. Good course, learned a lot.

5. This class needs at least two more days.

6. I do not agree with the math section left until the last day. Too difficult for a non-mathematical individual such as I to comprehend without more time.

7. Would prefer five consecutive days instead of one day each week for five weeks.

School 2--Muskegon Community College

1. Much easier to pick up in classroom presentation than trying to read and understand textbook.

2. Too rushed at field exercises at times.

3. Field exercises could be used more often.

4. Too much material covered in too little of time. More field exercising in skid marks would have been helpful.

5. Unit #7 should have been 1st.

6. This course has helped a great deal in accident investigating.

7. This class is an excellent building ground in which to become a much more competent accident investigator. Experience is the best teacher, once you get the basics down.

8. More time spent on formulas possibly extend course to seven or eight days to accomplish this.

9. Very well organized instructors. All very well versed in field of accident investigation.

10. Too much reading off the outline from the overhead--can't instructors lecture without reading word for word off outline.

School 3--Madonna College

1. Thanks all, believe me I needed this.

2. Overall impression of this course is very impressive; if minor details could have been worked out the course would have been perfect.

3. Friday a bit hectic.

4. Excellent class.

5. #13-team partners had a tendency to want to rush through field exercises resulting in erroneous conclusions and restricting participation of some members of the team. More control over functions of individual teams by the staff would be beneficial.

6. I only wished it had not rained on the day of veh. evaluation. Possible obtaining a damaged motorcycle for inside field exercises.

7. Thanks for everything.

8. #12 were well planned and good exercises. The only drawback was time did not permit us to do the critiques.

9. A very good course.

10. Course should be longer than five days.

School 4--Lake Superior College (Soo)

1. A must for all accident investigators--I hope to take AI-2.

2. Excellent course.

3. Good school.

4. Very good course (2).

5. The amount of material presented should require more field training.

6. The course was well organized and it was obvious that both instructors had a lot of knowledge in the area. The class was interesting and kept interesting by the instructors. I came to class with some knowledge of fatal accident investigation and when I left I felt I gained a great deal more knowledge. I feel confident now in going to an accident scene and being able to conduct an organized, good investigation. Looking forward to AI #2.

7. Five straight days is a bit too much. I think I could have learned more if I had more time to read the text between classes. I would like to continue in the series of courses.

School 5--Lake Michigan Community College

1. I found AI-1 to be of value to me as a traffic officer; however, I think the following courses are needed to make the class truly effective.

2. I personally think the knowledge I have obtained will greatly help me not only in investigating accidents, but will benefit my department.

3. An informational and well-instructed course.

4. Excellent school.

5. I was sorry we broke the class into weeks. It should be put all together, easier to absorb.

6. Would be nice to have more time for some topics.

7. Well organized and instructed.

BIBLIOGRAPHY

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Books

Backstrom, C. H., and Hursh, G. D. Survey Research. Evanston, Ill.: Northwestern University Press, 1963.

Baker, J. Stannard. Traffic Accident Investigation Manual. Evanston, Ill.: Northwestern University Press, 1975.

Blalock, Hubert M., Jr. Social Statistics. New York: McGraw-Hill Book Company, Inc., 1960.

Borg, Walter R., and Gall, Meredith D. Educational Research. New York: David McKay Company, Inc., 1973.

Campbell, Donald T., and Stanley, Julian C. Experimental and Quasi-Experimental Designs for Research. Chicago: Rand McNally College Publishing Company, 1963.

Dixon, Wilfrid J., and Massey, Frank J. Introduction to Statistical Analysis. New York: McGraw-Hill Book Company, Inc., 1957.

Doby, John T. An Introduction to Social Research. New York: Appleton-Century-Crofts, 1967.

Ebel, Robert L. Essentials of Educational Measurement. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972.

________. Measuring Educational Achievement. Englewood Cliffs, N.J.: Prentice-Hall, 1965.

Glock, Charles Y. Survey Research in the Social Sciences. New York: Russell Sage Foundation, 1967.

Good, Carter, and Scates, Douglass. Methods of Research. New York: Appleton-Century-Crofts, Inc., 1954.

Gronlund, Norman E. Constructing Achievement Tests. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1968.

Hays, William L. Statistics for the Social Sciences. 2nd ed. New York: Holt, Rinehart and Winston, Inc., 1973.

Kerlinger, Fred M. Foundations of Behavioral Research. New York: Holt, Rinehart and Winston, Inc., 1973.

Kirkpatrick, Donald L. Evaluating Training Programs. Madison, Wisc.: Training and Development, Inc., 1975.

Marshall, J. C., and Hales, L. W. Classroom Test Construction. Menlo Park, Calif.: Addison-Wesley Publishing Company, 1971.

Stone, Eugene. Research Methods in Organizational Behavior. Santa Monica, Calif.: Goodyear Publishing Company, Inc., 1978.

Thorndike, Robert L. Educational Measurement. 2nd ed. Washington, D.C.: American Council on Education, 1971.

Tyler, L. E. Tests and Measurements. 2nd ed. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1971.

Periodicals

Catalanello, R. F., and Kirkpatrick, D. L. "Evaluating Training Programs--The State of the Art." Training and Development Journal (May 1968): 2-9.

Deveny, J. J., and Bookout, J. C. "The Intensive Language Course, Toward a Successful Approach." Foreign Language Annuals 9 (1976): 58-63.

Epperson, W. V., and Peck, R. C. "Questionnaire Response Bias as a Function of Respondent Anonymity." Accident Analysis and Prevention 9,4 (1977): 249-56.

Hefferlin, J. B. Lon. "Intensive Courses: An Old Idea Whose Time for Testing Has Come." Journal of Research and Development in Education 6 (1972): 83-97.

Kirkpatrick, Donald L. "Evaluating Training Programs: Evidence vs. Proof." Training and Development Journal (November 1977): 9-12.

________. "Techniques for Evaluating Training Programs." Training and Development Journal (June 1979): 78-92.

Kropp, R. P., and Hankin, E. K. "Paper and Pencil Tests for Evaluating Instruction." Training Directors Journal (November 1962).

Quensel, W. P. "How to Measure Program Effectiveness." Journal of Traffic Safety Education (April 1976): 6-7.

Rose, Homer C. "A Plan for Training Evaluation." Training and Development Journal (May 1968).

Scott, Owen. "A Comparison of Summer School and Regular Session Achievement in 11th Grade American History." _Journal of Educational Research_ 49 (1966): 235-37.

Smith, D. I. "Official Driving Records and Self-Reports as Sources of Accident and Conviction Data for Research Purposes." _Accident Analysis and Prevention_ 8 (1976): 207-11.

Solecki, J. J. "An Intensive Method of Language Teaching." _Foreign Language Annuals_ 4 (1971): 278-82.

Walker, R. W. "An Evaluation of Training Methods and Their Characteristics." _Human Factors_ 7 (1965): 347-54.

Wallace, John A. "Three Weeks Equals Thirty Weeks?--A Report on an Experimental Intensive January Language Course." _Foreign Language Annuals_ 6 (1972): 88-94.

Walsh, W. B. "Self-Report Under Socially Undesirable and Distortion Conditions." _Journal of Counseling Psychology_ 16 (1969): 569-74.

________. "Validity of Self-Report." _Journal of Counseling Psychology_ 14 (1967): 18-23.

________. "Validity of Self-Report: Another Look." _Journal of Counseling Psychology_ 15 (1968): 180-86.

Publications of Organizations

Armstrong, Robert J., and Jensen, John A. _The Accuracy of Student-Reported Grades on the ATP Student Descriptive Questionnaire_. The College Entrance Examination Board, January 1975.

Chabotar, Kent J., and Lad, Lawrence J. _Evaluation Guidelines for Training Programs_. East Lansing: Public Administration Programs, Department of Political Science, Michigan State University, 1974.

Doyle, R.; Moursi, M.; and Wood, D. _The Effects of Intensive Scheduling: A Field Experiment_. Mt. Pleasant: Institute for Personal and Career Development, Central Michigan University, 1979.

Goldberg, David. _Projects of Population and Employment in Michigan 1970-2000_. Ann Arbor: The Population Studies Center, University of Michigan, September 1978.

Highway Safety Policies for Police Executives. Gaithersburg, Md.: International Association of Chiefs of Police. Annually updated.

Law, Alexander I., and Bronson, William H. Program Evaluators Guide. The Evaluation Improvement Program, California State Department of Education, 1977.

MacGregor, Gay, and St. George, Arthur. Evaluation of State and Local Programs: A Primer. New Mexico State Planning Office, 1976.

Michigan Department of State Police. 1978 Michigan Traffic Accident Facts. East Lansing: Michigan Department of State Police, 1978.

Michigan State Economic Record 22 (May 1980). East Lansing: Division of Research, Graduate School of Business Administration, Michigan State University.

Powell, B. S. Intensive Education: The Impact of Time on Teaching. Newton, Mass.: Educational Development Center, 1976.

Student Reactions to Instruction. Memo to the Faculty, Center for Research on Learning and Teaching, The University of Michigan, Ann Arbor, 1976.

Whittenburg, J. A. et al. Driver Improvement Training and Evaluation. Final Report PB 234-078. Springfield, Va.: National Technical Information Service, 1974.

Other Sources

Conger, Anthony J.; Conger, Judith C.; and Riccobno, John A. National Longitudinal Study of the High School Class of 1972. Reliability and Validity of National Longitudinal Study Measures: An Empirical Reliability Analysis of Selected Data on a Review of the Literature on the Validity and Reliability of Survey Questionnaires. Bethesda, Md.: ERIC Document Reproduction Service, ED 151 396, 1976.

Doyle, Richard, and Yantes, John. Facilitating Non-Traditional Learning: An Update on Research and Evaluation in Intensive Scheduling. Bethesda, Md.: ERIC Document Reproduction Service, ED 144 459, 1977.

Dyer, Frederick and others. A Method for Obtaining Post Formal Training Feedback: Development and Validation. Bethesda, Md.: ERIC Document Reproduction Service, ED 110 032, 1975.

Mazanec, Joseph. "The Effect of Course Intensity on Academic Achievement, Student Attitudes, and Mortality Rate." Ph.D. dissertation, Michigan State University, 1972.

Nash, William. Personal interview. Lansing, Michigan, June 1980.

Parsons, Robert L. "Task Analysis of the Physical Performance Requirements Necessary to Performance as a Michigan Police Officer." Ph.D. dissertation, Michigan State University, 1980.

Witherell, Jerome W. "The Feasibility of Using Selected Student Data Bases for the Assessment and Evaluation of Driver Education Programs in the State of Minnesota." Ph.D. dissertation, Michigan State University, 1973.