A COMPARATIVE STUDY OF THE TEACHING EFFECTIVENESS OF THE AETNA DRIVO-TRAINER AND THE MULTIPLE CAR OFF-STREET DRIVING RANGE

Thesis for the Degree of Ed. D.
MICHIGAN STATE UNIVERSITY
Robert Ogborn Nolan
1965

This is to certify that the

thesis entitled

A COMPARATIVE STUDY OF THE TEACHING EFFECTIVENESS OF THE AETNA DRIVO-TRAINER AND THE MULTIPLE CAR OFF-STREET DRIVING RANGE

presented by

Robert Ogborn Nolan

has been accepted towards fulfillment
of the requirements for

Ed. D. degree in Secondary Education

Major professor

Date March 1, 1965

ABSTRACT

A COMPARATIVE STUDY OF THE TEACHING EFFECTIVENESS OF THE MULTIPLE CAR OFF-STREET DRIVING RANGE AND THE AETNA DRIVOTRAINER

by Robert Ogborn Nolan

Statement of the Problem

Driving simulators and multiple car off-street driving ranges are two of the methods being used in driver education programs throughout the country today; however, there exists a difference of opinion regarding the relative effectiveness of these methods. Claims have been made by the proponents of the two systems stating one method is superior to the other, but experimental evidence has never been presented to support the contentions of either side.

This research study was undertaken to investigate whether students who were taught to drive by means of the AEtna Drivotrainer would be comparable when tested on attitudes, knowledge and driving skill to students who were taught to drive by use of the multiple car off-street driving range program.

Description of the Methods, Techniques and Data Used

Both the multiple car off-street driving range and the driving simulators used in this study are located on the campus at Michigan State University.

The multiple car off-street driving range covers approximately three and one-half acres measuring four hundred and fifty-eight feet in length and three hundred and fifty-seven feet at its extreme width. The primary function of this area by reason of design, construction and use is to provide complete or major portions of behind-the-wheel experiences. Twelve automobiles were used for instructional purposes on this range, eleven of which had automatic transmissions with dual brakes and one was equipped with a dual brake and clutch pedal and standard transmission. Communication to all drivers in vehicles on the range was accomplished by the instructor using a portable transistorized horn.

The AEtna Drivotrainer realistically simulates the behind-the-wheel appearance and operation of a modern automobile. Fifteen of these simulators were used in this study. By means of motion pictures projected on a large screen at the front of the classroom, students reacted to an ever-changing variety of traffic situations. Individual responses were automatically scored by an electronic recording device at the rear of the Drivotrainer classroom. Nine films selected from a series of twenty-six

which had been produced in close association with the Drivotrainer Curriculum Committee and the Board of Education of the city of New York along with The Smith System of Non-accident Driving comprised the Drivotrainer course of study.

This research study was conducted in the East Lansing High School, East Lansing, Michigan, during the school year 1959-60. Because of the high school's proximity to Michigan State University, the students in this study were easily transported in a school bus to the Drivotrainer laboratory and multiple car off-street driving range.

One hundred and thirty-three students were assigned to the Drivotrainer and off-street groups from each of three driver education classes meeting daily at the high school. Groups were matched proportionately on variables of sex, age, I.Q., grade level and previous driving experience. Three graduate assistants of driver education in the Highway Traffic Safety Center at Michigan State University, who had had previous high school teaching experience in driver education, were selected to be instructors in the range and Drivotrainer programs. The instructor selected to teach the classroom work in driver education had acquired his Master's Degree in Driver Education and Traffic Safety before the study was conceived and was the regular teacher assigned this course at the East Lansing High School.

Instruction in the Drivotrainer consisted of ten clock hours supplemented with three hours behind-the-wheel on-the-street and six hours of observation in a dual

control car. Total instruction time for the Drivotrainer classes was eight weeks, of which the first two and one-half weeks involved instruction in the Drivotrainer with students meeting for sixty minutes, four times each week while the remaining five and one-half weeks were devoted to the supplemental three hours behind-the-wheel experience. Instruction was by means of films, verbal and manual assistance from the instructor, and the use of other teaching aids such as a chalk board, magnetic traffic board, etc. Errors made by the students were recorded automatically by the Drivotrainer master recorder.

Instruction on the multiple car off-street driving range consisted of ten clock hours, during which one instructor guided three groups (eleven to twelve students per group) through a series of eight prescribed lessons. One student was assigned per car. Following a two and one-half hour instructional period on the range, these students received two hours behind-the-wheel on-the-street and four hours of observation in a dual control car.

Before instruction began, all students were administered a driving attitude scale, a general opinion survey involving ideas in human relations, two driving knowledge achievement tests, and a road test conducted on the off-street range to assist in determining levels of previous driving experience.

Upon completion of their instruction, all students were again measured with the same driving attitude and

driving knowledge criteria. In addition, driving skill was measured by a road test administered by a skilled examiner over a previously determined course on-the-street.

Statistical analysis of the data involved significance of mean differences compared by "t" tests of the critical ratios for driving knowledge and the scores of the on-the-road test. Significance of correlations between chronological age, intelligence and previous driving experiences, respectively, and the on-the-road test were tested by Chi square. Correlations between chronological age and intelligence, respectively, and the other final criteria were calculated by the product moment technique and were tested by critical ratios.

The Major Findings of this Investigation

The following is a summary of the major findings of this investigation:

1. After instruction, no significant differences in driving attitude scores existed between the Drivotrainer and driving range groups.
2. After instruction the second semester Drivotrainer and multiple car groups exceeded significantly the first semester Drivotrainer and multiple car groups in driving attitude.
3. After instruction no significant differences in general opinion existed between or within the Drivotrainer and multiple car groups.

4. After instruction no significant differences in general driving knowledge scores existed between the Drivotrainer and multiple car groups.
5. After instruction the Drivotrainer and multiple car boys had significantly better general driving knowledge scores than the Drivotrainer and multiple car girls.
6. After instruction the first semester Drivotrainer and multiple car groups exceeded in a significant manner the general driving knowledge scores attained by the second semester Drivotrainer and multiple car groups.
7. After instruction the Drivotrainer and multiple car groups were comparable with respect to specific driving knowledge scores.
8. After instruction the scores attained by the second semester Drivotrainer and multiple car groups exceeded in a significant manner the scores attained by the first semester Drivotrainer and multiple car groups on the specific driving knowledge test.
9. The Drivotrainer and multiple car groups had no significant mean changes in driving attitude.
10. After instruction, the Drivotrainer and multiple car groups had no significant mean changes in general opinion.
11. Both Drivotrainer and multiple car groups made significant positive mean changes in general driving knowledge.

12. Both Drivotrainer and multiple car groups changed significantly in a positive direction in mean specific driving knowledge scores. However, the mean change for the second semester Drivotrainer and multiple car groups was far more significant than that for the first semester Drivotrainer and multiple car groups.

13. After instruction the differences in mean road test (vehicle handling) scores between the Drivotrainer and multiple car groups were not significant. However, the Drivotrainer boys out performed the Drivotrainer girls at the .02 level of significance.

14. After instruction the differences in mean road test (road problems) scores between the Drivotrainer and multiple car groups were not significant. However, the Drivotrainer boys again out performed the Drivotrainer girls at the .02 level of significance.

15. A low but significant negative correlation was obtained in the Drivotrainer group between chronological age and performance on the "road problems" section of the on-the-road test. This negative relationship was in favor of the younger students.

16. There were significant positive coefficients of correlation in both Drivotrainer and multiple car groups between intelligence quotients and driving knowledge scores.

17. The low correlations obtained for the Drivotrainer and multiple car groups when comparing intelligence and final road test scores were not significant.
18. Previous driving experience did not correlate with either driving attitude, general opinion, or driving knowledge scores.
19. An association significant at the .01 level was obtained between previous driving experience categories and post-test scores for the Drivotrainer group on the road problems section of the final road test.

A COMPARATIVE STUDY OF THE TEACHING EFFECTIVENESS OF THE AETNA DRIVO-TRAINER AND THE MULTIPLE CAR OFF-STREET DRIVING RANGE

By

Robert Ogborn Nolan

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF EDUCATION

College of Education

1965

ACKNOWLEDGEMENTS

The writer wishes to thank Dr. Carl H. Gross, who, as his Major Professor and Guidance Committee Chairman, provided counsel and encouragement in all phases of the study. He also wishes to express his appreciation to other members of his Guidance Committee, Dr. John A. Fuzak, Dr. William A. Mann, and Dr. George R. Myers, for giving their time, criticism and suggestions.

Grateful acknowledgement is due to Mr. Gordon H. Sheehe, Director of the Highway Traffic Safety Center for making available facilities and personnel.

Special thanks are extended to Dr. James E. Carnahan, Mr. Martin Dolan, Mr. Raymond Martinez, Mr. Phillip O'Leary, and Mr. Milton Rhoades for their cooperation and assistance during the teaching and testing phases of the study.

Finally, to his Wife, Alice Nolan, the writer expresses greatest appreciation for her inspiration and vital moral support, without which this study would have been impossible.

TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER I

THE NATURE OF THE PROBLEM

Introduction

There are approximately ninety-one million licensed drivers and seventy-nine million vehicles in the United States.[1] Daily vehicle travel on the nation's approximately three and one-third million miles of streets and highways is estimated at two billion miles.[2] If the present rate of five and three-tenth fatalities per one hundred million vehicle miles of travel should continue unchanged during the next decade, traffic accidents will claim nearly five hundred thousand lives.[3] Statistics have shown the cost of traffic accidents to the American people during the decade nineteen hundred and fifty to nineteen hundred and sixty was one hundred billion dollars.[4]

---

[1]Gene Miller, "The 1962 Traffic Story," Traffic Safety Magazine, 62:7, March, 1963.

[2]Gordon H. Sheehe, "Highway Traffic Problems," (paper read at the General Federation of Women's Clubs Highway Traffic Safety Conference, East Lansing, Michigan, February 4-6, 1963).

[3]Automotive Safety Foundation, The Proceedings of the National Conference on Driving Simulation (Washington: Automotive Safety Foundation, 1961), p. 7.

[4]Ibid.

Approximately one-fifth of all licensed drivers are under twenty-five years of age.[5] Further examination indicates that the age group fifteen to twenty-four has for many years been involved in a disproportionate share of motor vehicle accidents.[6] Recent statistics published by insurance companies point out that drivers under twenty years of age, total less than eight per cent of all drivers, but are involved in more than eleven per cent of the traffic fatalities and fourteen per cent of all motor vehicle accidents.[7]

In an attempt to lower these accident rates, much interest has been shown in having public schools offer courses in driver education. Michigan, in 1955, led the nation by enacting through a special session of its legislature a driver education law requiring young people under eighteen years of age to successfully complete an approved driver education course before applying for a State Motor Vehicle Operator's License. The course includes a minimum of thirty clock hours of classroom instruction and an average of six clock hours of behind-the-wheel instruction in a dual control equipped automobile. Further, individual schools are reimbursed up to a maximum of twenty-five

---

[5]American Automobile Association, What Chief State School Officials Say About Driver Education, Pamphlet 3388 (Washington: The Association, 1960).

[6]Ibid.

[7]Lloyd Shearer, "Teenagers: Why They Drive That Way," Parade Sunday Newspaper Magazine, April 21, 1963, p. 4.

dollars for each student enrolled in the course.

Michigan's annual driver education enrollment has shown a steady increase since enactment of the driver education law. Table 1 shows the yearly enrollment figures since 1956-57, as reported by the State Department of Public Instruction.[8]

Table 1. Michigan's yearly driver education enrollment, 1956-1963.

Year	(Numbers Enrolled Public, Non-public, Out of School)
1956-57	65,387
1957-58	97,282
1958-59	108,727
1959-60	102,005
1960-61	103,456
1961-62	106,543
1962-63	124,464

Present school enrollment in Michigan indicates that by 1966-67 the estimated number of students taking driver education will be in excess of one hundred and fifty thousand per year. These increases in enrollment are occurring nationally, creating an impact of significance in driver education.

The knowledge and understanding of young drivers must be carefully developed so they will not only know how

[8]Michigan Department of Public Instruction, Lansing, 1963.

to drive safely, but will be motivated to do so and will accept the responsibilities which accompany the driving privilege.[9]

The basic educational problem of teaching America's drivers how to use potentially safe equipment on potentially safe highways must be accomplished, and the best place to begin is with the novice. Effective driver education courses in our nation's schools will develop the essential knowledge, correct habits, fundamental skills, proper attitudes and sound understanding necessary.

The Problem

Statement of the Problem

Many school systems have been re-examining their driver education methods in order to determine the most efficient and economical means of instructing the ever increasing numbers of students enrolling in driver education classes. Several types of driver education programs have been introduced in schools throughout the country in an attempt to make instruction both effective and economical. Only limited research has been completed to determine the effectiveness of these plans.

Driving simulators and multiple car off-street driving ranges are two of the methods being used in driver

---

[9]Thirteenth Annual National High School Driver Education Award Program--School Year 1959-60. Insurance Institute for Highway Safety, 1710 H Street, N.W., Washington 6, D.C.

education programs throughout the country today, however, there exists a difference of opinion regarding the relative effectiveness of these methods. Claims have been made by the proponents of the two systems stating one method is superior to the other, but experimental evidence has never been presented to support the contentions of either side.

With the establishment of a Highway Traffic Safety Center at Michigan State University in 1956, increased emphasis was given to the development of an outstanding program in driver education with primary concern directed to teacher preparation and research. A multiple car off-street driving range was designed by the investigator and constructed at Michigan State University, and fifteen driving simulators were installed in a classroom for the purpose of providing future teachers of driver education with knowledge and practical experience in the use of these two teaching methods.

This research study was undertaken to investigate whether students who are taught to drive by means of the AEtna Drivotrainer[10] would be comparable when tested on attitudes, knowledge and driving skill to students who are taught to drive by use of the multiple car off-street driving range program. The design of this study provides that students in both the Drivotrainer and the multiple car

---

[10]"Drivotrainer" is a copyrighted name for a driving simulator originally developed by the AEtna Casualty and Surety Company, Hartford, Connecticut. These units are now manufactured by the Rockwell Manufacturing Company, Pittsburgh, Pennsylvania.

off-street driving range program shall be combined for their driver education classroom instruction under the supervision of the same teacher.

Contributions of the Study

The results of the study will provide vital information presently not available as to the educational effectiveness of two instructional programs receiving rather wide-spread national use in driver education. Should one method prove to be significantly superior to the other, then school administrators can use this information in presenting recommendations to their boards of education when consideration is being given to the inclusion of either in a school system.

Hypotheses

1. Driver-attitude test scores of students receiving instruction in the Drivotrainer are equal to or better than similar test scores of students taught on the multiple car off-street driving range.

2. Driver-knowledge test scores of students receiving instruction in the Drivotrainer are equal to or better than similar test scores of students taught on the multiple car off-street driving range.

3. Driving-skill test scores of students receiving instruction in the Drivotrainer are equal to or better than similar test scores of students taught on the multiple car off-street driving range.

Definition of Terms

Driver Education refers to those experiences provided by the school to help students learn and understand interrelated problems of driving as well as to drive a dual control car.

Behind-the-wheel instruction refers to a minimal portion of a driver education course during which the student actually manipulates the controls of the dual control car.

Dual-control car refers to an automobile having either a standard or automatic transmission with a duplicate brake and clutch, or brake, on the instructor's side of the car.

Observation refers to the portion of a driver education course during which the students learn by observing from the back seat of the dual control car the driving techniques of the instructor or of a fellow student.

On-the-street training refers to that portion of behind-the-wheel instruction which is conducted on the public streets under traffic conditions.

Multiple car off-street driving range refers to a specially designed area equipped to handle large numbers of students driving conventional automobiles under the supervision of one instructor. (Chapter II contains details.)

AEtna Drivotrainer refers to an electro-mechanical device which records reactions of students while they are manipulating actual car controls in simulated driving situations. (Chapter II contains details.)

Methods of Procedure

The study involves high school boys and girls assigned to driver education classes at East Lansing High School, East Lansing, Michigan, during the school year 1959-60. These students were randomly assigned to either the Drivotrainer or the multiple car off-street driving range. Students assigned to the multiple car off-street driving range were given ten hours of instruction on the range followed by two hours of instruction in a dual control car on the street; those assigned to the Drivotrainer received ten hours of instruction in the simulator followed by three hours of instruction in a dual control car on the street. All students received their classroom instruction from the same teacher.

Both groups were administered a battery of pre- and post-tests to determine knowledge, skills and attitudes before and after instruction. Terminal driving ability was measured by a driving skills test administered to all by one examiner.

Data collected was processed and analyzed using statistical methods to determine the relative effectiveness of the two teaching techniques. A more detailed description

of the methods of research and analyses of the data appears in Chapters III and IV.

Organization of the Study

Chapter II contains a detailed and illustrated description of the multiple car off-street driving range and the AEtna Drivotrainer. Chapter III describes: (1) the selection of the school and the methods of selecting the instructors who were involved in the study, (2) the method of obtaining the sample of students, (3) the characteristics of the students involved in the study, (4) the instructional and testing programs, (5) the methods of instruction, and (6) the testing devices and methods used in this investigation. In Chapter IV all test results were analyzed by comparing the average performances of the Drivotrainer and multiple car off-street driving range groups as well as sub-groups. Computations of the relationships between age, intelligence, previous driving experience, and all terminal tests are also found in Chapter IV along with the findings of this research study. Chapter V contains a brief statement of: (1) the problem, method of procedure and major findings; (2) conclusions based on the findings; and (3) recommendations for the use of the Drivotrainer and the multiple car off-street driving range as well as recommendations for further research.

CHAPTER II

A DESCRIPTION OF THE MULTIPLE CAR OFF-STREET DRIVING RANGE AND THE AETNA DRIVOTRAINER

In a recent report distributed by the Insurance Institute for Highway Safety, Mr. Leonard J. McEnnis, Jr., Director of Public Relations for that organization said, "three million eligible high school students will be enrolled in driver education during the current year (1963-64)."[11] He further warned: "Unless facilities are expanded and advanced teaching methods and aids are fully utilized, a larger percentage of students will leave school each year without taking a driver education course."[12]

The multiple car off-street driving range and the AEtna Drivotrainer are designed to enable schools to keep pace with the rising tide of enrollments and to provide broad experiences necessary for the development of safe traffic behavior.

Driver education programs using these plans make it possible for one teacher to instruct as many as eighteen students operating cars on the off-street driving range or

---

[11] Leonard J. McEnnis, "Report on Driving Simulators and Ranges" (Washington: Insurance Institute for Highway Safety, 1963), p. 1. (Mimeographed.)

[12] Ibid.

twenty-five students in the AEtna Drivotrainer. Research studies comparing these two methods with an on-the-street program have indicated these students to be as good or better drivers as those receiving their entire behind-the-wheel training on-the-street.

Brazell[13] found that high school students in Dearborn, Michigan, who had completed a driver education program in which all behind-the-wheel instruction was given on a multiple car off-street driving range, had driving performance records equal to or better than students receiving all their behind-the-wheel training in an on-the-street program. Bernoff[14] found no significant differences between matched groups of students in knowledge, attitudes and driving skills acquired when one group received instruction using an on-the-street program and the other, a combination of the AEtna Drivotrainer and on-the-street programs.

Reports to the Insurance Institute show that during 1962-63, three hundred and ninety-nine schools in thirty-four states used driving simulators for part of the practice

---

[13]Robert E. Brazell, "A Follow-Up Study of Public School Driver Trainees, Relating Driving Performance Records to Selected Academic and Training Factors" (unpublished Doctoral thesis, The University of Michigan, Ann Arbor, Michigan, 1961), p. 68.

[14]Louis I. Bernoof, "An Experimental Study of the Teaching Effectiveness of An Elector-Mechanical Device and Conventional Driver Training Methods" (unpublished Doctoral thesis, The University of Southern California, Los Angeles, 1958), pp. 207-208.

driving instruction for nearly one hundred thousand students. In nineteen states, off-street driving ranges were used by three hundred and ninety-eight schools to give all or part of the behind-the-wheel training for nearly ninety-one thousand students.[15]

According to a summary released by the Department of Public Instruction, Michigan trained one hundred and twenty-four thousand, four hundred and sixty-four driver education students in its public school districts during the fiscal year July 1, 1962, through June 30, 1963.[16] Fifty-six schools reported using off-street multiple car driving ranges and training a total of forty-five thousand, six hundred and fifty-four driver education students. Of the total number of schools reporting the range program, twenty-six listed their range as designed and built specifically for driver education.[17] It is interesting to note that more than one-third of all Michigan driver education students received either all or a part of their behind-the-wheel experience on an off-street driving range during 1962-63. Furthermore, it is estimated that the number of driver education students for the 1963-64 school year will approximate one hundred forty thousand, six hundred sixty-one,

---

[15] McEnnis, op. cit., p. 2.

[16] Michigan Department of Public Instruction, Summary of Annual Reimbursement Reports for 542 Public Schools (Lansing: Michigan Department of Public Instruction, 1963), p. 1.

[17] Ibid., p. 2.

an increase of sixteen thousand, one hundred and ninety-seven students.[18]

Since this study attempts to determine the relative teaching effectiveness of driver education programs using the AEtna Drivotrainer and the multiple car off-street driving range, a detailed description of these devices with references to their origin will be made for clarification purposes.

The original idea of the multiple car plan on an off-street area must be credited to the late Gordon Graham, a Detroit public school safety engineer greatly interested in and zealous of driver education, who presented to the City of Detroit and the nation a new concept in behind-the-wheel experience. While Graham was in Chicago with the National Safety Council (1936-43), he did some work for Chicago's Lane Technical High School, the first school to offer a practice driving program on an off-street area.[19] In this program, an instructor rode with a student driver in the front seat of a dual control car while several other students observed from the rear seat.

In 1944, the first multiple car off-street driving range in Detroit was constructed at Pershing High School. This marked the first time in the United States that behind-the-wheel training had been taught on an off-street area

---

[18] Ibid.

[19] W. Howard Cox, "The History of High School Driver Education in Michigan" (unpublished Master's thesis, The University of Michigan, Ann Arbor, 1956), p. 25.

with one instructor outside the car giving instructions to several student drivers at the same time.[20] In this year, Detroit began what is known today as the "Michigan Plan," which combined driver education in the classroom with behind-the-wheel practice driving on an off-street area in a multiple car plan.[21]

There are many variations of the off-street driving range today. Areas originally designed to serve as parking facilities have been modified to accommodate vehicles driven by students receiving instruction in the basic skills of vehicle operation. Some programs use a single car on a blocked off street as a practice area; others may use a local recreational area or park in the early phase of their program. This shows that the term off-street area may involve a rather heterogeneous grouping of many areas, and the mere use of the term by schools claiming to use this in their teaching may not actually reflect the true nature of the program.

The multiple car off-street driving range referred to in this study (Figure 1) was constructed on Michigan State University property in 1956. This range was developed by the University's Site Planning Office from an original design by the investigator of this research project and covers approximately three and one-half acres measuring

---

[20] Ibid., p. 26.

[21] Ibid., p. 27.

four hundred and fifty-eight feet in length and three hundred and fifty-seven feet at its extreme width. The primary function of this area by reason of design, construction, and use is to provide complete or major portions of behind-the-wheel experiences provided in the teacher preparation program of driver education at Michigan State University. There are twelve automobiles used for instructional purposes on this range, eleven of which have automatic transmissions equipped with dual brakes, and one having a standard transmission with dual brake and clutch pedals. Communication to all drivers in vehicles on the range is accomplished by the instructor using a portable transistorized horn.

Figure 1 presents a diagram of the complete multiple car off-street driving range as it is constructed on the campus at Michigan State University; however, various enlargements of specific areas of the range have been made which will be referred to now when describing the exercises employed in the instructional program of the research study.

Specific Areas of the Multiple Car Off-Street Driving Range and Exercises Used

The "T" Exercise

This exercise derives its name from the basic shape of the driving area in Figure 2. A flag on a four foot stanchion, which represents a fixed object such as a parked automobile, or a parking meter, is found at either end of

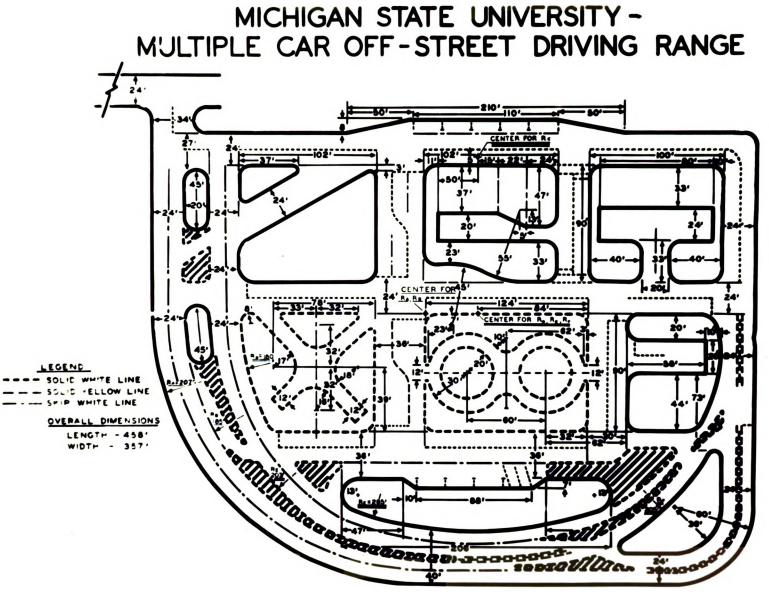


Figure 1. Michigan State University multiple car off-street driving range.

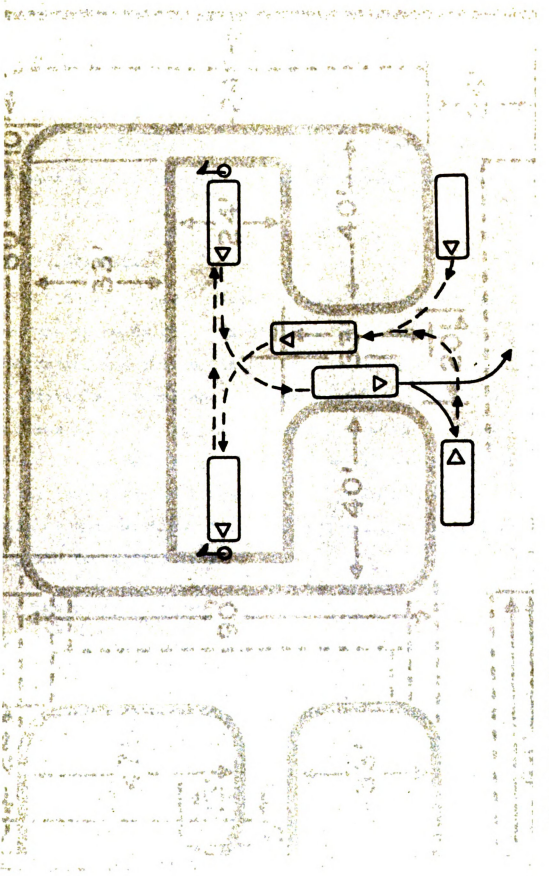


Figure 2. The "T" exercise.

the "T" on the area, and the exercise practiced develops in the driver the skills needed to control a car moving slowly toward one flag, stopping when within a distance of twelve inches from the flag and then proceeding slowly forward to a distance of three inches and stopping. This movement is then repeated in reverse toward the other flag at the opposite end of the "T".

The "X" Exercise

This exercise (Figure 3) also derives its name from the shape of the area on which it is practiced, duplicating the skills learned on the "T" exercise of the driver's forward and backward movement of the vehicle to flags placed at the extreme ends of an "X". In addition, this exercise requires that the driver maintain the vehicle within lane lines while backing in a straight line to the point of intersection of the "X" and making a rear turn into the designated lane.

The Figure "8" Exercise

The figure "8" exercise (Figure 4) develops correct hand over hand steering technique. As the vehicle moves slowly through the exercise, the driver practices the hand over hand steering in order to keep his car within the lane lines.

The Double Garage Exercise

Figure 5 duplicates the floor pattern of a double garage with flags representing the forward wall and the

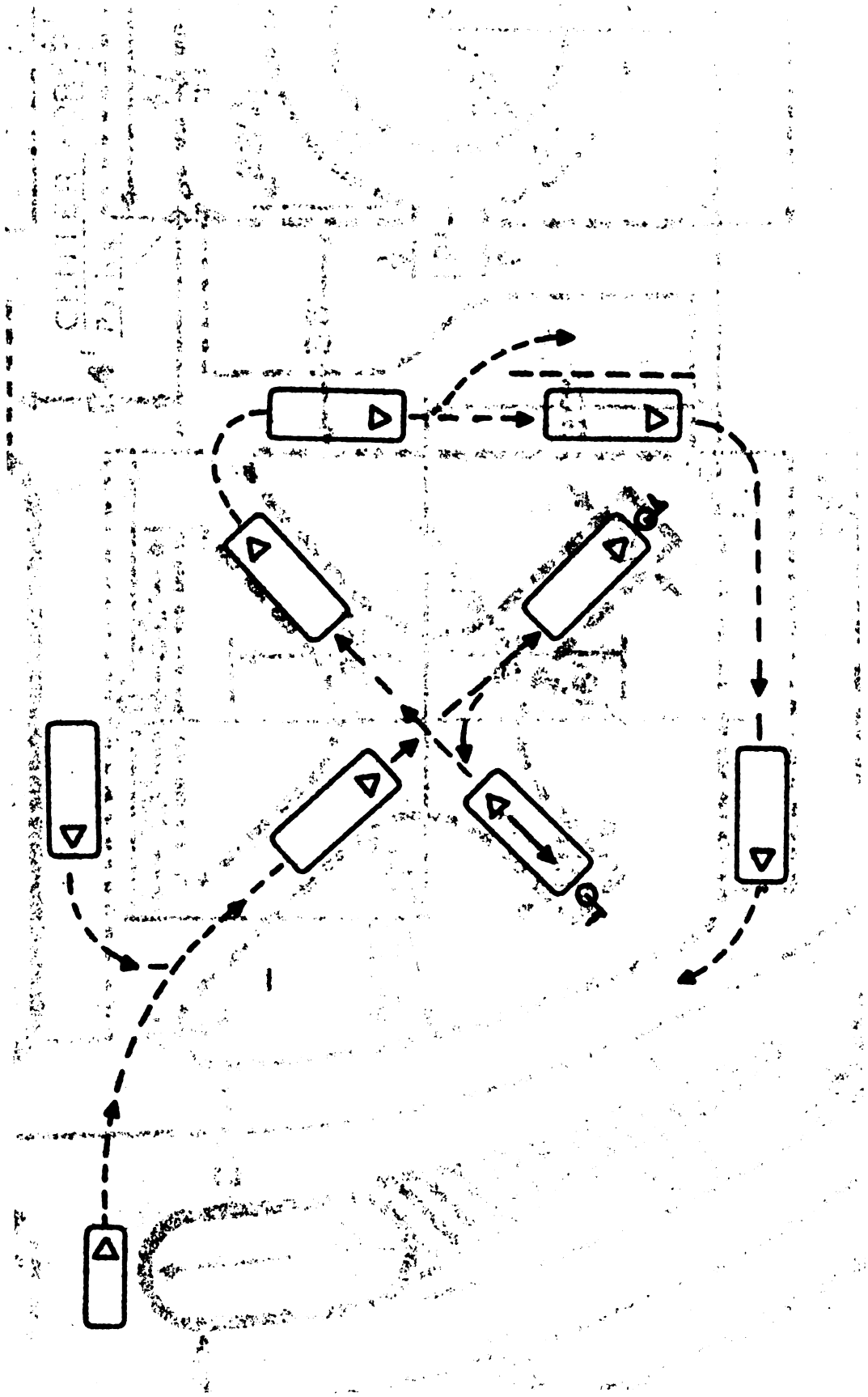


Figure 3. The "X" exercise.

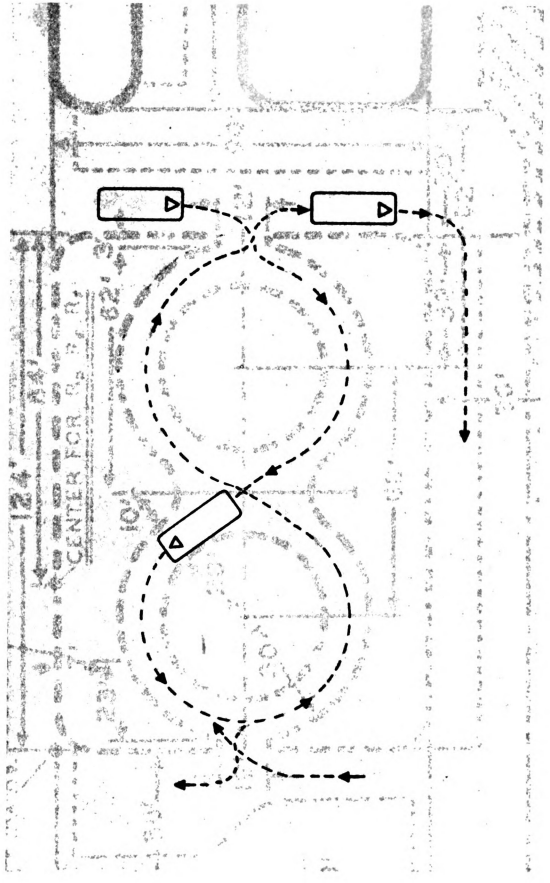


Figure 4. The figure "8" exercise.

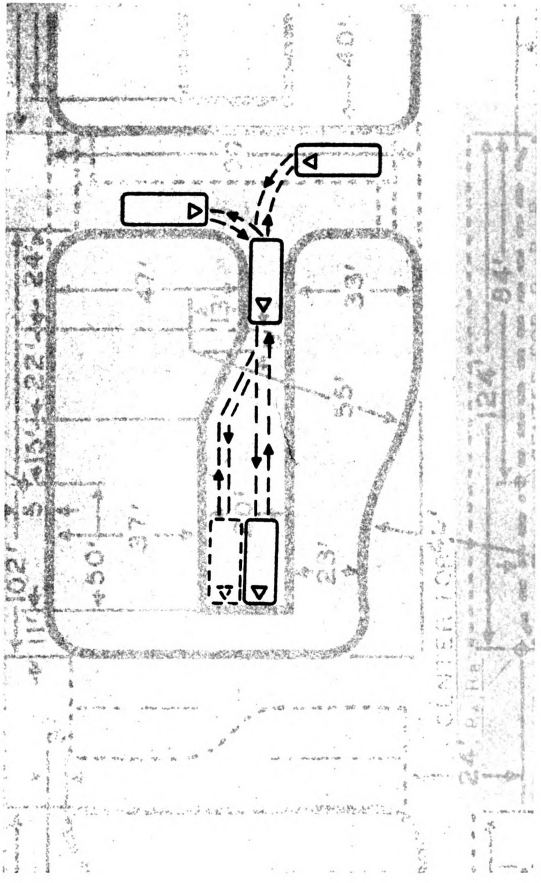


Figure 5. The double garage exercise.

rear center post. The exercise develops the ability necessary for the driver to back out onto a single narrow driveway to the street. Backing into the correct traveling lane on the street completes the exercise.

The "Y" Turn Exercise

A dead-end street with a distance of twenty-six feet from curb face to curb face is representative of the area shown in Figure 6 on which the "Y" turn is practiced. The exercise requires the driver to turn his car around from a stopped or parked position using two movements: one forward and to the left side of the street, the other to the rear while backing right. Completion of the exercise has the operator drive the car forward to the left into the proper lane.

Lane Changing Exercises

Lane changing diagrammed in Figures 7a, 7b, 7c and 7d requires that the vehicle be moved into the correct traveling lane preparing for either a turning movement or continuing ahead. In making a lane change, the driver is required to check traffic to the rear, give a proper signal, check the blind spot, and then accelerate moderately into the new lane, after which he adjusts his speed.

Parking on a Hill

This exercise (Figure 8) gives the driver experience in parking a car correctly on either an up-grade or a

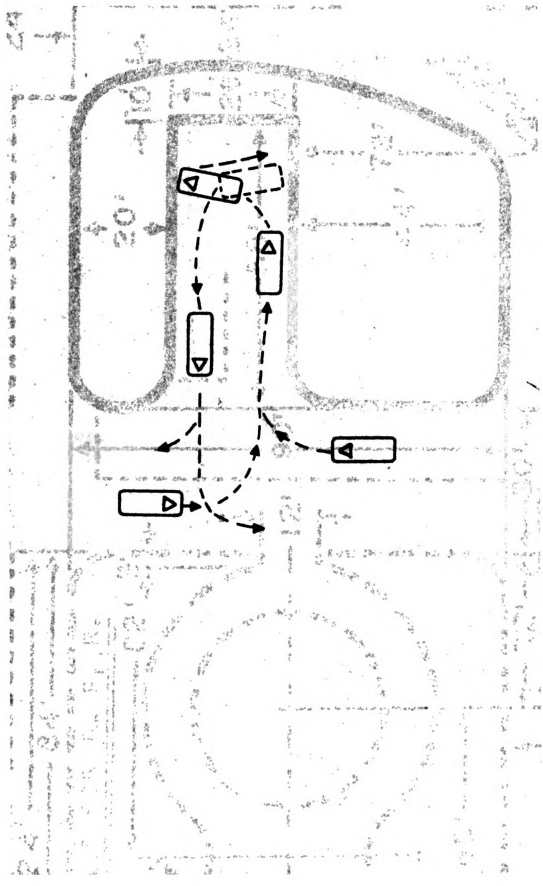


Figure 6. The "Y" turn exercise.

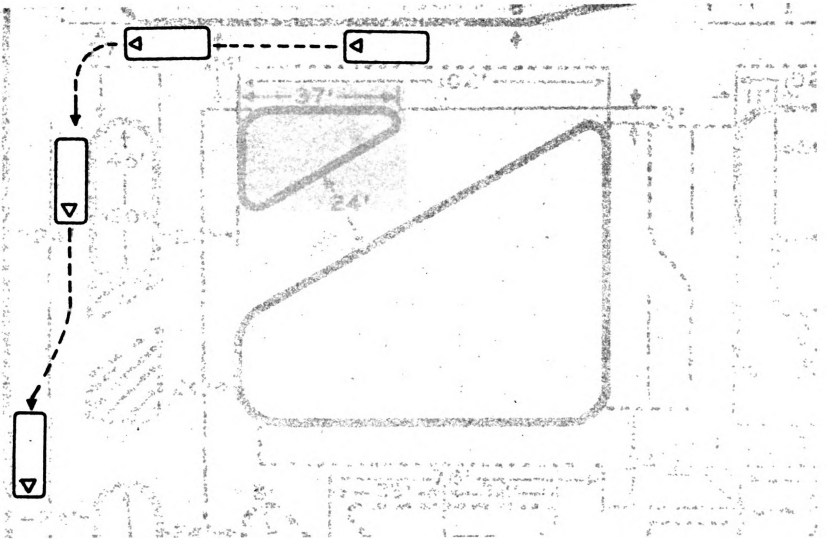


Figure 7a. Lane changing exercise.

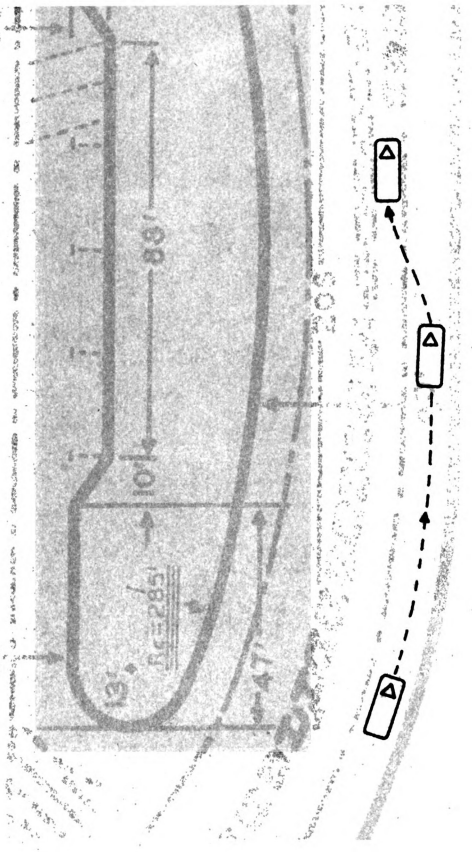


Figure 7b. Lane changing exercise.

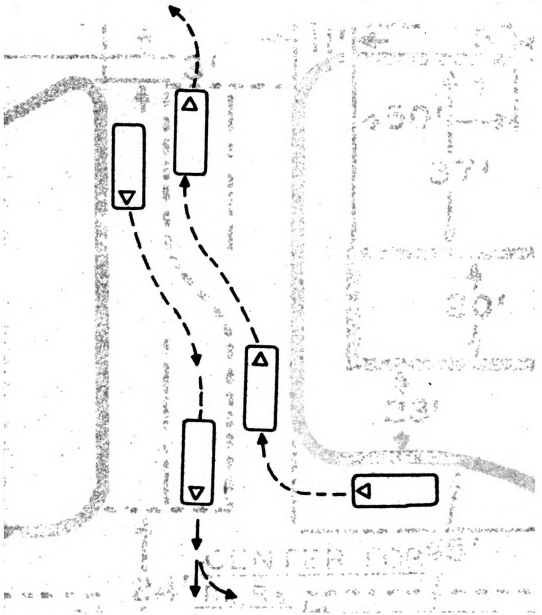


Figure 7c. Lane changing exercise.

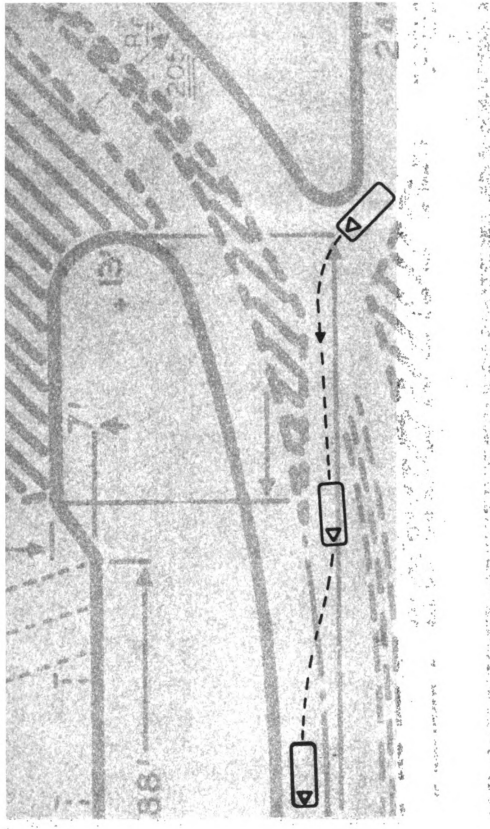


Figure 7d. Lane changing exercise.

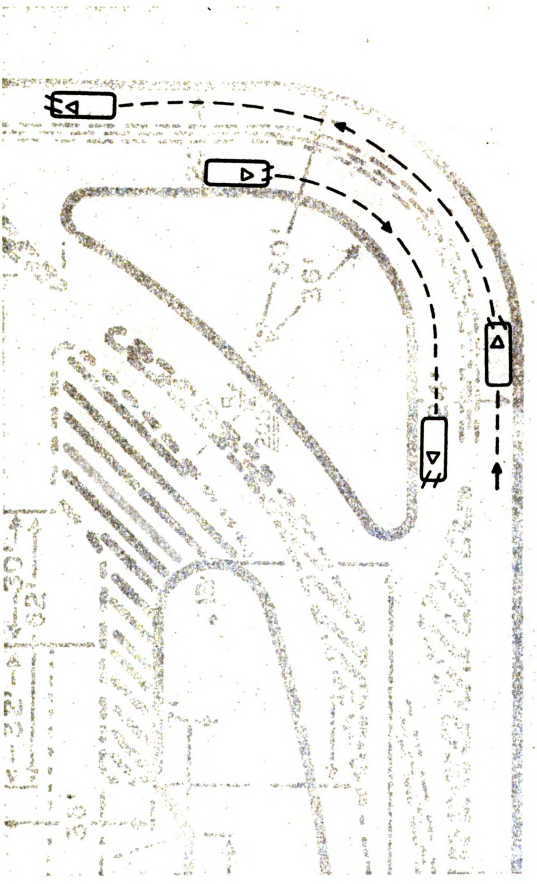


Figure 8. Parking on a hill.

down-grade. When parking a vehicle on a down-grade, the driver is instructed to position the car parallel to and approximately six inches from the curb with the front wheels turned to the right. On an upgrade, the vehicle is positioned the same with the front wheels turned to the left. In either case, the front wheels are so turned by the driver as to prevent the car from rolling forward or to the rear should the parking brake become disengaged.

Turns

Figures 9a, 9b, 9c, 9d, 9e and 9f present different types of intersections which require the driver to develop skills in making turns emphasizing correct vehicle placement, signalling, turning and speed control.

Angle and Parallel Parking

The exercises practiced on the areas in Figures 10 and 11 provide the student driver with the knowledge and skills necessary in removing his vehicle safely from traffic, parking it, and then again returning to street traffic correctly.

The AEtna Drivotrainer

The AEtna Casualty and Surety Company of Hartford, Connecticut, began in 1935 to pioneer the development of what ultimately became the Drivotrainer. The first public school units, similar to those in use today, were installed in a New York City high school in 1953.

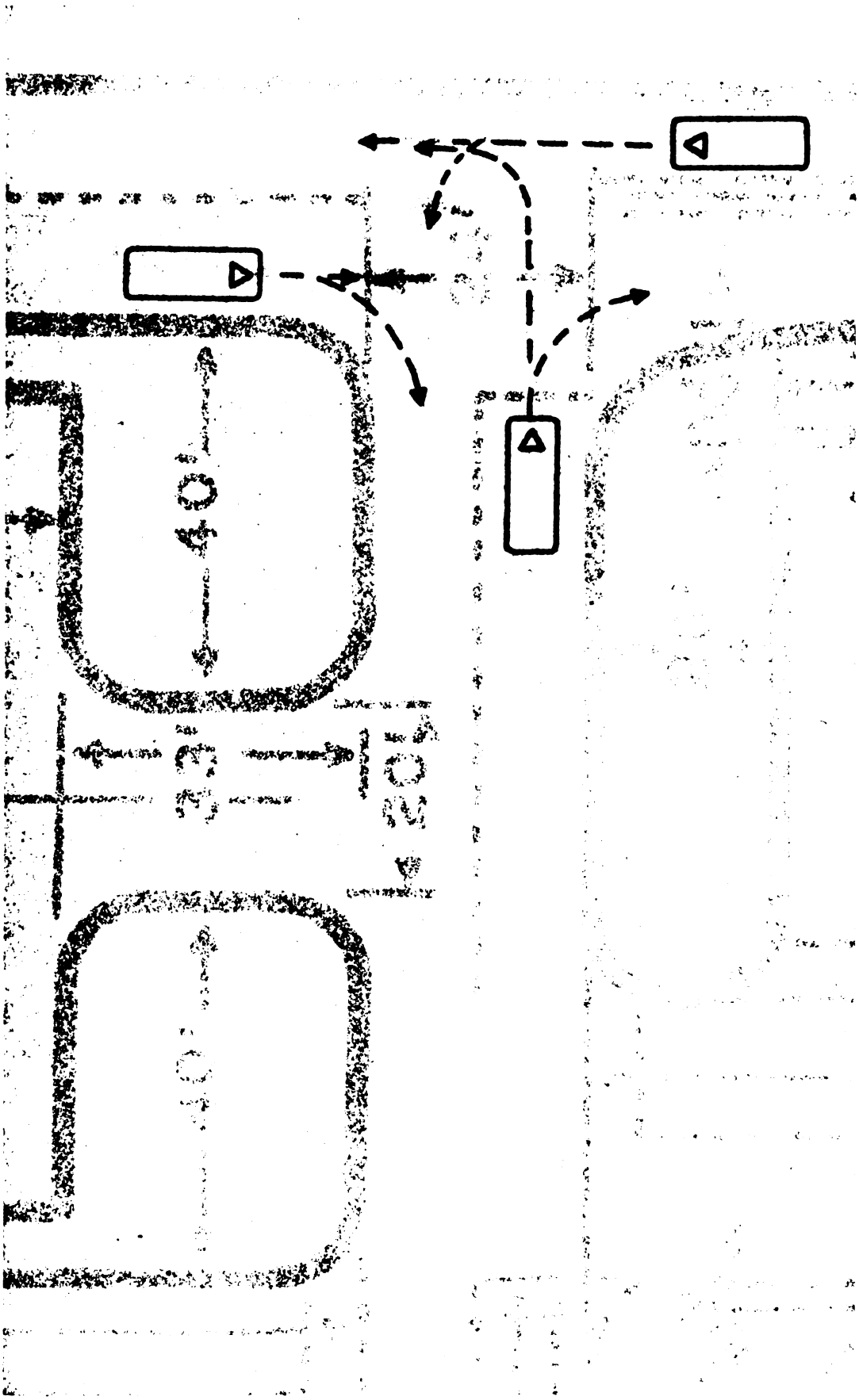


Figure 9a. Turns--"T" Intersection.

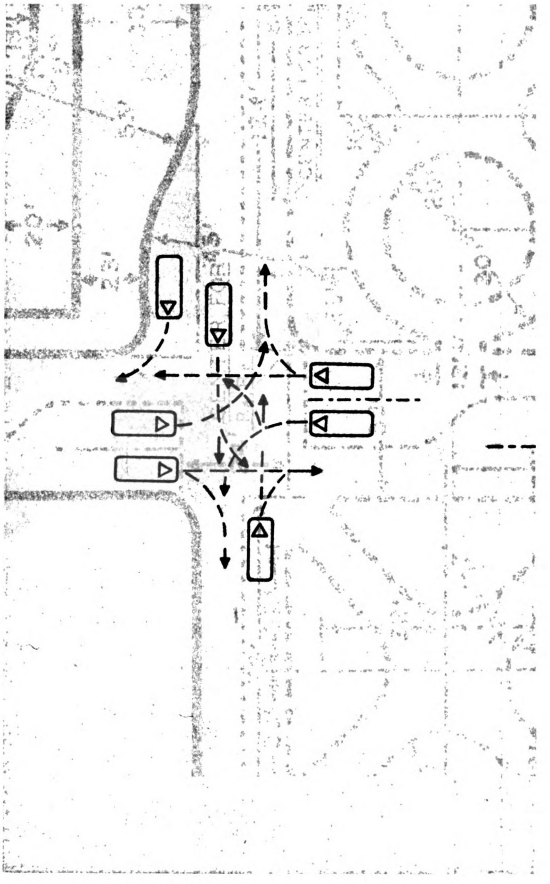


Figure 9b. Turns--signalized intersection.

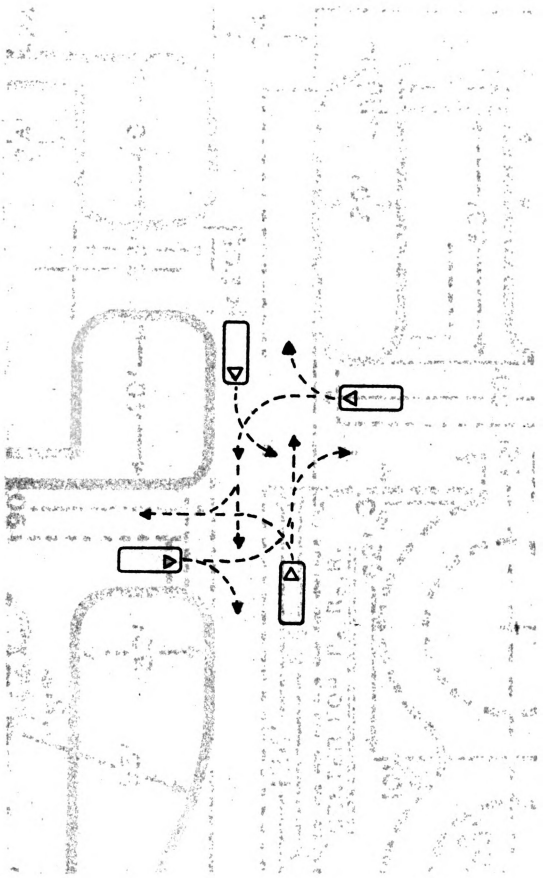


Figure 9c. Turns--off-set intersection.

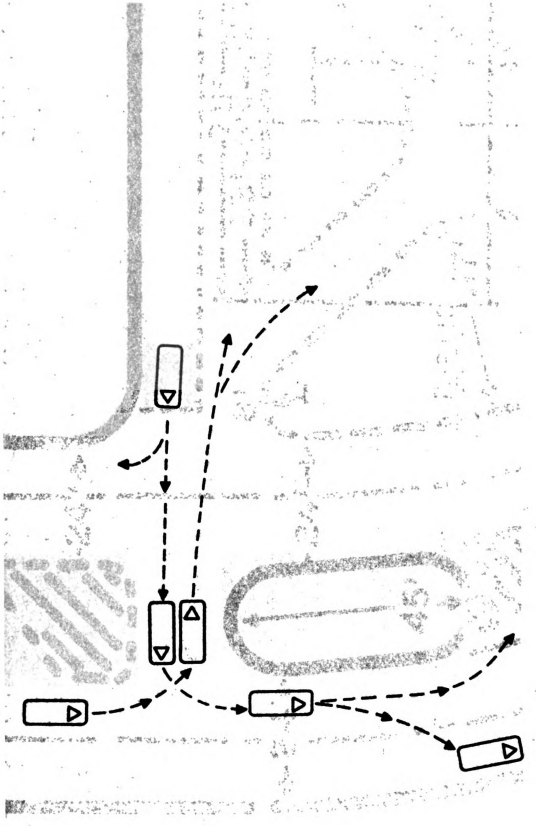


Figure 9d. Turns--left turns across multiple lanes.

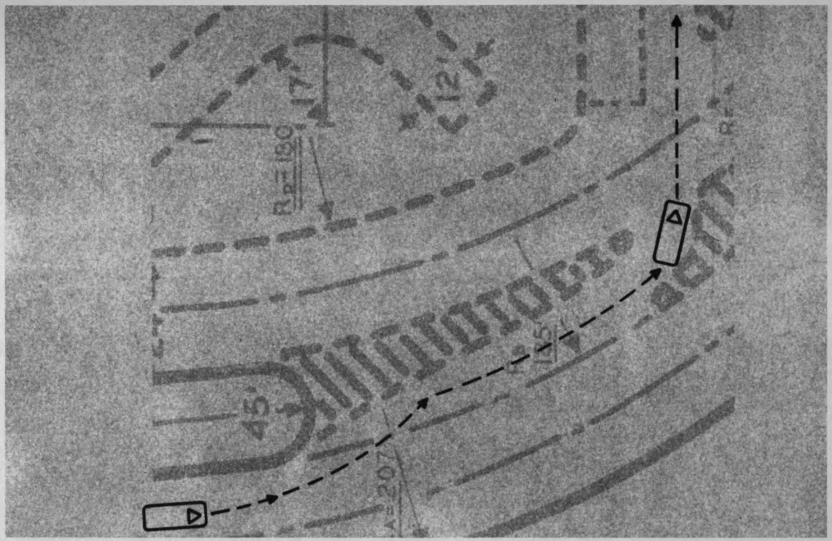


Figure 9e. Turns--left turns across multiple lanes.

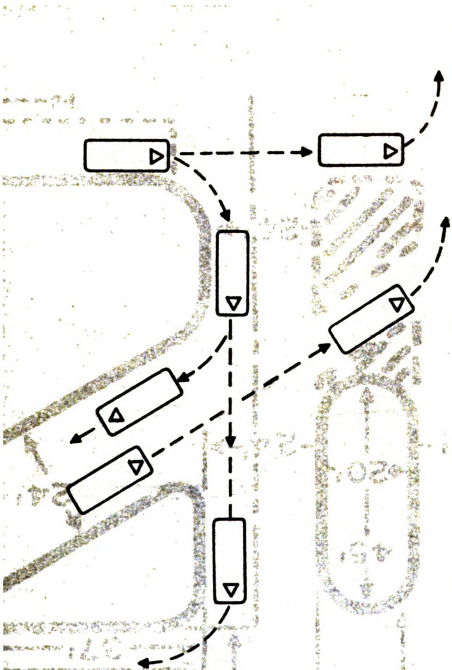


Figure 9f. Turns--left turns across multiple lanes.

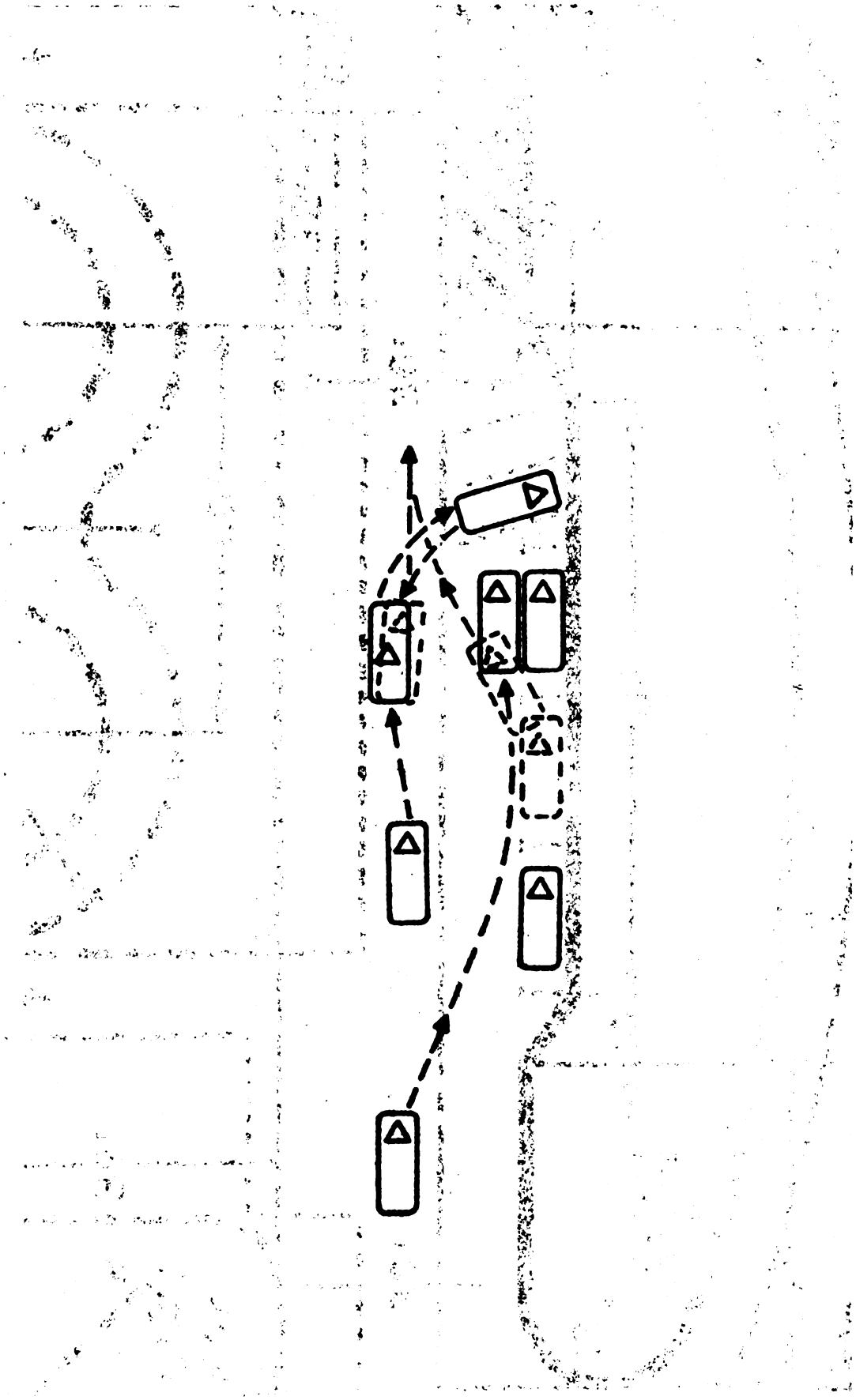


Figure 10. Angle and parallel parking.

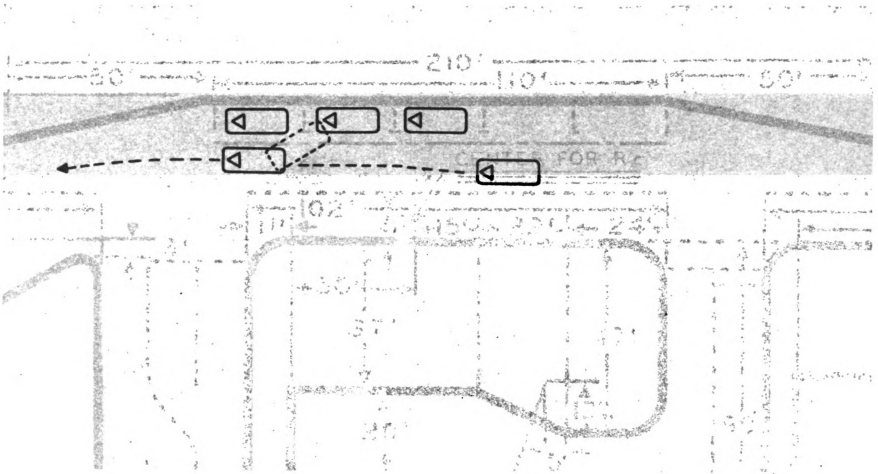


Figure 11. Parallel parking.

Essentially the device offers a means of providing more students with a quality behind-the-wheel experience at a greatly reduced cost per pupil. A typical driver education class being conducted in a driving simulator laboratory at Michigan State University is shown in Figure 12.

The educational theory which lies behind the Drivotrainer is similar to that which the aviation industry employs in utilizing the Link Trainer for pilot training and the Dehmel Flight Simulator which leading airlines of the nation use in training crews of large commercial aircraft. The Drivotrainer realistically simulates the behind-the-wheel appearance and operation of a modern automobile.

By means of motion pictures projected on a large screen at the front of the classroom, students react to an ever changing variety of traffic situations. Individual responses are automatically scored by an electronic recording device at the rear of the Drivotrainer classroom. While the film is in progress, the instructor can either check the score sheet as it leaves the recording unit or can circulate about the classroom observing student progress and lending assistance when needed.

A series of twenty-six films produced in close association with the Drivotrainer Curriculum Committee[22]

---

[22]The Drivotrainer Curriculum Committee is composed of driver education instructors from secondary schools and colleges who act in an advisory capacity to the Information and Education Department of the AEtna Casualty and Surety Company.

Figure 12. Driving simulator laboratory.

and the Board of Education of the City of New York comprises the Drivotrainer course of study. Subject areas include such fundamental and advanced subjects as familiarization with the driver's compartment, preparing to drive, starting and stopping, turning at intersections, driving on hills, driving in light and heavy city traffic, passing, parking the car, driving on expressways and rural highways and defensive driving.

In addition to providing many experiences in the mechanics of driving, the Drivotrainer films emphasize the part that good driving behavior plays in the safe operation of a motor vehicle.

The remainder of this chapter is devoted to a discussion of a Drivotrainer installation consisting of the following components: (1) the Drivotrainer cars (fifteen are used in this study), (2) the master recording unit, (3) the motion picture projector with a special micro-switch attachment, (4) a complete set of instructional motion picture films and programming plugs and, (5) the screen.

The Drivotrainer Car

Each Drivotrainer car is a single place unit (Figure 13) which is equipped with the following operable controls: clutch and brake pedals, accelerator pedal, steering wheel, gearshift lever, directional signals, horn ring, ignition switch and starter and parking brake lever (Figure 14). The Drivotrainer car is also equipped with a

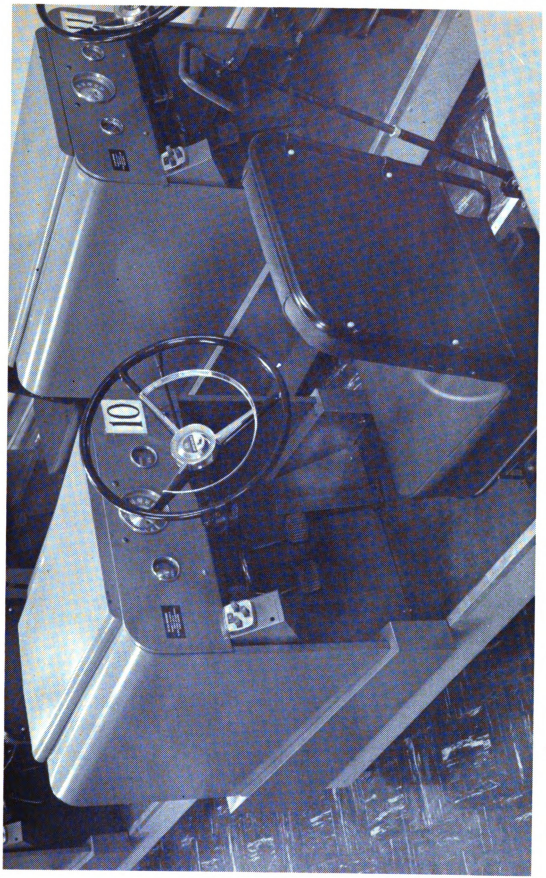


Figure 13. The Drivotrainer car.

Figure 14. Drivotrainer operating controls.

push-button automatic transmission enabling the instructor to train students in both automatic and standard transmission operation. Each car is provided with a simple plug arrangement for changing from manual to automatic shift. All controls are electrically connected to the recording unit so that the instructor may record the actions of any or all Drivotrainer cars. In addition, a speedometer indicates the approximate simulated road speed when the Drivotrainer car is being "driven" (Figure 15). The seat of each Drivotrainer car is adjustable.

A large mirror, mounted on the back of the seat, is used when backing situations are presented on the screen. The mirror is placed just behind and to the right of the student and simulates the view the student would get through the rear window of his car. When backing, the student turns his head to look in the mirror which reflects the image of the road shown on the screen. Under the hood of the Drivotrainer car are the electro-mechanical parts which make it possible to simulate the operation of a real automobile.

The indicated speed on the speedometer can be increased or decreased at the will of the operator by depressing or releasing the accelerator. The rate of deceleration is controlled by the degree of braking and whether the car is in gear or the clutch disengaged. When operating the Drivotrainer car with standard shift, the grabbing sensation experienced in real cars when the

Figure 15. Drivotrainer instrument panel.

friction point is reached, is created by a vibrator attached to the clutch. Another device causes the motor to stall when the clutch is engaged too rapidly.

The steering mechanism has a turning ratio comparable to that found in a 1956 Ford passenger car. It is constructed so that the instructor is able to record on the score card three positions of the steering wheel on either side of the straight-ahead position: slight, medium, and full steering movement of the wheel to the left or to the right. A combination of springs and pneumatic cylinders provides resistance to the movement of the steering wheel and returns the wheel to its straight-ahead position when released, so that real steering feel and action is simulated (Figure 16).

The brake pedal mechanism is designed to give the operator the feel of the brake pedal of a standard automobile, in that increased resistance is felt as the pedal is depressed. This mechanism allows the instructor to record three brake pedal positions: soft, medium, and hard brake. A special electrical circuit allows brake pumping to be recorded where it is called for in the films. The braking mechanism is also connected with the speedometer so that when the brakes are applied the speedometer needle will reflect a corresponding decrease in speed.

The accelerator mechanism allows the instructor to check and record four different accelerator positions: 0 to 1/4 acceleration, 1/4 to 1/2, 1/2 to 3/4, and 3/4 to

Figure 16. Drivotrainer steering mechanism.

full throttle. A device connected with the accelerator simulates motor noise, so as the student accelerated the noise is increased (Figure 17).

Other electrical relays allow the instructor to record on the score card starting, stalling, use of the horn, directional signals, hand brake, clutch and all positions of the gearshift lever or automatic push-button transmission selector.

The Master Recorder

A master recorder (Figure 18) housed in a cabinet approximately fifty-five inches high, thirty inches wide, and twenty-four inches deep, is located at the rear of the classroom. The top of this cabinet serves as a platform for the motion picture projector.

The Control Panel. On one side of the cabinet is the control panel (Figure 19) containing the switches for the power, projector and ribbon rewind; push buttons for the eight scoring groups; paper feed button; start button; and the receptacle for the programming plugs, which govern the recording on automatic operation. Also located on the control panel are two sets of fuses which protect the Drivotrainer's electrical circuits. The two AC fuses, in the upper right hand corner of the panel, protect the recorder. A fifth fuse, located to the right and above the right hand spool of printing ribbon, protects the group printing mechanism.

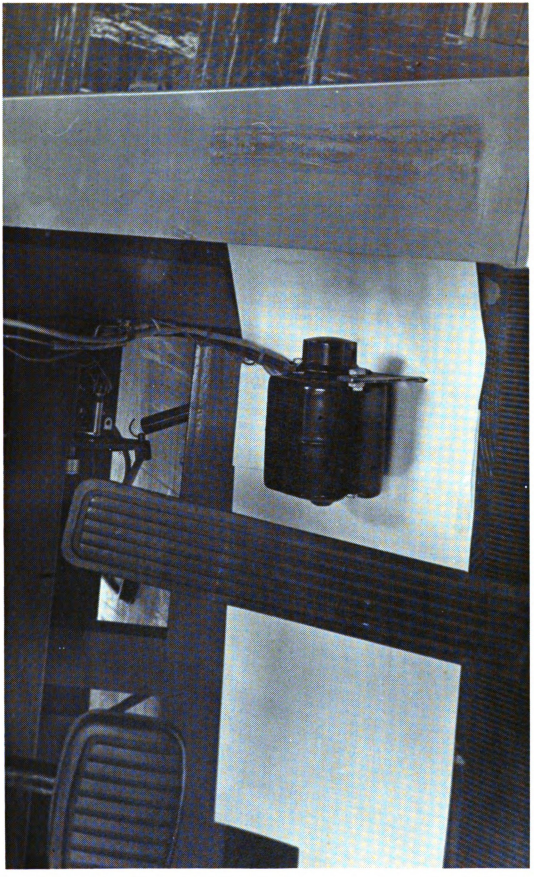


Figure 17. Drivotrainer motor simulator.

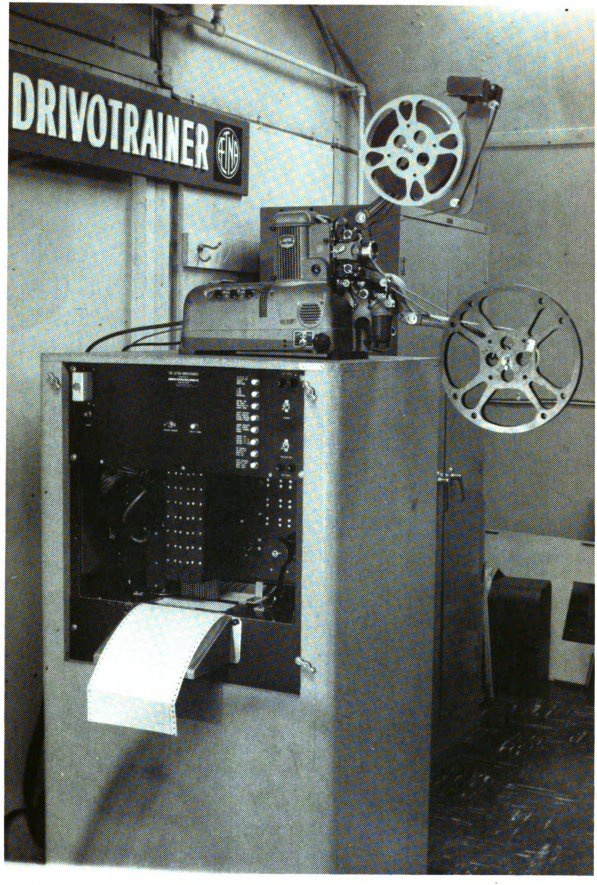


Figure 18. The master recorder.

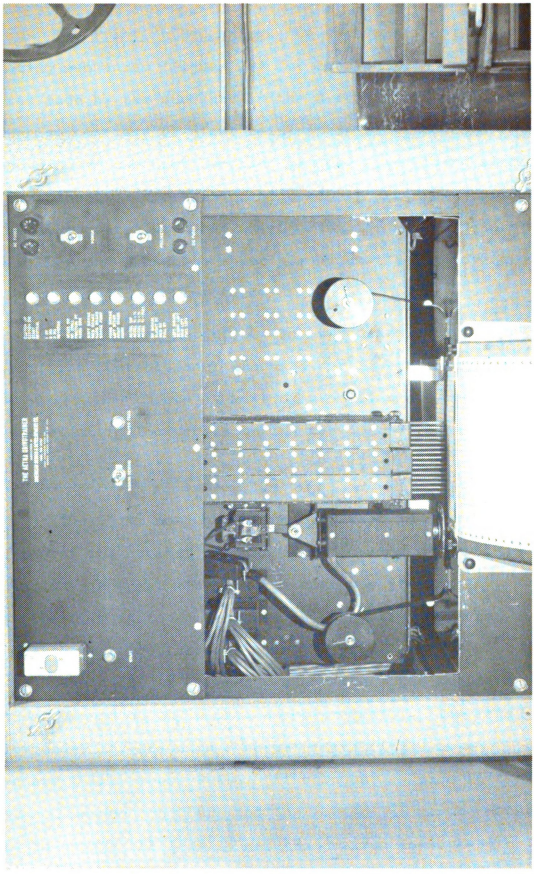


Figure 19. The control panel.

The Printing Mechanism. On the control panel is the printing mechanism (Figure 20) for the recording of the scores made by the students in the Drivotrainer cars. The mechanism consists of eight relay-operated plungers corresponding to the eight scoring groups, a revolving ribbon, a score sheet, a score sheet hold down plate and an assembly of relay-operated plungers which print the scores. Both the ribbon and the score sheet are automatically advanced as each operation is recorded.

The Cabinet Interior. The two doors on the opposite side of the control panel are used for replenishing the supply of score sheets as well as providing easy access to the electrical circuits behind the control panel.

The Motion Picture Projector

The 16 mm motion picture projector is mounted on the top of the cabinet. Attached to the top of the projector is a special micro-switch assembly (Figure 21). When the film is to be recorded on automatic operation, it must be threaded through this assembly.

The controls for the projector are the standard controls found on any modern sound projector. The lens recommended for use with a normal installation is a standard 1-1/2" lens, F 1.6. If changes are made in the distance between the lens and the screen, it may be necessary to change the lens to get the desired focal length for proper projection. A 750 or 1000 watt projection lamp

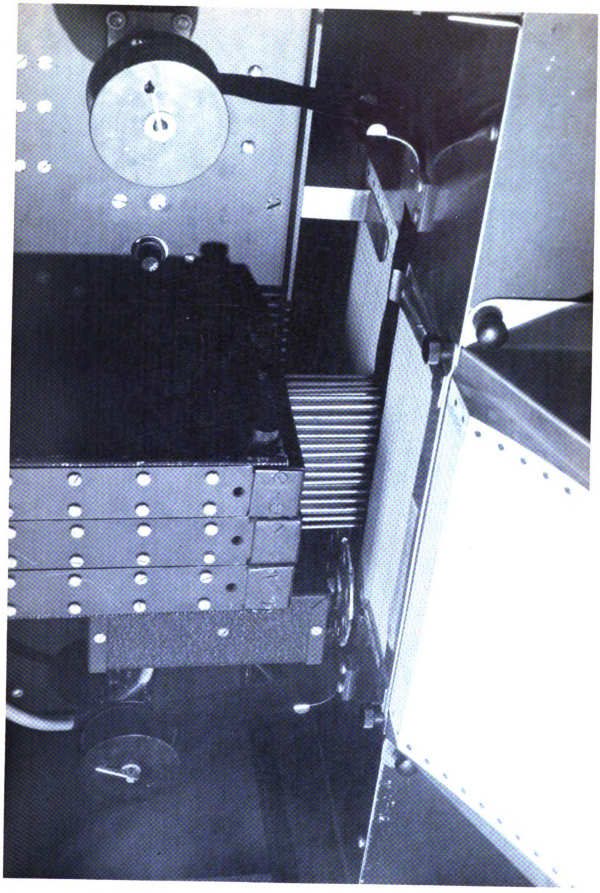


Figure 20. The printing mechanism.

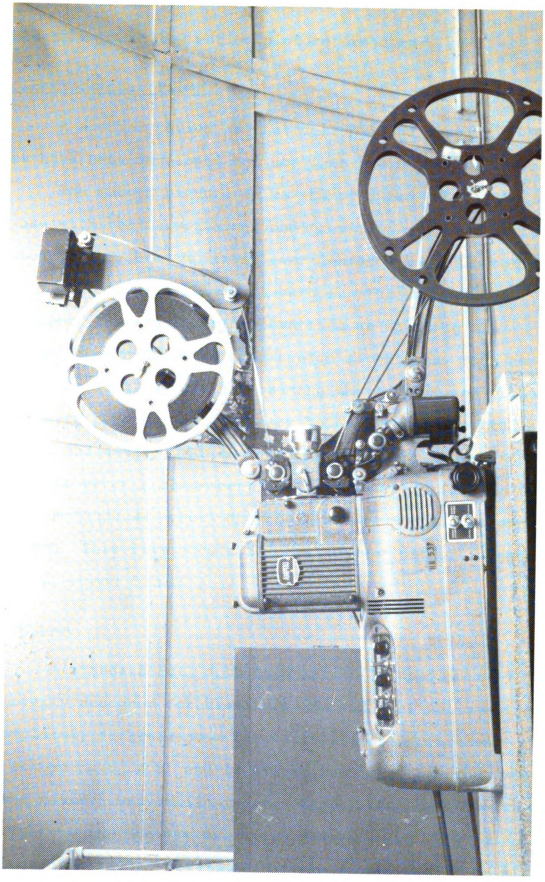


Figure 21. The motion picture projector and micro-switch assembly.

should be used in the motion picture projector.

The Instructional Films

A special series of instructional and testing films have been developed for use with the Drivotrainer.

The motion picture films are produced especially for use with the Drivotrainer and provide a complete course of study. They are the first ever designed to bring behind-the-wheel training into the classroom. The films guide the student from such basic operations as shifting and steering through the more complicated situations, such as parallel parking, always emphasizing the correct and proper action with appropriate attention being given to attitudes, judgment and safety. At the conclusion of the course, the student is given a comprehensive final film examination which simulates an actual driving test for a state license examiner. This film covers all the subject matter taught in the previous films.

The Screen

A standard pull-down type screen is used. It is especially designed for classroom use and does not require a completely darkened room for satisfactory projection. The screen is 6' x 8' and is placed ten feet from the front of the nearest Drivotrainer car. Experience has shown that ten feet is the minimum practical distance for viewing without eyestrain. The center of the screen should be six to seven feet above the floor so that students will be

looking straight ahead, as if through the windshield of a car. The Drivotrainer cars are placed so that they are within an acceptable angle from the center of the screen.

Summary

This chapter has described in detail the multiple car off-street driving range and the AEtna Drivotrainer as used in this research study. Animated illustrations as well as photographs are used to describe the specific areas of the multiple car off-street driving range and the mechanical components that comprise a Drivotrainer installation.

Chapter III will describe the methods of selecting the school and the instructors, the methods of selecting and assigning the students, a description of the characteristics of the students, the instructional and testing programs, and the methods of instruction.

CHAPTER III

PROCEDURE

Chapter III describes (1) the selection of the school and the methods of selecting the instructors who were to be involved in the study, (2) the method of obtaining the sample of students, (3) the characteristics of the students involved in the study, (4) the instructional and testing programs, (5) the methods of instruction, and (6) the testing devices and methods used in this investigation.

At this point, the investigator feels that further reference to the training techniques, the students, and the instructors involved, could be facilitated by the use of code letters and numbers rather than lengthy sentences. The following terms will be used throughout the remainder of this chapter and the chapters to follow:

DOT instructors refers to the instructor(s) who were assigned to train students in the Drivotrainer program.

MCR instructor refers to that instructor who was assigned to train students in the multiple car off-street driving range program.

DOT students refers to the total group of students who were trained in the Drivotrainer.

MCR students refers to the total group of students trained on the multiple car off-street driving range.

To facilitate statistical analysis, DOT and MCR groups were coded according to (1) a student's alphabetical position in the class, (2) the period in which he was enrolled for driver education (A, B, or C), (3) the school semester, and (4) the training technique to which he had been assigned. For example:

1A-1 DOT refers to the first person in "A" period, first semester assigned to the Drivotrainer group.

13A-1 MCR refers to the first person in "A" period, first semester assigned to the multiple car off-street driving range.

1B-2 DOT refers to the first person in "B" period, second semester assigned to the Drivotrainer group.

13B-2 MCR refers to the first person in "B" period, second semester assigned to the multiple car off-street driving range.

All students in each driver education period for the first and second semester were assigned in a manner similar to the examples given.

Selection of the School and the Instructors

This study was conducted in the East Lansing High School, East Lansing, Michigan, during the school year 1959-60. East Lansing, the location of Michigan State University, is an upper middle class community of 22,000

persons located in the south central portion of Michigan's lower peninsula. Because of the high school's proximity to Michigan State University, the students in this study were easily transported in a school bus to the Drivotrainer laboratory and multiple car off-street driving range located on the University campus.

Three graduate students with previous high school teaching experience in driver education, who at the time of the study were employed as graduate teaching assistants in driver education in the Highway Traffic Safety Center at Michigan State University, were selected to be instructors in the study. Each of the instructors was also a candidate for the Master of Arts Degree. The selection and assignment of the instructors was dependent upon their being entirely familiar with the two instructional programs and their availability during the periods of the day when the high school students would be taking the driver education course.

Two instructors were assigned to the DOT program. One, taught two periods; the other, one period of each instructional day. The third instructor taught in the MCR program exclusively.

The instructor selected to teach the classroom work in driver education had acquired his Master's degree in Driver Education and Traffic Safety before the study was conceived and was the regular teacher assigned this course at the East Lansing High School.

Methods of Obtaining the Sample

This section describes the methods of selecting and assigning the students, and presents the factors used in determining the size of the training groups.

Selection of Students

Students participating in the study were screened according to the following criteria: (1) must be in the process of taking a course in driver education; (2) have no previous driving experience; and (3) be at least fifteen years of age at the time they began their training.

Assignment of Students

East Lansing High School students enroll in driver education for the eighteen weeks semester. For purposes of this study, the one hundred and thirty-three participating students received their classroom and behind-the-wheel instruction during the course of the normal school day. No student received any driver education instruction before or after school hours.

During each semester the driver education classes occurred during the morning hours, and were designated A, B, and C periods, with all students being assigned to one of the two training techniques.

Determining the Size of the Groups

The fact that twelve vehicles were available for the instruction of the MCR group made it necessary to limit

the enrollment to twenty-four students for each driver education class. Although fifteen students per period could have been accommodated in the DOT, no more than twelve were assigned during any one period. Thus, if a class had the maximum enrollment of twenty-four students, half the group was assigned to the DOT and half to the MCR.

There were three DOT and three MCR groups each semester, making a total of six groups assigned to each of the training techniques during the school year. By following the alphabetical class roll, students were alternately assigned to either a DOT or MCR group. This was an arbitrary designation undertaken during the first meeting of each driver education class for both the first and second semesters.

Three periods had an equal number of students assigned to the DOT and MCR groups, with two of these periods occurring during the first semester and one during the second; however, during the first and second semesters a DOT group was assigned one more student than the corresponding MCR group, and during the second semester one MCR group was assigned one more student than had been assigned to the DOT group.

Characteristics of the Students

This section presents descriptions of the distribution of the DOT and MCR groups according to sex, age,

grade level, intelligence quotients and previous driving experience.

Distribution According to Sex

The distribution of boys and girls according to instruction group is shown in Table 2. Although the boys outnumbered the girls in DOT-1, the reverse was true in DOT-2. The same is true for MCR-1 and MCR-2; therefore, the total enrollment between the DOT and MCR groups could be said to be of approximate equal distribution according to sex.

Chronological Age Range

In Tables 3 and 4 are found the ages in years and months of the DOT and MCR groups respectively. The age of each student was his age to the nearest month, as of the day he began his instruction. The mean age for both the DOT and MCR groups was sixteen years, one month. For the DOT boys, the mean age was sixteen years; for the MCR boys, fifteen years, eleven months. For the DOT girls, the mean age was sixteen years, one month; and for the MCR girls, sixteen years, one month. The total age range was between fifteen years and eighteen years, ten months. Fifty-eight per cent of the DOT group was below sixteen years of age, while fifty-nine per cent of the MCR group was also below age sixteen.

Table 5 shows the levels of significance of the differences in mean ages between the DOT and MCR groups and

Table 2. Frequency distribution of the DOT and MCR groups classified by sex and semester of instruction.

Group	Boys	Girls	Total
DOT-1	21	14	35
DOT-2	14	18	32
Total DOT	35	32	67
MCR-1	19	15	34
MCR-2	14	18	32
Total MCR	33	33	66

Key:

DOT-1--Drivotrainer Instruction Group, First Semester
DOT-2--Drivotrainer Instruction Group, Second Semester
MCR-1--Multiple car off-street driving range instruction group--first semester
MCR-2--Multiple car off-street driving range instruction group--second semester

Table 3. Frequency distribution of DOT groups classified according to sex and age.

Age	DOT-1			DOT-2			DOT Totals		Grand Total	
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	No.	%
15-0 to 15-5	4	1	5	1	2	3	5	3	8	12
15-6 to 15-11	12	6	18	5	8	13	17	14	31	46
16-0 to 16-5	2	6	8	5	3	8	7	9	16	24
16-6 to 16-11	3	1	4	3	2	5	6	3	9	13
17-0 to 17-5	0	0	0	0	2	2	0	2	2	3
17-6 to 17-11	0	0	0	0	0	0	0	0	0	0
18-0 to 18-5	0	0	0	0	0	0	0	0	0	0
18-1 to 18-11	0	0	0	0	1	1	0	1	1	2
Grand Totals	21	14	35	14	18	32	35	32	67	100
Mean Age	15/10	16/0	15/11	16/2	16/2	16/2	16/0	16/1	16/1	--

Table 4. Frequency distribution of MCR groups classified according to sex and age.

Age	MCR-1			MCR-2			MCR Totals		Grand Total	
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	No.	%
15-0 to 15-5	3	2	5	1	0	1	4	2	6	9
15-6 to 15-11	11	6	17	9	7	16	20	13	33	50
16-0 to 16-5	3	6	9	3	9	12	6	15	21	30
16-6 to 16-11	1	0	1	0	2	2	1	2	3	5
17-0 to 17-5	0	0	0	1	0	1	1	0	1	2
17-6 to 17-11	0	1	1	0	0	0	0	1	1	2
18-0 to 18-5	1	0	1	0	0	0	1	0	1	2
18-6 to 18-11	0	0	0	0	0	0	0	0	0	0
Grand Totals	19	15	34	14	18	32	33	33	66	100
Mean Age	15/10	16/0	15/11	15/11	16/1	16/0	15/11	16/1	16/0	--

Table 5. Comparisons of mean ages between DOT and MCR groups (significance of mean differences measured by "t" tests[a] of critical ratios).

Groups Compared	N_1	N_2	Md	SE_{Md}	CR	Comments	Direction
DOT and MCR	67	66	0.48	1.13	0.42	Not significant	
DOT-G and DOT-B	32	35	1.97	1.73	1.13	Not significant	
MCR-G and MCR-B	33	33	2.19	1.45	1.51	Not significant	
DOT-G and MCR-G	32	33	.42	1.83	0.23	Not significant	
DOT-B and MCR-B	35	33	.64	1.48	0.43	Not significant	
DOT-1 and DOT-2	35	31	3.49	1.54	2.26	Significant beyond .02 level	DOT-2
MCR-1 and MCR-2	34	32	1.32	1.70	0.78	Not significant	

[a].05 (one-tail).

Key: Md = Difference of means

SE_{Md} = Standard error of difference of means

CR = Critical ratio

Comments = Significance of the critical ratio

Direction = Higher mean score indicated at .05 level or lower

between both halves of the DOT and MCR groups as well as between boys and girls. There were no significant differences between either the Drivotrainer and Multiple Car groups, and boys and girls within or between groups. There was a significant difference between the DOT-1 and DOT-2 groups. The students in the DOT-2 group were three and one-half months older on the average than those students in the DOT-1 group. This difference is significant beyond the 5 per cent level. There was no significant difference between the MCR-1 and MCR-2 groups.

Age sixteen is significant in this study because it is at this age, in Michigan, that the youngsters of the state can obtain their regular operator's license if they have successfully completed an approved driver education course and obtain parental permission.

Grade Level Distribution

The distribution of four grade levels classified according to sex and instructional group are presented in Tables 6 and 7 respectively.

In the total DOT group, ninety-five per cent of the students were in grades 10 and 11. Of this total, approximately sixty-four per cent of the students were tenth graders.

Ninety-six per cent of the total MCR group were in grades 10 and 11. As in the DOT group, sixty-four per cent of this total were in the tenth grade.

Table 6. Frequency distribution of DOT groups classified according to sex and grade level.

Grade Level	DOT-1			DOT-2			DOT Totals		Grand Total	
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	No.	%
9	0	0	0	0	0	0	0	0	0	0
10	14	4	18	12	11	23	26	15	41	61
11	5	10	15	2	6	8	7	16	23	34
12	2	0	2	0	1	1	2	1	3	5
Grand Totals	21	14	35	14	18	32	35	32	67	100

Table 7. Frequency distribution of MCR groups classified according to sex and grade level.

Grade Level	MCR-1			MCR-2			MCR Totals		Grand Total	
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	No.	%
9	0	0	0	0	1	1	0	1	1	1
10	12	4	16	11	13	24	23	17	40	61
11	6	10	16	3	4	7	9	14	23	35
12	1	1	2	0	0	0	1	1	2	3
Grand Totals	19	15	34	14	18	32	33	33	66	100

One ninth-grade and five twelfth-grade students were included in the total DOT and MCR distribution.

The distribution of the grade levels between the DOT and MCR groups was proportionate. That there were almost twice as many tenth graders in both the total DOT and MCR groups can be attributed to the fact that the greater percentage of students enroll for driver education during their sophomore year in high school.

There was a wide disparity between the ratio of boys to girls in the DOT-1 group at the tenth grade level. The boys comprised 60 per cent of the group. However, this difference in ratio was reversed at the eleventh-grade level where we find girls outnumbering boys approximately two to one. When the total DOT group is considered, the proportion of boys to girls is approximately equal.

In the MCR-1 group boys outnumbered girls by three to one at the tenth-grade level. For this same MCR-1 group, girls again were in the majority at the eleventh-grade level, comprising 63 per cent of the group. For the total MCR group the ratio of boys to girls was equal.

The totals just described were found not to be statistically significant at or beyond the five per cent level when tested by Chi square and shown in Table 8.

Distribution on Intelligence Quotients

Tables 9 and 10 show the distribution of intelligence for the DOT and MCR groups respectively. The mean I.Q. for the DOT group was 112.5 with a median I.Q. of 111.3; for

Table 8. Comparison of the distribution of grade levels between the DOT and MCR groups, classified by sex. (Siginficance of distribution differences measured by Chi square.)

Grade Level	Boys			Girls			Boys and Girls		
	Chi Square	DF	P	Chi Square	DF	P	Chi Square	DF	P
10-1	0.04	1	.85	0.00	1	.99	0.03	1	.87
10-2	0.00	1	.99	0.04	1	.85	0.02	1	.89
11-1	0.00	1	.99	0.00	1	.99	0.00	1	.99
11-2	0.00	1	.99	0.10	1	.76	0.00	1	.99
12-1	0.00	1	.99	0.00	1	.99	0.00	1	.99
12-2	--	-	--	0.00	1	.99	0.00	1	.99
Total	0.04	4	.99	0.14	5	.99	0.05	5	.99

Key: DF = Degrees of freedom

P = Level of significance of the Chi square

Table 9. Frequency distribution of DOT groups classified according to sex and intelligence quotient.

I.Q.	DOT-1			DOT-2			DOT Totals		Grand Total	
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	No.	%
140-149	0	0	0	0	0	0	0	0	0	0
130-139	2	0	2	0	3	3	2	3	5	7
120-129	5	0	5	4	1	5	9	1	10	15
110-119	8	8	16	4	4	8	12	12	24	36
100-109	6	5	11	5	9	14	11	14	25	37
90-99	0	1	1	1	1	2	1	2	3	5
80-89	0	0	0	0	0	0	0	0	0	0
70-79	0	0	0	0	0	0	0	0	0	0
Grand Totals	21	14	35	14	18	32	35	32	67	100
Mean I.Q.	115.5	110.0	112.8	111.5	112.7	112.1	113.5	111.4	112.5	--
Median I.Q.	114.0	111.0	112.5	111.0	109.0	110.0	112.5	110.0	111.3	--

Table 10. Frequency distribution of MCR groups classified according to sex and intelligence quotient.

I.Q.	MCR-1			MCR-2			MCR Totals		Grand Total	
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	No.	%
140-149	0	1	1	0	0	0	0	1	1	1
130-139	0	1	1	1	0	1	1	1	2	3
120-129	5	1	6	1	2	3	6	3	9	14
110-119	6	7	13	5	6	11	11	13	24	36
100-109	5	3	8	7	7	14	12	10	22	33
90-99	3	2	5	0	2	2	3	4	7	11
80-89	0	0	0	0	0	0	0	0	0	0
70-79	0	0	0	0	1	1	0	1	1	1
Grand Totals	19	15	34	14	18	32	33	33	66	100
Mean I.Q.	111.2	113.1	112.2	111.9	106.0	109.0	111.6	109.6	110.6	--
Median I.Q.	112.0	111.0	111.5	109.0	108.0	108.5	110.5	109.5	110.0	--

the MCR group the mean was 110.6, with a median of 110.0. Thus, both the DOT and MCR were almost perfect normal distributions. For the DOT boys the mean I.Q. was 113.5 with a median of 112.5; for the MCR boys it was 111.6, with a median of 110.5. For the DOT girls the mean I.Q. was 111.4 with a median of 110.0; for the MCR girls it was 109.6, with a median of 109.5.

As indicated by Tables 9 and 10, both groups showed a tendency towards scores in the upper ranges. Forty-eight per cent of the total DOT group and fifty-four per cent of the total MCR group had scores of 110 or better.

As shown in Table 11, the differences in mean I.Q. between the DOT and MCR groups, between boys and girls in either group, and between the respective halves of the groups were not significant.

Distribution of Students with Varying Amounts of Driving Experiences

Tables 12 and 13 respectively present distributions within the DOT and MCR groups of all students according to three categories of previous driving experience. Thirty-one per cent of the DOT and thirty-five per cent of the MCR students were without previous driving experience of any kind. In the remaining two categories, there was quite a disparity between the DOT and MCR groups within the category of considerable driving experience. Thirty-six per cent of the DOT group and twenty-three per cent of the MCR group were in this category. However, this is balanced

Table 11. Comparisons of mean intelligence quotients between DOT and MCR groups. (Significance of mean differences measured by "t" tests[a] of critical ratios.)

Groups Compared	Md	SE_{Md}	CR	Comments
DOT and MCR	2.07	1.83	1.13	Not significant
DOT Girls and DOT Boys	2.88	2.26	1.27	Not significant
MCR Girls and MCR Boys	2.36	2.83	.83	Not significant
DOT Girls and MCR Girls	1.74	2.68	.65	Not significant
DOT Boys and MCR Boys	2.26	2.43	.93	Not significant
DOT-1 and DOT-2	.90	2.25	.40	Not significant
MCR-1 and MCR-2	3.55	2.80	1.26	Not significant

[a].05 (one-tail)

Key: Md = Difference of mean scores

SE_{Md} = Standard error of differences of mean scores

CR = Critical ratio

Comments = Level of significance of the critical ratio

Table 12. Frequency distribution of DOT groups classified according to sex and previous driving experience categories.

Previous Driving	DOT-1			DOT-2			DOT Totals		Grand Total	
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	No.	%
None	5	6	11	1	9	10	6	15	21	31
Limited	6	4	10	4	8	12	10	12	22	33
Considerable	10	4	14	9	1	10	19	5	24	36
Grand Totals	21	14	35	14	18	32	35	32	67	100

Table 13. Frequency distribution of MCR groups classified according to sex and previous driving experience categories.

Previous Driving	MCR-1			MCR-2			MCR Totals		Grand Total	
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	No.	%
None	5	3	8	4	11	15	9	14	23	35
Limited	7	9	16	6	6	12	13	15	28	42
Considerable	7	3	10	4	1	5	11	4	15	23
Grand Totals	19	15	34	14	18	32	33	33	66	100

somewhat by the MCR group who had forty-two per cent in the limited driving experience category, while the DOT group had thirty-three per cent. The differences of distribution between the groups of DOT and MCR girls among the three categories were well within the range of a normal distribution with approximately forty-two per cent of the MCR and forty-seven per cent of the DOT girls having had no previous driving experience, and the remaining percentage equally distributed among the other two categories.

In the case of the boys, they were equally distributed among the first two categories; however, for the DOT group, more than fifty-three per cent had considerable driving experience while thirty-three per cent of the MCR group were within this category.

Table 14 shows that the distributions shown in Tables 12 and 13 produced no divergences of statistical significance, therefore, the null hypothesis must be retained.

The Instructional and Testing Programs

The instructional program consisted of: (1) the classroom program, (2) the DOT program, (3) the MCR program; followed by the testing program which included two phases: (1) the pre-testing program, and (2) the post-testing program.

Table 14. Comparisons of the distribution of previous driving experience categories between the DOT and MCR groups classified by sex (Significance of distribution differences measured by Chi square.)

Previous Driving	Boys			Girls			Boys and Girls		
	Chi Square	DF	P	Chi Square	DF	P	Chi Square	DF	P
None	0.67	1	.43	0.07	1	.79	0.53	1	.47
Limited	0.43	1	.52	0.37	1	.56	0.42	1	.53
Considerable	1.63	1	.21	0.00	1	.99	1.64	1	.20
All Experience Combined	2.73	2	.26	0.44	2	.80	2.59	2	.28

Key: DF = Degrees of Freedom

P = Level of significance of the Chi square.

The Classroom Program

Students at East Lansing High School enroll in driver education for one semester or approximately ninety clock hours of instruction. It is important to note that students participating in this study received both their classroom and behind-the-wheel instruction during the regularly scheduled time of their driver education class.

The Michigan Driver Education Law, passed by a special session of the Michigan Legislature in 1955, provides that classroom instruction shall not be less then thirty clock hours. Students participating in this study received approximately forty-five clock hours of classroom instruction, which began after the administration of the pre-testing program.

Instruction for all students was under the direction of the regular driver education teacher at East Lansing High School, whose text for the classroom was the sixth edition of Man and the Motor Car.[23] Classroom instruction was divided into three phases: (1) the initial phase--all students received classroom instruction lasting four weeks; (2) the second phase following the instructional program in the DOT and MCR--students assigned to each group were given behind-the-wheel instruction on-the-street by the MCR and DOT instructors; and (3) the third and final phase--continuance of classroom instruction for students

---

[23]Center for Safety Education, New York University, Man and the Motor Car (sixth ed.; New Jersey: Prentice-Hall, Inc., 1959).

until completion of the course, and the post-testing program.

The DOT Program

Instruction for the sixty-seven students in the DOT program consisted of ten clock hours in the DOT, supplemented with three clock hours behind-the-wheel and six hours of observation in a dual-control car on-the-street, making a total instruction period of eight weeks. Of this, the first two and one-half weeks involved instruction in the Drivo-trainer followed by five and one-half weeks devoted to the supplemental three hours behind-the-wheel and six hours of observation time.

The MCR Program

Instruction for the sixty-six students assigned to the MCR program consisted of ten clock hours on the multiple car off-street driving range, supplemented with two clock hours behind-the-wheel and four hours of observation time in a dual-control car on-the-street, making a total instruction period of eight weeks. The first two and one-half weeks involved instruction on the range followed by five and one-half weeks of the supplemental two clock hours behind-the-wheel and four clock hours of observation time.

The Pre-testing Program

During the first three days of the semester, each student was tested for driver knowledge, driver attitude

and driving skill. Driver knowledge was measured by means of two driver education achievement tests based on the texts Man and the Motor Car and Sportsmanlike Driving.[24] Driver attitude was measured by the Mann Personal Attitude Survey[25] and the Sundwall General Opinion Survey.[26] Driving skill was measured using a brief road test on the MCR. All of these tests are described elsewhere in this chapter.

Each student was permitted to work on his written tests as rapidly as he chose. As soon as one test was completed, another could be started. If class time did not permit completion of a test, it was collected and returned to the student for completion during the first part of the period on the following day. Each test paper was identified with the student's name, the date and the MCR or DOT group to which he had been assigned.

The Post-testing Program

Immediately after completion of their instruction, students were again tested for driver knowledge, driver attitude and driving skill. The same knowledge and attitude tests used in pre-testing again were administered as post-tests. Terminal driving skill was measured using an

---

[24]American Automobile Association, Sportsmanlike Driving (3rd ed.; Washington, D.C.: The Association, 1955).

[25]Dr. William A. Mann is a Professor of Education, Michigan State University, East Lansing, Michigan.

[26]Dr. Harry Sundwall is a Professor of Education, Arizona State University, Tempe, Arizona.

on-the-road test developed by the American Association of Motor Vehicle Administrators and was conducted over a predetermined course on the city streets of East Lansing, Michigan.

The DOT and MCR Methods of Instruction

In the previous section, a brief discussion of the instructional and testing programs was presented; in this section, the methods of instructing the DOT and MCR groups will be explained.

The ten hours of DOT instruction and the supplemental three hours behind-the-wheel on-the-street will be discussed in terms of (1) the DOT films, (2) the instructor's role in the DOT, and (3) behind-the-wheel instruction on-the-street.

The DOT Films

The eight simulator films used in this study were selected from a group of twenty-four regularly used DOT films. The Smith System of Non-accident Driving,[27] a film depicting correct seeing habits, and not a part of the DOT film series, was also used. Each film was selected for instructional content and its contribution in the total preparation of the student for the road experience to follow. Films used at the beginning present relatively few driving problems; however, as the student progresses, later films

---

[27]Harold L. Smith, The Smith System of Non-accident Driving (Dearborn, Michigan: The Ford Motor Company, 1957).

present a greater challenge in terms of driving lessons and experiences.

DOT films used were of the "combination" type, that is each combined the best features of (1) the instructional films, and (2) the test films. A more detailed explanation of these film types follows:[28]

Instructional film. Is sub-divided into three distinct methods of instruction.

(a) Demonstration: these films sequences are designed to give the students an over-all picture of the subject or subjects to be presented in the film. High angle, fixed and close-up photography are used for vivid presentation of material.

(b) Third Person Demonstration: in these film sequences, the students are instructed to follow the actions of the driver, as he goes through the driving practices correctly.

(c) First Person Instructional: this film gives the student a through-the-windshield view of the road, placing him in the driver's position to perform driving operations according to step-by-step spoken instructions.

The test film. This is a "first person" film with all step-by-step instructions removed, using narrative

---

[28]Clarence Barger, George Forlano, and Richard J. O'Connor, Teachers Manual for the AEtna Drivotrainer (Hartford: AEtna Casualty and Surety Company, 1957), pp. v-1, v-2.

commands only to inform the students to follow certain directions, such as "Turn right at the next intersection," etc.

The combination type film used the first type with the second by giving a demonstration, placing the student behind the wheel to practice, and finally testing him on his accomplishment.

Figure 22, the schedule of DOT instructional films, includes the period in the Drivotrainer, film number, film title, running time and number of showings for each film used during an instructional period in the DOT. The first period was devoted to: (1) acquainting the student to the Drivotrainer in terms of its physical components, its operation and its films; (2) developing an understanding of the function of simulators; and (3) learning the fundamentals of driving, such as how to hold and turn the steering wheel, how to put the car in motion, and when to signal, accelerate and brake.

Two films were used during the second period and each was shown one time. The first, Steering, Signalling, and Braking, was originally adopted for use with the standard shift transmission; however, film content is such that it can be used equally well for automatic transmission driving. The film provides for a continuation of the basic fundamentals learned during the first period with the student now actually performing the skills and techniques of proper steering control, signalling, and braking techniques on the

Period in Drivotrainer	Film Number	Film Title	Running Time in Minutes	Number of Showings
1	1	Introducing the Drivotrainer	18:02	1
2	2	Steering, Signalling and Braking	12:03	1
	3	Smith System of Non-Accident Driving	12:00	1
3	4	Traffic Driving II	13:44	2
4	5	Shifting Smoothly	11:55	2
5	6	Always on Guard	9:21	2
6	7	Park Like A Pro	17:49	2
7	8	Driving on One-Way Streets	15:22	2
8	9	Expressway Experts	13:37	2
9	10	Learning to Drive on Country Highways	21:27	1
10		Learning to Drive on Country Highways	21:27	1

Figure 22. Schedule of DOT instructional films.

street, and eventually is tested with regard to the degree of proficiency he has acquired. The Smith System of Non-accident Driving emphasizes the important seeing habits and basic defensive concepts in the driving task: (1) aim high in steering; (2) get the "big picture"; (3) keep your eyes moving; (4) make sure others see you; and (5) leave yourself an out. The Smith System was used at this time because the investigator was of the opinion that greater film impact could be obtained after the student had been introduced to on-the-street situations such as were shown during the film Steering, Signalling, and Braking.

Traffic Driving II, the film used during the third period in the DOT reinforced the lessons the student had learned in other films as well as providing experience in turning and to test his attitude toward and judgment of traffic and pedestrians. Beginning with this period and during the remaining periods, all films in the DOT series were shown twice.

Limited introduction to the standard shift by the Drivotrainer students occurred during the fourth period. Learning to shift was purposely subordinated to a rather minor role, for the actual shifting of gears plays a relatively insignificant role in the safe operation of an automobile. Instead, it is important that a student perceives correctly the complex traffic situations with which he is confronted and exercises proper judgment and attitude toward these situations. Thus, if a student has acquired

the ability to operate an automatic transmission car in traffic, then the teaching of the neuro-muscular skills involved in gear shifting becomes a rather simple task.

Film # 5, Shifting Smoothly, concerns itself with the teaching of the basic skills of shifting, the use of the clutch and the use of the accelerator.

The concept of defensive driving was taught in film # 6, Always on Guard. This film demonstrated to students how careful drivers are always alert for potential accidents and how they take measures to prevent such situations from developing. In addition, the film demonstrates how good drivers act in emergency situations to prevent accidents. Five emergency situations are provided in the test portion of the film, with the students being scored to see if they made the correct response actions in each case. The defensive driving concept was introduced during this lesson because films to follow would demand driver reaction to complex traffic situations requiring an understanding of defensive driving before proceeding further.

Period # 6 which involved instruction in parallel parking utilized the film Park Like A Pro to teach the techniques of steering, braking, accelerator control, and safety precautions.

Driving On One-Way Streets, film # 8, used during the seventh hour in the Drivotrainer, provides basic instruction in safely negotiating one-way streets with special emphasis on correct lane usage, lane changing,

parallel parking on the left side, and turns made into and off of both two-way and one-way streets.

During the eighth period the film Expressway Experts demonstrated the safety practices and the judgment necessary for safe driving on modern expressways. Students were shown the safe and proper way to enter and leave an expressway emphasizing the necessity of remaining alert, establishing a safe following distance, and matching their speed with other traffic.

The last two periods in the Drivotrainer dealt with instruction in driving safely on rural roads. To provide this experience, film # 10, Learning to Drive on Country Highways, takes the student driver on gravel as well as paved surfaces, where he learns the many different types of situations that might occur on roadways of this type emphasizing proper speed control in relation to geometric design and road surface. Instruction is given in passing another car at the higher speeds one encounters in rural areas, as well as important defensive concepts that must always be considered. Because of its broad content and implications for safe rural driving, it was necessary to devote two periods to the discussion and showing of this film.

The Instructor's Role in the DOT Classroom

Both teachers assigned to the Drivotrainer followed a definite pattern in their teaching. Following the first or introductory session, emphasis was placed on the use of

supplementary teaching aids during each period in the Drivotrainer classroom. A magnetic traffic board, blackboard, and flashlight pointer were used to clarify and simplify problems arising from the films. During the actual showing of a film, the instructor found it extremely helpful to interject comments of his own during pauses in narration on the film sound track. Where advisable, traffic situations seen in the films were related to actual traffic situations in the community and adjacent area in which the students would be driving after instruction.

The discussion of driving errors after each film was based on the score sheet produced by the recording machine during the showing of the film (Figure 23). As the instructor read the score sheet for results, each student scored his own Error Check Sheet (Figure 24). Following each class session the student score sheets were collected and filed as a permanent record of their progress.

The DOT Group in the Dual Control Car

Immediately following the ten periods of instruction in the Drivotrainer, students were scheduled in groups of three for three hours of instruction in a dual control car on-the-street with the same instructor they had had in the Drivotrainer. The first hour on-the-street was one of familiarization, that is, the student made left and right turns, accelerated, slowed down, used his brakes, etc., to get the "feel" of the car. Students adapted quite

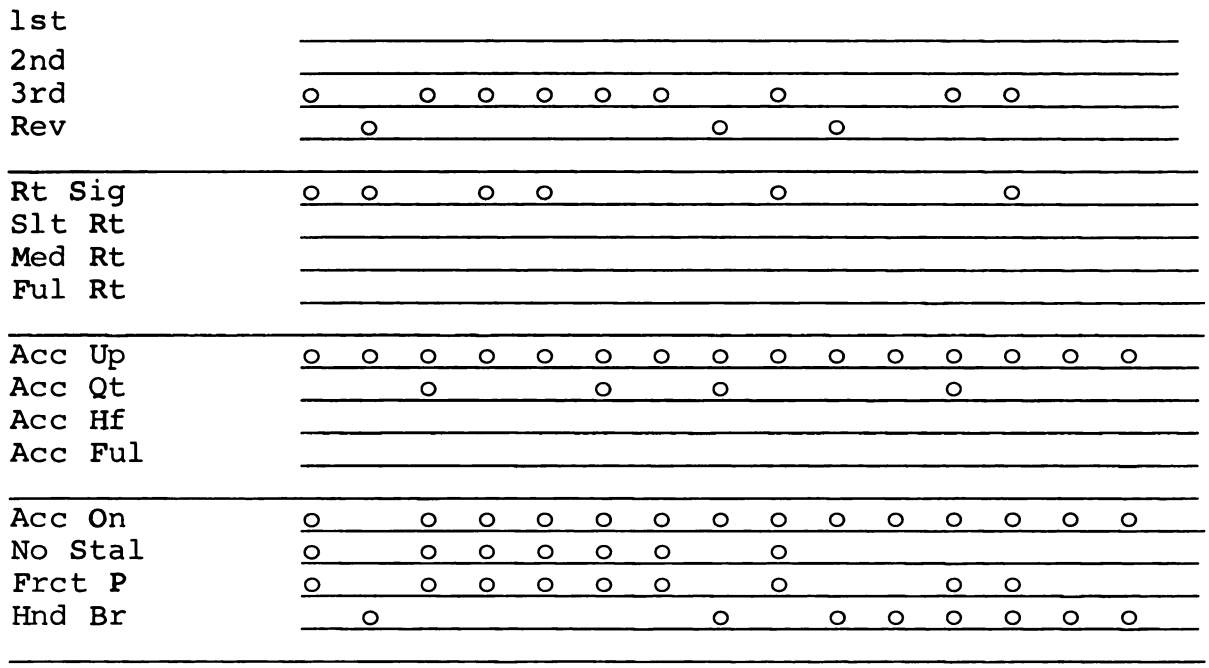


Figure 23. Drivotrainer score sheet.

DRIVOTRAINER STUDENT ERROR CHECK SHEET

STUDENT ERROR CHECK SHEET Film 6 FILM - ALWAYS ON GUARD

Student's Name _____ Class _____ Date _____

INSTRUCTIONS: Indicate in the proper column with a check mark whether you DID or DID NOT complete the items listed on the left. In the REMARKS column, indicate errors brought to your attention by the instructor.

ACTION	DID	DID NOT	REMARKS
EXAMPLE: RIGHT STEER			Oversteered Right
1. We are driving behind a station wagon ACCELERATE 1/4 - 1/2			
2. Station wagon suddenly cuts in front of us HARD BRAKE			
3. We are passing a line of parked cars ACCELERATE UP			
4. Door opens on a parked car LEFT STEER, HARD BRAKE, HORN			
5. We drive on again SHIFT 1ST, 2ND, 3RD			
6. We are told to turn left at the light LEFT SIGNAL, MEDIUM LEFT			
7. We approach the light SOFT BRAKE			
8. We stop at light CLUTCH DOWN, NEUTRAL			
9. The light changes in our favor SHIFT TO 1ST			
10. A car runs the light and turns left CLUTCH FRICTION POINT (NEGATIVE CHECK), NO STALL, ACCELERATOR DOWN (NEGATIVE CHECK)			
11. We turn left at the light MEDIUM LEFT			
12. We approach another intersection ACCELERATOR UP			

ACTION	DID	DID NOT	REMARKS
13. Station wagon cuts in front of us HARD BRAKE			
14. We continue our drive SHIFT 1ST, 2ND, 3RD			
15. We are told to turn left at next intersection LEFT SIGNAL			
16. We approach the intersection ACCELERATOR UP			
17. Oncoming car turns short left at intersection RIGHT STEER, HARD BRAKE			
18. We move up to the intersection SHIFT TO 1ST			
19. We stop at the intersection SOFT BRAKE			
20. We turn left at the intersection MEDIUM LEFT			457-191

Figure 24. Student error check sheet.

readily to the actual automobile, and no problems presented themselves during this phase of the program. In fact, instructors found it generally unnecessary to give verbal instructions prior to and during the various driving maneuvers, so the assumption could be made that the practice in the Drivotrainer had sufficiently demonstrated that which was expected of the students. Instructors were able for the most part to confine themselves to directing the students where to go and the maneuver to execute next. The second and third hours on-the-street involved driving in the city and on rural roads. All DOT students drove over identical routes and practiced specific skills and maneuvers at identical or nearly identical spots. An outline suggesting roads, routes, intersections and other experiences was closely followed (see Appendix A).

The area surrounding East Lansing High School within a radius of approximately ten miles was used for instruction in the dual control car.

The preceding paragraphs have presented the Drivotrainer method of instruction. Following is a description of the MCR method employed in this study in which students are taught in the multiple car off-street driving range program.

The MCR Instructional Lessons

Students were assigned individually to MCR cars for a period of three lessons, after which, another car was assigned to each student. This plan permitted all students

to have experience in driving either a standard size car, a compact, or a station wagon. The instructional program which confined itself to the multiple car off-street driving range followed the ten prepared lessons (Figure 25) and is included in detail in Appendix B.

When students arrived on the MCR for their lesson, they were assigned cars and given a practice driving guide (see Appendix C) which outlined all the experiences they would be held responsible for while on the MCR. All demonstrations of lessons were done on a group basis using a transistorized portable horn in making instructions audible.

Instructions for lesson # 1 were given while students were sitting in their assigned cars. All cars were parked in accordance with the diagram attached to MCR lesson plan # 1 Appendix B. Orientation to the driver's compartment was done on a car-group basis, that is, students assigned to standard-sized cars were given instructions first, those in the compact cars next, followed by the student in the station wagon. Following orientation to the driver's compartment, and having made the required preparations to drive, the students, cued by the instructor, moved their cars on an individual basis forward and to the rear as indicated on the lesson diagram. Having proceeded forward and to the rear as indicated on an individual basis and under close observation by the instructor, students were then told to proceed through the same exercise on their own. This accomplished, students were given instructions

LESSON NUMBER	LESSON TOPIC
1	1. Orientation to the driver's compartment 2. Preparing to drive 3. Starting and stopping procedure 4. Proper steering technique 5. Moving the car forward and to the rear 6. Driving around the MCR
2	1. Review starting procedure 2. Lane changing 3. The "T" exercise
3	1. The "X" and figure "8" exercises 2. MCR hill to be opened during this period
4	1. Double garage exercise
5	1. Parking on a hill 2. Angle parking
6	1. "Y" turn exercise 2. Parallel parking
7	1. Passing 2. Start testing program
8	1. Testing 2. Open driving
9	1. Testing 2. Open driving
10	1. Testing 2. Open driving

Figure 25. Schedule of MCR instructional lessons.

in driving around the area in a counter clock-wise direction. While the others sat in their cars and observed, one student was guided around the area by the instructor giving instructions with the portable transistorized horn. All students completed the same maneuver in their assigned cars with time permitting them to complete at least two trips around the area. At the end of the period, cars were parked as indicated on the lesson diagram.

Following lessons proceeded in much the same manner with a lesson demonstration of the skill scheduled for the day being done by a student driver and guided by the instructor using the horn for communication. After demonstration of the special maneuvers, students went to their cars and began their practice driving. As students completed scheduled maneuvers satisfactorily, the instructor so noted by initialling an MCR Assignment Card (Appendix D).

Starting with the seventh lesson and continuing through the tenth and final lesson, a skill test (Appendix E) covering the driving requirements included in the MCR practice driving guide was administered to all students. As can be noted from the test copy included in the Appendix, greatest numerical weight was attached to those items emphasizing correct driver behavior. The instructional program was completed with the eighth lesson; however, two additional hours of driving were included so the testing program could be finished and students would have additional practice time of driving maneuvers.

The Instructor's Role on the MCR

In addition to daily instruction of scheduled driving skills, perhaps the most important task of the instructor on the MCR is close attention to the driving habits exhibited by members of the class as they react to the traffic pattern established by classmates in other cars on the range. Contrary to what one might believe, the fact that the instructor does not sit in the cars, except on occasion where individual instruction is warranted, places him in an advantageous position to observe all vehicles as they go through the various required maneuvers and drive about the area.

The MCR Group in the Dual Control Car

Upon completion of the ten periods of instruction on the MCR, students were scheduled in groups of three for two hours of instruction in a dual control car on-the-street with the same instructor they had had on the MCR. The first hour on-the-street was devoted to driving in the cities of Lansing and East Lansing, while the second hour included instruction and experience in driving on rural roads such as divided highways, narrow, paved, sharply crowded secondary roads and gravel county roads. As did the DOT group, all students drove over identical routes and practiced specific skills and maneuvers at identical or nearly identical spots.

The Testing Devices and Methods

In this section are described the nature, the method of use, and the methods of scoring the instrument used for gathering data for this investigation. The instruments included are: (1) The Mann Personal Attitude Survey, (2) The Sundwall General Opinion Survey, (3) The Achievement Test for Man and the Motor Car, (4) The Sportsmanlike Driving Final Test, (5) The Elementary Skills Test (Appendix F), and (6) The On-The-Road Test (Appendix G).

Achievement Test in Driver Education for Man and the Motor Car

This is a self-administered knowledge test based on material contained in the textbook Man and the Motor Car (Sixth Edition). It is a one hundred item test composed of ten multiple choice questions, thirty-seven sentence completion questions, eight matching questions and forty-five true and false questions.

The tests were scored by counting the correct responses made and recorded at the bottom of each page. No attempt has ever been made to standardize this test; therefore, no statistical evidence was available for either the internal validity or the reliability of the test. It was assumed, however, that the test had curricular validity and was accurate and representative sampling of the material contained in the book Man and the Motor Car for which it was devised.

Achievement Test in Driver Education for Sportsmanlike Driving (Third Edition)

This final examination is a self-administering test, composed of fifty multiple choice items on material contained in the textbook Sportsmanlike Driving. The answers are recorded on a separate answer sheet where instructions to this effect are given. A total score is obtained by summing the correct responses on the answer sheet.

The validity of the test was established by eliminating from an original pool of 591 questions, those questions which were found to be too easy, too difficult, or did not discriminate between the "good" and "poor" students who originally took the test. "Good" and "poor" students were those who made the best and poorest overall scores respectively on the test.

There appears to be no evidence as to the test's reliability. Norms have been established which indicate grades of A, B, C, D, and E. Grades of A and E represent the upper and lower six per cent respectively; grades B and D represent the next twenty-five per cent respectively; a grade of C represents the middle thirty-eight per cent of the distribution. These are contained in a research report from the American Automobile Association.

The Mann Personal Attitude Survey

This is a self-administering survey including sixty statements reflecting attitudes and feelings about oneself and one's reactions to others in traffic and other social

settings. While validity and reliability for this test have not been established, highly interesting results have been obtained in situations where the test has been administered. Clemence, Miller and Stille, in an unpublished report titled A Comparative Analysis of Knowledge and Attitudes Toward Traffic Safety Among Instructors, Teen-age Novice Drivers and Traffic Violators found that a group of violators demonstrated a wide enough difference in total scores and deviation from normal in enough specific questions to give credence to the belief that attitude and driving performance are closely associated. Kenel,[29] in administering the test to high point violators referred by the courts to a traffic improvement school, found that some 200 cases could be classified either aggressive or constrictive as a result of scores attained on the test.

The Sundwall General Opinion Survey

This is a self-administering survey consisting of 135 statements involving ideas in human relations. No statistical evidence is available regarding validity and reliability.

On-the-Road Test

The purpose of this test was to determine the relative ability of students to control the car under actual

---

[29]Francis C. Kenel is Director of Safety and Traffic Education, Illinois State University, Normal, Illinois.

driving conditions. A course was selected in the vicinity of East Lansing High School which included right and left turns, multiple lane traffic, traffic signals, a blind intersection, up and down hill parking, and pedestrian crosswalks. A map of the course is shown in Figure 26. The streets selected for the on-the-road tests did not constitute a part of the regular on-the-street training given to the DOT and MCR groups.

As he drove, each student was scored by the examiner, a doctoral candidate in Education, who by reason of his experience and training in the Colorado Highway Patrol was adjudged to be well qualified to administer the road test.

The score sheet used for this test (Appendix J) was devised by the American Association of Motor Vehicle Administrators.[30] The test is divided into three sections: (1) Vehicle handling, (2) Traffic problems, (3) Road problems. Each time that a student failed to perform properly during any part of the test, a mark was placed in the column headed "needs training." Conversely, when the examiner noted acceptable action on the part of the driver, he placed a mark in the column headed "Good." Tests were scored as recommended in the A.A.M.V.A. Manual.

---

[30]American Association of Motor Vehicle Administrators, A Manual for Driver-Licensing Authorities in the Examining of Applicants for Drivers Licenses (Washington: American Association of Motor Vehicle Administrators, 1959), p. 105.

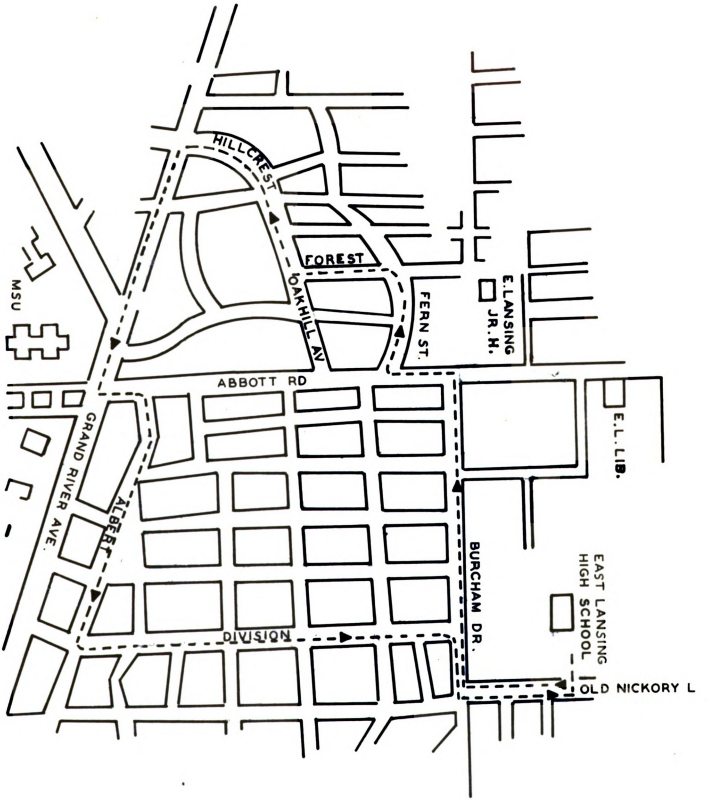


Figure 26. Map of the on-the-road test.

The Elementary Skills Test

This test was administered to all students assigned to either the DOT or MCR prior to the start of their training programs. Items for the test were selected from the first three areas appearing on the MCR practice driving guide previously discussed.

Summary

In this chapter were described the methods of selecting the school and the instructors, the methods of selecting and assigning the students, and a description of the characteristics of the students.

The school and instructors were chosen on a selective basis as well as their availability for the study. The students were selected on the basis of a few select criteria and randomly assigned to the DOT and MCR groups. The students were distributed on the basis of sex, age, grade level, intelligence, and previous driving experience.

Also described were the methods of designing the DOT and MCR instructional programs, the methods of conducting the pre- and post-testing programs, the methods of instructing the DOT and MCR groups, and a description of each of the testing instruments used in the investigation. The following chapter is devoted to the methods of gathering, processing, and analyzing the data from the criteria used in this study.

CHAPTER IV

ANALYSIS OF THE DATA AND RESULTS

In the previous chapters, the methods of procedure for this investigation were presented. This chapter contains the results of a statistical analysis of the data. These results are presented under the following seven headings:

(1) Comparisons of driving attitude, personal opinion, and driving knowledge test scores between and within DOT and MCR groups before instruction;

(2) Comparisons of driving attitude, general opinion, and driving knowledge test scores between and within DOT and MCR groups after instruction;

(3) Changes in driving attitude and general opinion test scores;

(4) Changes in general driving knowledge test scores;

(5) Changes in specific driving knowledge test scores;

(6) Comparisons of driving skill test scores between and within the DOT and MCR groups after instruction; and

(7) Correlations between chronological age, intelligence quotients, and previous driving experience categories, respectively, and scores on the final criteria.

Prior to the statistical analysis of the data as done by the writer within this chapter, a statistical treatment was performed by the Department of Statistics, Michigan State University, employing the Wilk's Alpha Criterion.[31] This process involves the technique of analyzing the variances and covariances of multiple correlated variables and substantiates findings in this chapter which were determined by statistical methods as found in Garrett.[32] The significance of mean differences was tested by critical ratios for driving attitudes, general opinion driving knowledge, and the scores of the on-the-road test. Significance of correlations between chronological age, intelligence, and previous driving experience, respectively, and the on-the-road test, was tested by Chi square. Correlations between chronological age and intelligence, respectively, and the other final criteria, were calculated by the product moment technique and were tested by critical ratios.

Comparisons of Driving Attitude, General Opinion and Driving Knowledge Test Scores between and within DOT and MCR Groups before Instruction

In this section, are the findings resulting from "t" tests which compared mean group scores in driving

---

[31]C. Radhakrishna Rao, Advanced Statistical Methods in Biometric Research (New York: John Wiley and Sons, Inc., 1952).

[32]Henry E. Garrett, Statistics in Psychology and Education (New York: Longmans, Green and Company, Inc., 1958).

attitude, general opinion, general driving knowledge, and specific driving knowledge before instruction. These findings are shown in Tables 15, 16, 17, and 18, respectively.

Driving Attitude Pre-test Scores

Table 15 contains the differences in mean driving attitude test scores and the levels of significance of these differences on the Mann Personal Attitude Survey administered before instruction. Table 15 shows that:

1. There was no significant difference in mean driving attitude scores between the DOT and MCR groups.
2. The DOT boys had a 4.68 lower mean driving attitude score than the DOT girls, significant beyond the .01 per cent level.
3. The DOT-1 group had 6.60 lower mean driving attitude score than the DOT-2 group, significant beyond the .001 per cent level.
4. The MCR-1 group had a 4.23 lower mean driving attitude score than the MCR-2 group, significant beyond the .01 per cent level.
5. For all other differences measured, the null hypothesis must be retained.

General Opinion Pre-test Scores

Table 16 contains the differences in mean general opinion test scores and the levels of significance of these differences on the Sundwall General Opinion Survey administered

Table 15. Significance of the differences in mean driving attitude (Mann) pre-test scores between and within the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Groups Compared	N	Md	SE_{Md}	CR	Comments	Direction
DOT and MCR	133	.28	1.19	.24	Not significant	
DOT Girls and DOT Boys	67	4.68	1.65	2.84	Significant beyond .01 level	DOT-Boys
MCR Girls and MCR Boys	66	2.46	1.58	1.56	Not Significant	
DOT Girls and MCR Girls	65	.87	1.48	.58	Not Significant	
DOT Boys and MCR Boys	68	1.35	1.75	.77	Not Significant	
DOT-1 and DOT-2	67	6.60	1.32	5.00	Significant beyond .001 level	DOT-1
MCR-1 and MCR-2	66	4.23	1.53	2.76	Significant beyond .01 level	MCR-1

[a].05 (one-tail)

Key: N = Number of students within groups compared.
Md = Difference of mean scores
SE_{Md} = Standard error of differences of mean scores
CR = Critical ratio
Comments = Level of significance of the critical ratio
Direction = Higher mean score indicated at .05 level or lower

Table 16. Significance of the differences in mean general opinion (Sundwall) pre-test scores between and within the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Groups Compared	M	Md	SE_{Md}	CR	Comments	Direction
DOT and MCR	133	0.00	2.07			
DOT Girls and DOT Boys	67	1.94	2.94	.65	Not significant	
MCR Girls and MCR Boys	66	3.36	2.86	1.18	Not significant	
DOT Girls and MCR Girls	65	.69	2.94	.23	Not significant	
DOT Boys and MCR Boys	68	.73	2.87	.25	Not significant	
DOT-1 and DOT-2	67	5.97	2.71	2.20	Significant beyond .05 level	DOT-2
MCR-1 and MCR-2	66	4.14	2.99	1.38	Not significant	

[a].05 (one-tail)

Key: N = Number of students within groups compared
Md = Difference of mean scores
SE_{Md} = Standard error of differences of mean scores
CR = Critical ratio
Comments = Level of significance of the critical ratio
Direction = Higher mean score at .05 level or lower

before instruction. Table 16 shows that:

1. The DOT-2 group had a 5.97 higher mean general opinion score than the DOT-1 group, significant beyond the .05 per cent level.
2. For all other differences measured, the null hypothesis must be retained.

General Driving Knowledge Pre-test Scores

Table 17 contains the mean differences and their levels of significance in general driving knowledge between and within the DOT and MCR groups when tested before instruction with the Sportsmanlike Driving final examination. The following findings are taken from the table:

1. The DOT boys group exceeded the DOT girls group by 9.75 mean score points, significant beyond the .01 level.
2. The MCR boys group had a 5.28 higher mean score than the MCR girls group, significant at the .05 level.
3. The DOT-1 group had a 17.37 higher mean score than the DOT-2 group, significant beyond the .001 level.
4. The MCR-1 group had a 15.45 higher mean score than the MCR-2 group, significant beyond the .001 level.
5. The null hypothesis must be retained for all other differences.

Table 17. Significance of the differences in mean general driving knowledge pre-test scores between and within the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Groups Compared	N	Md	SE_{Md}	CR	Comments	Direction
DOT and MCR	133	.36	2.04	.18	Not significant	
DOT Girls and DOT Boys	67	9.75	3.59	2.71	Significant beyond .10 level	DOT-B
MCR Girls and MCR Boys	66	5.28	2.78	1.89	Significant at .05 level	MCR-B
DOT Girls and MCR Girls	65	2.19	3.16	1.44	Not significant	
DOT Boys and MCR Boys	68	2.28	2.37	.96	Not significant	
DOT-1 and DOT-2	67	17.37	2.04	8.51	Significant beyond .001 level	DOT-1
MCR-1 and MCR-2	66	15.45	2.36	6.54	Significant beyond .001 level	MCR-1

[a].05 (one-tail)

Key: N = Number of students within groups compared
Md = Difference of mean score
SE_{Md} = Standard error of differences of mean scores
CR = Critical ratio
Comments = Level of significance of the critical ratio
Direction = Higher mean score indicated at .05 level or lower

Specific Driving Knowledge Pre-test Scores

In Table 18 are presented the differences and levels of significance between mean scores in specific driving knowledge obtained when the achievement test for Man and the Motor Car was administered before instruction. The table shows the following findings:

1. The DOT boys exceeded the DOT girls by 4.17 mean score points, significant beyond the .05 level.
2. The DOT-2 group scored 6.75 points higher than the DOT-1 group, significant beyond the .001 level.
3. The MCR-2 group was 10.98 score points better than the MCR-1 group, significant beyond the .001 level.
4. The null hypothesis is tenable for all other differences.

Comparisons of Driving Attitude, General Opinion and Driving Knowledge Test Scores between and within DOT and MCR Groups after Instruction

The findings which resulted from comparing the groups on the post-instruction criteria for driving attitude, general opinion, and driving knowledge are presented in Tables 19, 20, 21, and 22. These findings are presented under the headings of (1) driving attitude, (2) general opinion, (3) general driving knowledge, and (4) specific driving knowledge.

Table 18. Significance of the differences in mean specific driving knowledge pre-test scores between and within the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Groups Compared	N	Md	SE_{Md}	CR	Comments	Direction
DOT and MCR	133	1.65	1.58	1.04	Not significant	
DOT Girls and DOT Boys	67	4.17	1.94	2.15	Significant beyond .05 level	DOT Boys
MCR Girls and MCR Boys	66	.54	2.19	.24	Not significant	
DOT Girls and MCR Girls	65	.78	1.65	.47	Not significant	
DOT Boys and MCR Boys	68	3.93	2.42	1.62	Not significant	
DOT-1 and DOT-2	67	6.75	1.82	3.71	Significant beyond .001 level	DOT-2
MCR-1 and MCR-2	66	10.98	2.36	6.54	Significant beyond .001 level	MCR-2

[a].05 (one-tail)

Key: N = Number of students within groups compared
Md = Difference of mean scores
SE_{Md} = Standard error of differences of mean scores
CR = Critical ratio
Comments = Level of significance of the critical ratio
Direction = Higher mean score indicated at .05 level or lower

Driving Attitude Post-test Scores

In Table 19 are presented the differences and levels of significance of these differences of mean performance on the Mann Personal Attitude Survey administered at the termination of instruction. Tabulation of the findings reveals:

1. With respect to the total DOT and MCR groups, the null hypothesis must be retained.
2. The DOT-2 group exceeded the DOT-1 group by 6.69 mean score points, significant beyond the .001 level.
3. The MCR-2 group in turn exceeded the MCR-1 group by 6.81 mean score points, significant beyond the .001 level.
4. No other significant differences exist between or within groups, causing the null hypothesis to be retained.

General Opinion Post-test Scores

Table 20 records the differences in mean performance between DOT and MCR groups on the Sundwall General Opinion Survey administered at the completion of instruction. The table shows that:

1. No significant differences exist between or within groups, therefore the null hypothesis must be retained in all instances.

Table 19. Significance of the differences in mean driving attitude (Mann) post-test scores between and within the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Groups Compared	N	Md	SE_{Md}	CR	Comments	Direction
DOT and MCR	133	.64	1.22	.52	Not significant	
DOT Girls and DOT Boys	67	1.53	1.69	.91	Not significant	
MCR Girls and MCR Boys	66	1.89	1.61	1.71	Not significant	
DOT Girls and MCR Girls	65	.81	1.44	.56	Not significant	
DOT Boys and MCR Boys	68	.45	1.83	.25	Not significant	
DOT-1 and DOT-2	67	6.69	1.46	4.58	Significant beyond .001 level	DOT-2
MCR-1 and MCR-2	66	6.81	1.38	4.93	Significant beyond .001 level	MCR-2

[a].05 (one-tail)

Key: N = Number of students within groups compared

Md = Difference of mean scores

SE_{Md} = Standard error of differences of mean scores

CR = Critical ratio

Comments = Level of significance of the critical ratio

Direction = Higher mean score indicated at .05 level or lower

Table 20. Significance of the differences in mean general opinion (Sundwall) post-test scores between and within the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Groups Compared	N	Md	SE_{Md}	CR	Comments
DOT and MCR	133	1.74	2.34	.74	Not significant
DOT Girls and DOT Boys	67	2.82	3.43	.82	Not significant
MCR Girls and MCR Boys	66	3.16	3.20	.99	Not significant
DOT Girls and MCR Girls	65	1.51	3.33	.45	Not significant
DOT Boys and MCR Boys	68	1.17	3.31	.35	Not significant
DOT-1 and DOT-2	67	2.76	3.46	.80	Not significant
MCR-1 and MCR-2	66	.54	3.22	.17	Not significant

[a].05 (one-tail)

Key: N = Number of students within groups compared

Md = Difference of mean scores

SE_{Md} = Standard error of differences of mean scores

CR = Critical ratio

Comments = Level of significance of the critical ratio

General Driving Knowledge Post-test Scores

Table 21 reveals the differences in mean performance between DOT and MCR groups on the Sportsmanlike Driving final administered after instruction was completed. The table indicates that:

1. The null hypothesis with respect to a difference between the DOT and MCR groups was retained.
2. The DOT boys attained a score 7.71 points higher than the DOT girls, significant beyond the .01 level.
3. The MCR boys surpassed the MCR girls by 6.45 mean score points, significant at the .01 level.
4. The DOT-1 group had a mean score exceeding the DOT-2 group by 14.70 points, significant beyond the .001 level.
5. The MCR-1 group attained a mean score of 12.45 points, exceeding the MCR-2 group by 2.19 points, also significant beyond the .001 level.
6. Other differences measured were not significant.

Specific Driving Knowledge Post-test Scores

In Table 22 are found the mean differences in performance on the Achievement Test for Man and the Motor Car administered at the termination of instruction. The table records the following findings:

1. The DOT-2 group out-scored the DOT-1 group by 11.76 points, a difference significant beyond the .001 level.

Table 21. Significance of the differences in mean general driving knowledge post-test scores between and within the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Groups Compared	N	Md	SE_{Md}	CR	Comments	Direction
DOT and MCR	133	1.05	1.95	.53	Not significant	
DOT Girls and DOT Boys	67	7.71	2.72	2.83	Significant beyond .01 level	DOT-B
MCR Girls and MCR Boys	66	6.45	2.51	2.56	Significant at .01 level	MCR-B
DOT Girls and MCR Girls	65	.18	2.83	.06	Not significant	
DOT Boys and MCR Boys	68	1.44	2.38	.61	Not significant	
DOT-1 and DOT-2	67	14.70	2.34	6.28	Significant beyond .001 level	DOT-1
MCR-1 and MCR-2	66	12.45	2.19	5.68	Significant beyond .001 level	MCR-1

[a].05 (one-tail)

Key: N = Number of students within groups compared
Md = Difference of mean scores
SE_{Md} = Standard error of differences of mean scores
CR = Critical ratio
Comments = Level of significance of the critical ratio
Direction = Higher mean scores indicated at .05 level or lower

Table 22. Significance of the differences in mean specific driving knowledge post-test scores between and within the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Groups Compared	N	Md	SE_{Md}	CR	Comments	Direction
DOT and MCR	133	2.19	1.80	.82	Not significant	
DOT Girls and DOT Boys	67	.15	2.29	.07	Not significant	
MCR Girls and MCR Boys	66	.45	2.84	.16	Not significant	
DOT Girls and MCR Girls	65	2.31	2.47	.93	Not significant	
DOT Boys and MCR Boys	68	2.01	2.69	.74	Not significant	
DOT-1 and DOT-2	67	11.76	1.80	6.53	Significant beyond .001 level	DOT-2
MCR-1 and MCR-2	66	16.62	1.76	9.44	Significant beyond .001 level	MCR-2

[a].05 (one-tail)

Key: N = Number of students within groups compared
Md = Difference of mean scores
SE_{Md} = Standard error of differences of mean scores
CR = Critical ratio
Comments = Level of significance of the critical ratio
Direction = Higher mean scores indicated at .05 level or lower

2. The mean of 16.62 points, attained by the MCR-2 group, was 1.76 points more than the MCR-1 group, also significant beyond the .001 level.
3. A significant difference did not exist between the DOT and MCR groups.
4. There was no difference in performance between or within other groups, thus the null hypothesis can be accepted.

Mean Changes in Driving Attitude Test Scores

Table 23 indicates the differences in mean performance and the levels of significance of these differences from pre-test to post-test for both the DOT and MCR groups on the Mann Personal Attitude Survey.

Mean Changes in DOT Driving Attitude Scores

The following changes in the DOT group are shown in Table 23:

1. The total DOT group improved less than one mean score point in driving attitude.
2. The DOT boys improved less than two mean score points in driving attitude.
3. The DOT girls, however, regressed 1.47 mean score points on the post-test for driving attitude.
4. The DOT-1 group regressed less than one mean score point, while the DOT-2 group improved slightly less than one point.

Table 23. Significance of the mean changes in driving attitude (Mann) test scores for the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Group	N	Md	SE_{Md}	CR	Comments
DOT	67	- .13	.66	- .20	Not significant
Boys	35	-1.60	1.01	-1.59	Not significant
Girls	32	+1.47	.83	+1.77	Not significant
1	35	+ .03	1.01	+ .029	Not significant
2	32	- .38	.86	- .44	Not significant
MCR	66	- .41	.71	- .58	Not significant
Boys	33	-1.69	1.07	-1.58	Not significant
Girls	33	+ .12	.87	+ .14	Not significant
1	34	+1.00	.92	+1.08	Not significant
2	32	-1.84	1.08	-1.73	Not significant

[a] .05 (one-tail)

Key: N = Number of students assigned to two instructional programs
Md = Difference of mean scores
SE_{Md} = Standard error of differences of mean scores
CR = Critical ratio
Comments = Level of significance
+ = Positive mean change
- = Negative mean change

5. None of the changes could be termed significant at the levels applied.

Mean Changes in MCR Driving Attitude Scores

Table 23 also records the following mean changes in driving attitude:

1. The total MCR group improved less than one mean point in driving attitude.
2. The MCR boys improved less than two mean points in driving attitude.
3. The MCR girls regressed less than one score point in driving attitude.
4. The second semester MCR group improved almost two mean points, while the DOT-2 group's score was one mean point lower than their mean pre-test score.
5. The differences noted were of no significance.

Mean Changes in General Opinion Test Scores

In Table 24 are presented the mean changes and the significance of these changes in general opinion as a result of administering the Sundwall General Opinion Survey to the DOT and MCR groups before and after instruction.

Mean Changes in DOT General Opinion Scores

The following positive changes are indicated in Table 24 for the Drivotrainer group:

Table 24. Significance of the mean changes in personal opinion (Sundwall) test scores for the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Group	N	Md	SE_{Md}	CR	Comments
DOT	67	+ .74	.82	+ .90	Not significant
Boys	35	+ .34	1.17	+ .30	Not significant
Girls	32	+1.00	1.18	+ .85	Not significant
1	35	+1.60	1.39	+1.15	Not significant
2	32	- .19	1.07	- .18	Not significant
MCR	66	+2.71	1.29	+2.10	Significant beyond .05 level
Boys	33	+2.21	1.67	+1.32	Not significant
Girls	33	+1.82	1.73	+1.05	Not significant
1	34	+4.41	1.98	+2.22	Significant beyond .05 level
2	32	+ .84	1.60	+ .52	Not significant

[a].05 (one-tail)

Key: N = Number of students assigned to two instructional programs
Md = Difference of mean scores
SE_{Md} = Standard error of differences of mean scores
CR = Critical ratio
Comments = Level of significance of the critical ratio
+ = Positive mean change
- = Negative mean change

1. The total DOT group made a positive change of less than one mean score point.
2. DOT girls improved slightly more than DOT boys, although the difference was not significant.
3. The DOT-1 group improved, but not significantly over the DOT-2 group.

Mean Changes in MCR General Opinion Scores

The following mean changes are also shown in Table 24.

1. The total MCR group improved almost three mean score points, a gain significant beyond the .05 level.
2. The MCR girls and boys both showed a positive, but not significant gain.
3. The MCR-1 group improved more than four mean score points, a gain significant beyond the .05 level.
4. Other scores showed slight, but not significant improvement.

Mean Changes in General Driving Knowledge Test Scores

Table 25 presents the mean changes and the significance of these changes in general driving knowledge as a result of administering the Sportsmanlike Driving final examination to the DOT and MCR groups before and after training.

Mean Changes in DOT General Driving Knowledge Scores

1. The DOT group improvement of 2.73 mean score points was significant beyond the .001 level.
2. The DOT girls gained 3.37 mean score points in general driving knowledge which was significant beyond the .01 level.
3. The DOT-2 group improved their general driving knowledge score 4.06 points, significant beyond the .02 level.
4. Other scores, although showing positive improvement, were not found to be significant.

Mean Changes in MCR General Driving Knowledge Scores

Also shown in Table 25 are the changes in general driving knowledge for the MCR groups. These changes are summarized as follows:

1. The total MCR group improved 2.45 mean score points, significant beyond the .01 level.
2. The MCR boys improved their mean score 2.75 points, a gain significant beyond the .01 level.
3. The MCR-2 group gained 4.00 mean score points in general driving knowledge, significant beyond the .02 level.
4. Positive, but not significant gain was made by the MCR girls and the MCR-1 group in general driving knowledge.

Table 25. Significance of the mean changes in general driving knowledge test scores for the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Group	N	Md	SE_{Md}	CR	Comments
DOT	67	+2.73	.83	+3.29	Significant beyond .001 level
Boys	35	+2.17	1.15	+1.88	Significant at .05 level
Girls	32	+3.37	1.20	+2.81	Significant beyond .01 level
1	35	+1.51	.77	+1.96	Significant at .05 level
2	32	+4.06	1.51	+2.68	Significant beyond .02 level
MCR	66	+2.45	.83	+2.95	Significant beyond .01 level
Boys	33	+2.75	.78	+3.52	Significant beyond .01 level
Girls	33	+2.61	1.47	+1.77	Not significant
1	34	+1.00	.78	+1.28	Not significant
2	32	+4.00	1.47	+2.72	Significant beyond .02 level

[a].05 (one-tail)

Key: N = Number of students assigned to two instructional programs

Md = Difference of mean scores

SE_{Md} = Standard error of differences of mean scores

CR = Critical ratio

Comments = Level of significance of the critical ratio

\+ = Positive mean change

Mean Changes in Specific Driving Knowledge Test Scores

Presented in Table 26 are the changes and significance of changes in mean test scores in specific driving knowledge as determined by the Achievement Test for Man and the Motor Car which was determined before and after training.

Mean Changes in DOT Specific Driving Knowledge Scores

1. The total DOT group improved 9.86 mean score points, a gain significant beyond the .001 level.
2. Improvement significant beyond the .001 level was attained by both DOT girls and DOT boys.
3. The DOT-1 and 2 groups each in turn made improvement that was significant beyond the .001 level.

Mean Changes in MCR Specific Driving Knowledge Scores

Table 26 also shows that the changes for the MCR groups was comparable to significant gains made by the DOT groups. Following are the specific changes:

1. The total MCR group gained approximately 10.0 mean score points, an improvement significant beyond the .001 level.
2. Boys and girls in the MCR group showed improvement significant beyond the .001 level with the slightly higher score in favor of the MCR boys.

Table 26. Significance of the mean changes in specific driving knowledge test scores for the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Group	N	Md	SE_{Md}	CR	Comments
DOT	67	+ 9.86	.88	+11.24	Significant beyond .001 level
Boys	35	+ 7.60	1.01	+ 7.52	Significant beyond .001 level
Girls	32	+11.96	1.37	+ 8.73	Significant beyond .001 level
1	35	+ 6.82	1.02	+ 6.68	Significant beyond .001 level
2	32	+13.18	1.28	+10.29	Significant beyond .001 level
MCR	66	+ 9.98	1.03	+ 9.68	Significant beyond .001 level
Boys	33	+10.33	1.45	+ 7.12	Significant beyond .001 level
Girls	33	+ 9.21	1.25	+ 7.36	Significant beyond .001 level
1	34	+ 6.63	1.78	+ 3.72	Significant beyond .001 level
2	32	+13.56	.89	+15.23	Significant beyond .001 level

[a].05 (one-tail)

Key: N = Number of students assigned to two instructional programs

Md = Difference of mean scores

SE_{Md} = Standard error of differences of mean scores

CR = Critical ratio

Comments = Level of significance of the critical ratio

\+ = Positive mean change

3. Both the MCR-1 and MCR-2 groups exceeded their pre-test scores. The MCR-2 group improved 12.56 mean points while the MCR-1 group made an improvement of 6.63 mean score points, both significant beyond the .001 level.

Comparisons of On-The-Road Test Scores between and within DOT and MCR Groups after Instruction

At the termination of instruction, each student in this investigation was required to drive a dual control automobile over a pre-determined route on the public streets. Tables 27 and 28 contain the results of the scores obtained by the students on each of the two phases of this test.

On-the-road Test Scores (Part I - Vehicle Handling)

The mean score differences in vehicle handling between the DOT and MCR groups are presented in Table 27, which reveals the following findings:

1. There was no difference in performance between the DOT and MCR groups.
2. The DOT boys scored 6.12 points better on the vehicle handling test than did the DOT girls. Significance was beyond the .05 level.
3. All other differences were rejected in favor of the null hypothesis.

Table 27. Significance of the differences in mean road test scores (vehicle handling) between and within the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Groups Compared	N	Md	SE_{Md}	CR	Comments	Direction
DOT and MCR	133	1.83	1.93	.94	Not significant	
DOT Girls and DOT Boys	67	6.12	2.68	2.28	Significant beyond .05 level	DOT-B
MCR Girls and MCR Boys	66	3.63	2.67	1.35	Not significant	
DOT Girls and MCR Girls	65	3.21	2.86	1.12	Not significant	
DOT Boys and MCR Boys	68	.72	2.47	.29	Not significant	
DOT-1 and DOT-2	67	3.24	2.68	1.21	Not significant	
MCR-1 and MCR-2	66	4.26	2.68	1.58	Not significant	

[a].05 (one-tail)

Key: N = Number of students within groups compared
Md = Difference of mean scores
SE_{Md} = Standard error of the difference of mean scores
CR = Critical ratio
Comments = Level of significance of the critical ratio
Direction = Higher mean score indicated at .05 level or lower

On-the-road Test Scores
(Part II - Road Problems)

The mean score differences in road problems between the DOT and MCR groups are presented in Table 28, which shows the following:

1. The negligible difference in mean scores between the DOT and MCR groups indicates that the null hypothesis must be retained with respect to their scores on road problems.
2. Significance beyond the .05 level was gained by the DOT boys who scored 2.40 points better than the DOT girls on the road problems test.
3. Other group differences being small caused the null hypothesis to be retained.

Correlations between Chronological Age, Intelligence Quotients and Previous Driving Experience Categories respectively, and the Final Criteria

In the previous sections of this chapter were presented the findings resulting from comparing statistically the performance of the groups defined in this study with the criteria used in this study to measure driving attitude, general opinion, driving knowledge, and driving skill. This section contains the findings which resulted from computing correlations between the final criteria and certain variables. These findings are presented under the following headings: (1) chronological age and the final criteria; (2) intelligence quotients and the final

Table 28. Significance of the differences in mean road test scores (road problems) between and within the DOT and MCR groups as measured by "t" tests[a] of critical ratios.

Groups Compared	N	Md	SE_{Md}	CR	Comments	Direction
DOT and MCR	133	.21	.74	.28	Not significant	
DOT Girls and DOT Boys	67	2.40	1.01	2.37	Significant beyond .05 level	DOT-B
MCR Girls and MCR Boys	66	.09	1.15	.078	Not significant	
DOT Girls and MCR Girls	65	1.53	1.22	1.25	Not significant	
DOT Boys and MCR Boys	68	.96	1.14	.84	Not significant	
DOT-1 and DOT-2	67	.21	1.04	.21	Not significant	
MCR-1 and MCR-2	66	.32	1.02	.31	Not significant	

[a].05 (one-tail)

Key: N = Number of students within groups compared
Md = Difference of mean scores
SE_{Md} = Standard error of differences of mean scores
CR = Critical ratio
Comments = Level of significance of the critical ratio
Direction = Higher mean score indicated at .05 level or lower

criteria; and (3) previous driving categories and the final criteria.

Chronological Age and the Final Criteria

Correlations between chronological age scores on the six final criteria for both the Drivotrainer and multiple car groups are indicated in Table 29. The following findings are contained in this table:

1. In the DOT group, a negatively low ($r = -.32$) but significant correlation exists between age and scores on the road problems section of the on-the-road test. There was some indication that the younger students showed better performance than the older students.
2. All other correlations in the DOT group were not significant.
3. For the MCR group, none of the correlations were significant when comparing age and the final criteria.

Intelligence Quotients and the Final Criteria

In Table 30 are presented the correlations between students' intelligence quotients and their respective scores on the six final criteria. The following were the findings for both the DOT and MCR groups:

1. There were positive but rather low coefficients of correlation between final scores for general

Table 29. Correlations between age and post-test scores for the DOT and MCR groups as measured by Pearson's product moment r.

Post Test	DOT (N = 67)			MCR (N = 66)		
	r	SE_r	P	r	SE_r	P
General Driving Knowledge	-.21	.12	.08	+.02	.12	.87
Specific Driving Knowledge	+.21	.12	.08	-.12	.12	.32
Driving Attitude (Mann)	+.003	.12	.98	-.07	.12	.56
Personal Opinion (Sundwall)	+.21	.12	.08	+.40	.12	.01
Final Road Test	VH+.03	.12	.80	VH-.10	.12	.41
	RP-.32	.11	.0036	RP-.20	.12	.10

Key:

r = Product moment correlation

SE_r = Probable error of correlation

P = Level of significance of correlation

Table 30. Correlations between intelligence and post-test scores for the DOT and MCR groups as measured by Pearson's product moment r.

Post Test	DOT (N = 67)			MCR (N = 66)		
	r	SE_r	P	r	SE_r	P
General Driving Knowledge	+.33	.11	.01	+.41	.10	.01
Specific Driving Knowledge	+.23	.12	.05	+.11	.12	.36
Driving Attitude (Mann)	-.08	.12	.50	-.10	.12	.41
Personal Opinion (Sundwall)	+.05	.12	.67	+.10	.12	.41
Final Road Test	VH+.14 RP-.16	.12 .12	.25 .18	VH+.16 RP+.18	.12 .12	.18 .13

Key:

r = Product Moment Correlation

SE_r = Probable error of correlation

P = Level of significance of correlation

and specific driving knowledge and intelligence quotients. The DOT index of .33 for general driving knowledge was significant at the .01 level while for the same group an index of .23 for specific driving knowledge was significant at the .05 level.

2. A moderate (.41), but significant (.01 level) coefficient of correlation was found to exist between general driving knowledge and intelligence quotients for the MCR group.
3. Other indices were low and not significant at either of the applied levels.

Previous Driving Experience and the Final Criteria

Table 31 contains the Chi square associations between previous driving experience and the six final criteria. The significance of these correlations indicated the following:

1. There was no relationship between the amount of previous driving experience and final driving attitude or general opinion scores for this group.
2. There was no relationship between the amount of previous driving experience and final driving knowledge scores for either group.
3. There appeared to be some relationship between previous driving experience and scores attained by the DOT group on the "road problems" section of the on-the-road test. The relationship was

Table 31. Association between previous driving experience categories and post-test scores for DOT and MCR groups as measured by Chi square.

Post Test	DOT (N = 67) DF	Chi Square	P	C	MCR (N = 66) DF	Chi Square	P	C
Driving Attitude	2	5.27	.08		2	2.18	.35	
Personal Opinion	2	1.51	.47		2	.821	.67	
General Driving Knowledge	2	3.74	.16		2	1.17	.56	
Specific Driving Knowledge	2	1.85	.40		2	4.05	.14	
Final Road Test	2	VH= 3.08	.22		2	VH=5.49	.07	
		RP=13.31	.002	.51		RP= .523	.77	

Key:

DF = Degrees of freedom

C = Coefficient of contingency (based on Chi square) calculated only for that Chi square significant beyond the .05 per cent level.

P = Level of significance of association

indicated by a Chi square of 13.31, which was significant beyond the .05 level for two degrees of freedom. For the DOT group, this relationship was affected by the students with limited to considerable driving experience scoring well on the on-the-road test more often than would have been expected on the basis of chance.

Summary

In this chapter the findings of this investigation were presented. These findings showed comparisons between and within the Drivotrainer and Multiple Car groups on the six criteria used in this study, as well as relationships which existed between these criteria and the three variables--chronological age, intelligence quotients, and previous driving experience. In addition, mean score changes on tests taken before and after instruction were recorded for both groups. Chapter V contains the summary, conclusion, and recommendations taken from this investigation.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

In the preceding chapter, the analysis of the data and the findings of the study were presented. This chapter contains a brief statement of: (1) the problem, method of procedure and major findings; (2) conclusions based on the findings; and (3) recommendations for the use of the Drivotrainer and the multiple car off-street driving range as well as recommendations for further research.

Summary

Statement of the Problem

This research study was undertaken to investigate whether students who were taught using ten hours of Drivotrainer instruction and three hours behind the wheel of a dual control car, would be as competent drivers, when measured by various criteria, as students taught to drive using ten hours on the multiple car off-street driving range and two hours behind the wheel of a dual control car. This study was designed to investigate specifically the following problems: (1) do students who receive instruction in the Drivotrainer possess a driving attitude comparable to that of students receiving instruction on the multiple car off-street driving range? (2) Do students given

instruction in the Drivotrainer possess as much driving knowledge as students receiving instruction on the multiple car off-street driving range? (3) Do students receiving Drivotrainer instruction possess as much skill in manipulating an automobile as students who received their instruction on the multiple car off-street driving range?

In addition to these three main problems, this study investigated the following sub-problems: (a) would the random inclusion of students with varying amounts of previous driving experience influence the results of the study? (b) Does chronological age seem to be a factor in learning to drive an automobile? (c) Does intelligence seem to be a factor in learning to drive an automobile? (d) Do boys and girls seem to learn to drive equally well?

The Method of Procedure

East Lansing High School was selected for this study because of its close proximity to Michigan State University and the availability of its driver education students. Three graduate students were selected as instructors on the basis of training and experience. Two instructors taught with the Drivotrainer and one instructor taught on the multiple car off-street driving range. A fourth instructor, the driver education teacher at East Lansing High School, taught the classroom phase of the course. One hundred thirty-three students participated in the study. All were at least

fifteen years of age at the time they began their instruction, were enrolled in a course of driver education, and were assumed to have had no previous driving experience. Sixty-seven students were given instruction with the Drivotrainer and sixty-six students received their instruction on the multiple car off-street driving range.

Instruction with the Drivotrainer consisted of ten hours in the Drivotrainer supplemented with three hours behind the wheel and six hours of observation time in a dual control car. During the three two and one-half week Drivotrainer courses taught each semester, one instructor taught two periods and the other instructor taught one period. Instruction was by means of films plus verbal and manual assistance from the instructor. Errors made by the students were recorded automatically by the Drivotrainer recording device.

In the multiple car off-street driving range program, instruction consisted of ten hours on the range, two hours behind the wheel, and four hours of observation time in a dual control car on the street. Each lesson, with its special skill(s) was demonstrated by a student class member guided by the instructor using the portable loudspeaker for communication. After the demonstration, students went to their assigned cars and began their daily driving practice.

Before instruction began, all students were measured with a personal attitude survey dealing with traffic and

other social settings, a general opinion survey involving ideas in human relations, and two driving knowledge achievement tests. Immediately upon completion of instruction, all students were again measured with the same attitude and opinion surveys, and the driving knowledge criteria. In addition, driving skill was measured by an on-the-road test.

The groups were compared by testing the significance of mean differences with critical ratios for driving attitude, general opinion, and driving knowledge, and results of the final on-the-road test. Significance of correlations between age, intelligence and previous driving experience, respectively, and the final on-the-road test, were tested by Chi square.

The Major Findings

The following is a summary of the major findings of this investigation:

1. After instruction, no significant differences in driving attitude scores existed between the Drivotrainer and multiple car off-street driving range groups.
2. After instruction, the second semester Drivotrainer and multiple car groups exceeded significantly the first semester Drivotrainer and multiple car groups in driving attitude.
3. After instruction, no significant differences in general opinion existed between or within the

Drivotrainer and multiple car groups.

4. After instruction, no significant differences in general driving knowledge scores existed between the Drivotrainer and multiple car groups.
5. After instruction, the Drivotrainer and multiple car boys had significantly better general driving knowledge scores than the Drivotrainer and multiple car girls.
6. After instruction, the first semester Drivotrainer and multiple car groups exceeded significantly the scores attained by the second semester Drivotrainer and multiple car groups in general driving knowledge.
7. After instruction, the Drivotrainer and multiple car groups were comparable with respect to specific driving knowledge scores.
8. After instruction, the scores attained by the second semester Drivotrainer and multiple car groups exceeded significantly the scores attained by the first semester Drivotrainer and multiple car groups on the specific driving knowledge test.
9. The Drivotrainer and multiple car groups had no significant mean changes in driving attitude.
10. After instruction, the Drivotrainer and multiple car groups had no significant mean changes in general opinion.
11. Both Drivotrainer and multiple car groups made

significant positive mean changes in general driving knowledge.

12. Both Drivotrainer and multiple car groups changed significantly in a positive direction in mean specific driving knowledge scores. However, the mean change for the second semester Drivotrainer and multiple car groups was far more significant than that for the first semester Drivotrainer and multiple car groups.

13. After instruction, the differences in mean road test (vehicle handling) scores between the Drivotrainer and multiple car groups were not significant. However, the Drivotrainer boys out-performed the Drivotrainer girls at the .02 level of significance.

14. After instruction, the differences in mean road test (road problems) scores between the Drivotrainer and multiple car groups were not significant. However, the Drivotrainer boys again out-performed the Drivotrainer girls at the .02 level of significance.

15. A low but significant negative correlation was obtained in the Drivotrainer group between chronological age and performance on the road problems section of the on-the-road test. This negative relationship was in favor of the younger students.

16. There were significant positive coefficients of correlation in both Drivotrainer and multiple car groups between intelligence quotients and driving knowledge scores.
17. The low correlations attained for the Drivotrainer and multiple car groups when comparing intelligence and final road test scores were not significant.
18. Previous driving experience did not correlate with either driving attitude, general opinion, or driving knowledge scores.
19. An association significant at the .01 level, was obtained between previous driving experience categories and post-test scores for the Drivotrainer group on the road problems section of the final road test.

Conclusions

The following conclusions which are based on findings in this investigation should have implications for curricular changes in future driver education courses.

1. The Drivotrainer is a device which can be used successfully to give instruction to students as adequately as by a multiple car off-street driving range program.
2. Driver attitude test scores of students receiving ten hours of selected film instruction in the Drivotrainer and three hours of instruction on the

street are equal to similar test scores of students taught using ten hours of instruction on the multiple car off-street driving range and two hours of instruction on the street.

3. Driver knowledge test scores of students receiving ten hours of selected film instruction in the Drivotrainer and three hours of instruction on the street are equal to similar test scores of students taught using ten hours of instruction on the multiple car off-street driving range and two hours of instruction on the street.
4. Driving skill test scores of students receiving ten hours of selected film instruction in the Drivotrainer and three hours of instruction on the street are equal to similar test scores of students taught using ten hours of instruction on the multiple car off-street driving range and two hours of instruction on the street.

Recommendations

1. It is recommended that research be conducted to determine the optimum number of instructional hours to be spent in either the Drivotrainer or in the multiple car off-street driving range program.
2. An investigation should be made to determine whether students receiving instruction on a dual purpose off-street area, such as a parking lot

adapted to multiple car "type" of instruction, would be as good or better drivers than students who received instruction on a multiple car off-street driving range designed and constructed exclusively for driver education.

3. A study should be made to determine whether students who receive instruction in a program involving a combination of the multiple car off-street driving range and the Drivotrainer would be comparable to or better than students who received instruction exclusively on either.
4. An investigation should be made to determine whether students who receive all of their behind-the-wheel experience on a multiple car off-street driving range would be comparable to or better than students whose range experience is supplemented by limited additional time on the street in a dual control car.
5. Determine whether the use of the Drivotrainer recording device is necessary to assure optimum learning from the Drivotrainer film series.
6. An investigation should be made to determine the further use of radio communications with vehicles on the multiple car off-street driving range.
7. Determine a more effective means of measuring changes of attitudes in young drivers who are trained by either the Drivotrainer methods or on a multiple car off-street driving range.

8. Using the ex post facto method, study the driving records in terms of violations received, by the young drivers involved in this study to determine further comparison of training methods.

BIBLIOGRAPHY

Books

American Automobile Association, Sportsmanlike Driving. Washington, D.C.: The Association, 1955.

Center for Safety Education, New York University. Man and The Motor Car. 6th ed.; Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1959.

Garrett, Henry E. Statistics in Psychology and Education. New York: Longmans, Green and Company, Inc., 1958.

O'Connor, Richard, George Forlano, and Clarence Barger. Teacher's Manual for the AEtna Drivotrainer. Hartford, Conn.: AEtna Casualty and Surety Company, 1959.

Radhakrishna, Rao C. Advanced Statistical Methods in Biometric Research. New York: John Wiley and Sons, Inc., 1952.

Publications of Organizations

American Association of Motor Vehicle Administrators. A Manual for Driver-Licensing Authorities in the Examining of Applicants for Driver's Licenses. Washington: American Association of Motor Vehicle Administrators, 1959.

American Automobile Association. What Chief State School Officials Say About Driver Education. Pamphlet No. 3383. Washington, D.C.: The Association, 1960.

Automotive Safety Foundation. The Proceedings of the National Conference on Driving Simulation. Washington, D.C.: Automotive Safety Foundation, 1961.

Insurance Institute for Highway Safety. Thirteenth Annual National High School Driver Education Award Program. Washington, D.C.: Insurance Institute for Highway Safety, 1960.

Michigan Department of Public Instruction. Summary of Annual Reimbursement Reports for 542 Public Schools. Lansing: Michigan Department of Public Instruction, 1963.

Smith, Harold L. The Smith System of Non-accident Driving. Dearborn, Mich.: The Ford Motor Company, 1957.

Periodicals

Miller, H. Gene. "The 1962 Traffic Story," Traffic Safety Magazine, 62:6-8 and 30-31, March, 1963.

Unpublished Materials

Brazell, Robert E. "A Follow-Up Study of Public School Driver Trainees, Relating Driving Performance Records to Selected Academic and Training Factors." Unpublished Doctoral thesis, The University of Michigan, Ann Arbor, 1961.

Bernoff, Louis I. "An Experimental Study of the Teaching Effectiveness of an Electro-mechanical Device and Conventional Driver Training Methods." Unpublished Doctoral thesis, The University of Southern California, Los Angeles, 1958.

Cox, W. Howard. "The History of High School Driver Education in Michigan." Unpublished paper, The University of Michigan, Ann Arbor, 1957.

McEnnis, Leonard J. "Report on Driving Simulators and Ranges." Washington, D.C.: Insurance Institute for Highway Safety, 1963. (Mimeographed.)

Sheehe, Gordon H. "Highway Traffic Problems." Paper read at the General Federation of Women's Clubs Highway Traffic Safety Conference, Michigan State University, East Lansing, February 4, 1963.

Newspapers

Shearer, Lloyd. "Teenagers: Why They Drive That Way," Parade Sunday Newspaper Magazine, April 21, 1963. pp. 4-5.

APPENDICES

APPENDIX A

TEACHING GUIDE FOR THE ON-THE-STREET EXPERIENCE

I. Suggested areas in which to drive, or routes to follow.

A. Route U.S. 16 to Williamston - Proceed beyond Williamston to M-47. Turn left (correct lane and signal well ahead of time -- exit from high speed traffic) and follow M-47 approximately 3/4 mile to picnic grounds on left side of the road. Opportunity to change drivers and then return.

1. Important points to stress:

a. Proper speed - conditions permitting.

b. Proper acceleration.

c. Ability to maintain even speed.

d. Correct lane usage.

e. Knowledge of signs and signals

f. Correct passing -

Check traffic - use of mirrors (inside and out)

Signal

Proper acceleration - under most conditions you should not pass if you must accelerate beyond posted speed limit.

Horn as needed (explain)

Signal and return to proper lane as vehicle passed comes into view in inside rear view mirror.

g. Adjust to even speed as necessary. Stress proper seeing habits -- "get the big picture" -- "drive ahead."

h. Traffic awareness -- does driver react correctly to situation ahead?

i. Speed zones encountered: 25 - 35 - 45 - 55/65.

j. Types of roads encountered: 2, 3, and 4 lane asphalt.

B. Park Lake Road - M-78 to Park Lake Road. Left on Park Lake Road. Proceed beyond Ingham County Clinton County line (Deadman's Curve) to Coleman Road. Right on Coleman Road for approximately 1-1/2 miles to Wooden Church on the left side of the road, turn right at the Church - cross M-78 and proceed straight ahead to Lake Lansing and Haslett.

1. Important points to stress:

a. Narrow, sharply crowned asphalt.

b. Sharp curves - hilly - explain why speed must be reduced on this type of road.

c. Effect of "natural laws"

Gravity

Friction

Centrifugal - centripetal force

d. Coleman Road has surface of clay and loose stones.

e. Short sight distances.

f. Problem of dust in summer.

g. Surface affect on car control - speed should be reduced.

C. Assume that you are going to take an imaginary trip to Battle Creek -

Follow route M-78 across city of Lansing to Waverly Road. Turn left and return to East Lansing via US 27 and M-43. Turn on M-43 (E. Michigan Ave.) at corner of S. Cedar and E. Michigan Avenue. Trip requires a full period.

D. Frandor Shopping Center

1. Angle parking

2. Proper use of roadways

E. Around the Capitol -

East Michigan Avenue to State Capitol, turn right on Capitol Avenue (one way) and move to furthest left lane. Left on Ottawa (one way) to traffic signal. Turn left on Walnut (one way) and proceed to Allegan (one way). Left on Capitol, change lanes to the right in preparation for turn at the Olds Hotel onto East Michigan Avenue.

II. Following is a check list of driving experiences that should be included for all students.

A. Parking.

1. Parallel - M.A.C. Avenue in East Lansing, Pine Street and Sycamore Street behind Civic Center in downtown Lansing.

2. Angle - 45° and right angle - Municipal Parking lots in East Lansing.

B. Backing - straight line turning.

C. Start and stop on hills (proper parking procedure on hills). Try Evergreen and Forest, East Lansing.

D. Multiple lane traffic - rural and city.

E. Open intersections - East Lansing.

F. Left turns on Grand River in East Lansing.

G. Traffic signals, flashing red arrow, flashing amber, green arrow.

H. One way streets, two way to one way, one way to two way, one way to one way. Downtown Lansing.

I. Blind intersection - Hillcrest at Grand River, East Lansing - across from Central School.

J. Yield right of way.

K. Proper following distances at various speeds.

L. Passing - city, rural, 2, 3, and 4 lane roads.

M. Stop sign placed at railroad tracks. North Okemos Road between Haslett Road and U.S. 16.

N. Merging traffic, Hagadorn Road and M-78, East Lansing.

III. Intersections

A. Grand River and East Michigan - East Lansing.

B. Michigan and Capitol - Lansing.

C. Michigan and Washington - Lansing.

D. Mt. Hope and South Cedar - Lansing.

E. Hagadorn Road and M-78 - East Lansing - approach M-78 by turning left from Hagadorn Road and also by turning right directly onto M-78.

F. Abbott Road and Grand River - East Lansing.

G. Allegan and Capitol Avenue - Lansing.

H. Abbott Road and M-78 - Right and left turn from Abbott. Left turns from M-78 to Abbott from east and west.

I. Hamilton Road and Grand River - Okemos, place car at right angle to Grand River before entering.

J. Practice entrance and exit from Crest Theatre east of East Lansing on U.S. 16.

APPENDIX B

LESSONS FOR THE MULTIPLE CAR OFF-STREET DRIVING RANGE

Lesson I

I. Objectives.

A. Explain the following procedures:

1. Starting procedure.
2. Stopping procedure.
3. Steering procedure.
4. Driving forward and backward.

B. Begin driving around the periphery of the range.

II. Procedure.

A. Starting

1. Enter car on curb side.
2. Adjust seat and mirrors.
3. Check doors, open one window.
4. Check parking brake.
5. Gear shift in "N" or "P".
6. Foot on brake.
7. Depress gas pedal slightly.
8. Turn on ignition to start.
9. When engine starts, release ignition key and accelerator pressure.
10. Put in "Drive."

11. Release parking brake.

12. Check rear view mirrors, look over left shoulder.

13. Signal.

14. Apply soft gas, proceed cautiously.

B. Stopping

1. Check mirrors.

2. Signal.

3. Apply soft brake.

4. Put in "P", set parking brake, out curb side.

C. Steering

1. Forward - hands at 10-2 position.

2. Backing - right hand on back of seat, look over right shoulder, and sight distant target.

D. Driving forward and to the rear

1. Drive forward to flag line, stop, soft brake.

2. Start again, move forward to curb line.

3. Back to first flag line, use correct procedure for straight line backing, stop, soft brake.

4. Continue backing to starting point.

5. Repeat procedure, assist those students having difficulty.

E. Driving around the periphery of the range.

1. Start first student around area counter clockwise. Use loud speaker for communication. Have other students observe.

2. Start entire group, maintaining about four car-lengths between cars.

III. Materials.

A. Loud speaker.

B. Cars parked in position to begin class.

C. Flags properly placed on range.

IV. Suggestions for the instructor.

A. Check to see that all students understand the following:

1. Starting procedure.

2. Stopping procedure.

3. Steering procedure.

4. Backing.

5. Safe following distance and correct turning procedure.

V. Evaluation.

A. Check progress card for each student.

Lesson II

I. Objectives.

A. Review starting procedure.

B. Explain, then demonstrate lane changing.

C. Introduce, explain, and demonstrate the "T" exercise.

II. Procedure.

A. Getting class started.

1. Check steps in preparing to drive, using loud speaker, make sure car windows are down.

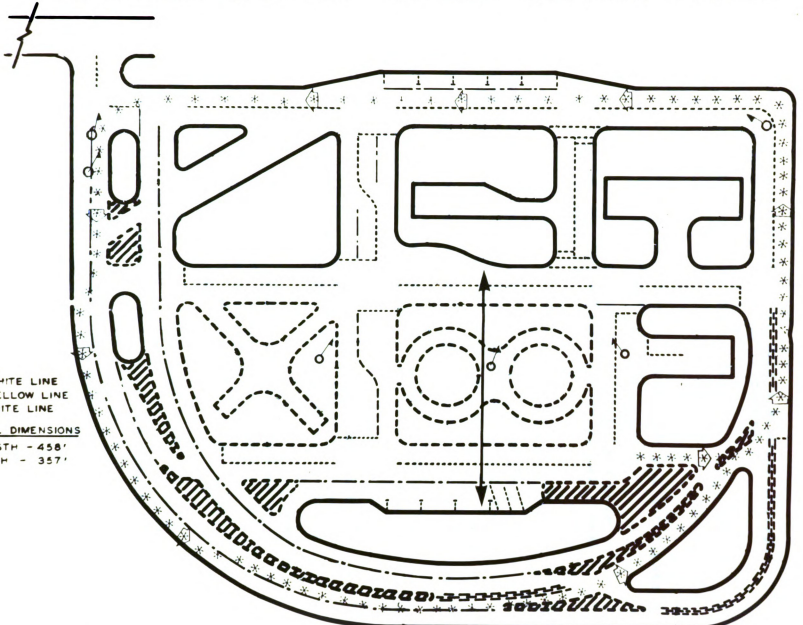
2. Check starting procedure.

3. Check for proper techniques in putting car in motion.

B. Correct lane changing techniques are essential in today's traffic.

1. Demonstrate on range model where lane changes are required.

MICHIGAN STATE UNIVERSITY - MULTIPLE CAR OFF-STREET DRIVING RANGE



2. Using the loud speaker, talk a student through the proper lane changing procedure.

   a. Check rear view mirror(s).

   b. Signal.

   c. Look over shoulder in direction you anticipate moving (blind spot check).

   d. If safe, accelerate moderately and move into the appropriate lane -- cancel signal if necessary.

   e. Adjust speed.

C. The "T" develops ability in judging distance, backing in a straight line, and maneuvering the car in a limited area.

   1. Signal before entering "T".

   2. Enter via proper lane.

   3. Signal for left turn.

   4. Drive forward slowly; stop 12-24 inches from flag with car centered on flag; move forward slowly (creep) until front bumper is 3 inches from flag.

   5. Back to the rear (using proper procedure as outlined in Lesson I) until back bumper is 12-24 inches from flag; move car slowly (creep) until rear bumper is 3 inches from and centered on flag.

   6. Leave exercise via correct lane.

   7. Stop before entering street -- use directional signal.

D. Return to cars and prepare to start; have students alternate in moving either in a clockwise or counter clockwise direction around the range. Have someone in "T" at all times.

III. Materials.

A. Loud speaker.

B. Cars parked in position to begin class.

C. Flags properly placed on the range.

D. Scale model of range.

IV. Suggestions for the instructor.

A. Do students understand the following:

1. Safe following distance.

2. Proper use of turn signals.

3. Hand over hand steering.

4. Correct lane changing procedure.

5. Critical corner (sharp turn).

6. Car control.

V. Evaluation.

A. Check daily progress card for each student.

Lesson III

I. Objectives.

A. Explain and demonstrate the following:

1. The "X".

2. The figure "8".

3. Techniques to be used in safely negotiating the hill.

B. Maintain safety on the range.

II. Procedure.

A. The "X" is designed to teach turning skills while backing, and to develop ability in judging distances to the rear.

1. Demonstrate by talking a student through the exercise while other students observe; use loud speaker.

a. Signal intention to enter the exercise.

b. Enter via correct lane.

c. Hand over hand turning.

d. Stop smoothly, 12-24 inches from flag, move forward slowly (creep) and stop 3 inches from flag.

e. Shift to reverse.

f. Back smoothly towards other flag, stopping when car is 12-24 inches from flag, continue backing and stop when rear bumper is 3 inches from flag.

g. Leavevia correct lane, stop and signal intention before leaving the exercise.

B. The figure "8" develops hand over hand steering techniques, judgment, and car control.

1. Demonstrate by talking a student through the "8" while other students observe.

a. Signal and <u>enter from right lane</u>.

b. Maintain steady speed.

c. Hand over hand steering.

d. Keep car between lines at all times.

e. Stop and signal before leaving.

C. The hill and curve in today's lesson provide experience in the correct method of starting and stopping on a hill, and the need for slowing down before attempting to negotiate sharp curves.

1. Demonstrate by talking a student through correct procedure while other students observe.

2. Stopping on a hill.

a. Check mirrors.

b. Signal for slow down and stop.

c. Stop; with foot brake on, put selection lever in "Park", set parking brake.

3. Starting on a hill.

a. Foot firmly on brake.

b. Put gear shift selector in "Drive" or "Low". (Depends on grade)

c. Release parking brake -- light pressure on gas pedal.

d. Release foot brake.

e. When car is past hill move gear shift selector to "Drive".

D. Maintain safety on the range at all times.

1. Due to additional exercises being opened, care in driving on the range should be stressed. Some students may have a tendency to be over-confident or careless. Check speed and following distances carefully.

III. Materials.

A. Loud speaker.

B. Flags placed properly on the range.

C. Cars parked in position to begin class.

D. Rotate cars.

IV. Suggestions for the instructor.

A. Check for:

1. Proper signaling.

2. Stop signs (proper vehicle placement).

3. Correct lane changing.

B. Do not permit more than one car at a time to negotiate the hill or the sharp northeast turn.

V. Evaluation.

A. Check daily progress card for each student as they complete an exercise.

Lesson IV

I. Objectives.

A. The double garage exercise.

B. Individual work with students who need assistance.

II. Procedure.

A. The double garage exercise provides experience in entering narrow driveways, entering an offset garage, backing to the street, and entering the proper lane.

1. Using the loud speaker, demonstrate by talking a student through the exercise while other students observe.

a. Give proper signal and check traffic conditions.

b. Turn into driveway, using hand over hand steering.

c. Enter garage slowly, left side first.

d. Back slowly to rear. Left hand on top of wheel; right arm on seat.

e. Stop before entering street; check traffic; back into correct lane.

f. Repeat procedure, this time parking in right side of garage.

g. Following same backing techniques as before, stop when reaching street, turn in opposite direction, and enter correct lane.

B. Make sure all students are up to date at this point; check all daily progress charts; give individual help where needed.

III. Materials.

A. Loud speaker.

B. Cars parked in position to begin class.

C. Flags placed on range.

IV. Suggestions for instructor.

A. Check for students "following the leader."

B. Exercise areas should be in use at all times during class.

C. Look for opportunities to suggest defensive driving tips.

D. Make sure students are using all range streets.

V. Evaluation.

A. Check daily progress charts; try to get all students through exercises covered to date.

Lesson V

I. Objectives.

A. To learn the correct method of:

1. Parking on an upgrade with a curb.

2. Parking on a downgrade with a curb.

3. Angle parking.

II. Procedure.

A. Correct parking on an upgrade will prevent a car from rolling into the path of traffic in the event the parking brake should not hold.

1. Demonstrate on model of the range, and by talking a student through the exercise.

a. Check mirror and signal for slow down and stop.

b. Steer vehicle to within 6 inches of the curb, and stop.

c. Let car roll back slowly, turning steering wheel to the left until front tire touches curb softly.

d. Put gear selector in "Park" and set parking brake; turn off ignition and release foot brake.

e. To put car in motion after parking on upgrade, follow starting procedure as outlined in Lesson I.

f. Remind students that front wheels are turned to the left.

B. The purpose in teaching parking on a downgrade with a curb is similar to that described in Section A.

1. Demonstrate on model of the range, and by talking a student through the exercise.

   a. Check mirror and signal for slow down and stop.

   b. Steer vehicle to within 6 inches of the curb and stop.

   c. Let car roll forward slowly, turning steering wheel to the right until tire touches curb lightly.

   d. Put gear selector in "Park" and set parking brake; turn off ignition and release foot brake.

   e. To put car in motion after parking on downgrade, follow correct starting procedure.

   f. While moving to the rear approximately 2-3 feet, straighten wheels.

   b. Check traffic, signal and steer into driving lane.

C. The angle parking exercise assists the student in acquiring the necessary skills to safely and efficiently park his car.

   1. Demonstrate by talking a student through the exercise while other students observe.

      a. Check mirror(s) and signal.

      b. Slow down and move your car to the far left of your traffic lane.

      c. When front bumper is even with the first line of the empty parking space, turn hand over hand as vehicle moves at slow speed.

      d. As car moves into center of space, check left front and right rear fender clearance, and straighten wheels.

      e. Permit car to roll slowly forward until front tire touches curb gently.

      f. Follow correct procedure for stopping the engine.

g. To leave -- start engine -- correct starting procedure.

h. Shift to reverse and release parking brake.

i. Back (creep) car in straight line to rear using correct steering technique. Check traffic continuously.

j. When the car has moved far enough for driver to have an unobstructed view of traffic, stop, and check both left and right.

k. When clear, continue backing and when left front fender will clear car on your left, turn wheel hand over hand to the right and back into correct lane. Straighten wheels just before stopping.

l. Do not cross lane line.

m. Shift to "Drive" and move forward.

III. Materials.

A. Loud speaker.

B. Cars parked in position before class.

C. Flags placed on the range.

D. Model of range.

IV. Suggestions for the instructor.

A. Using the range model, explain techniques used in parking on a hill without a curb.

B. Assist those students who have difficulty in getting close enough to curb while parking on the hill.

C. Check for correct turn signals.

D. Do not permit students to turn steering wheel when car is not moving.

V. Evaluation.

A. Check daily progress charts.

Lesson VI

I. Objectives.

A. Explain and demonstrate the following:

1. The turn around or "Y" turn.

2. Parallel parking, following the points brought out in the film Park Like A Pro.

B. Students should be developing good perceptive habits. The defensive driving concept needs to be emphasized.

II. Procedure.

A. The "Y" turn develops skills necessary in turning the car around in the width of a narrow street.

1. Signal before entering skill area.

2. Stop in right lane, close to, but not touching curb.

3. Signal for left turn.

4. Check traffic to the rear before moving to the left.

5. Steer hand over hand to full left.

6. Stop just before reaching opposite curb. (Approximately 18 inches away)

7. As car creeps foward towards curb, straighten wheels.

8. Shift to reverse and steer hand over hand to the right as the car moves slowly to the rear.

9. Stop before reaching the curb. (Approximately 18 inches away.)

10. Straighten wheels as you slowly back towards curb.

11. Move car forward turning hand over hand to the left.

12. Stop and signal before leaving the exercise.

B. Parallel parking: Have student demonstrate using the "check point system" as shown in the film Park Like A Pro.

1. Approach in correct lane.

2. Slow speed.

3. Signal.

4. Position car about 2 feet away and parallel to other car, with the backs of the front seats even.

5. Turn slowly right as you back, checking over right shoulder.

6. Continue until the back of your front seat is aligned with check point # 1, an imaginary point on the car to your right, approximately 2 feet from the end of the left rear fender. At this point your steering wheel should be turned full right. Pause as you continue to the rear maintaining the full right steering position.

7. Pause as you reach check point # 2, the back of your front seat is aligned with the left tail light of the car to your right.

8. Continue backing slowly and straighten wheels.

9. Pause at check point # 3, the right corner of your dash is aligned with the left tail light of the car to your right.

10. As you continue to the rear, turn steering wheel slowly hand over hand to the left; check right front fender clearance and look to the rear. Just before stopping, straighten wheels.

11. Shift to "Drive" and center your car in the parking space. Wheels should be parallel to, and approximately 4-6 inches from the curb.

12. To leave, start engine and back to the rear as much as space will permit.

13. Shift to "Drive," signal left, check traffic as you move slowly forward.

14. Turn steering wheel rapidly hand over hand to the left, and check right front fender clearance.

15. Check traffic again. As your right front door moves past the car ahead turn down your lane.

III. Materials.

A. Loud speaker.

B. Cars parked in position before class.

C. Flags placed on range.

D. Model of range.

E. Rotate cars today.

IV. Suggestions for the instructor.

A. Using the range model, demonstrate the "Y" turn and parallel parking.

B. Caution students not to turn steering wheels when car is not in motion.

V. Evaluation.

A. Check daily progress charts.

Lesson VII

I. Objectives.

A. Instruction in the fundamentals of the passing maneuver.

B. Begin final testing program.

II. Procedure.

A. Use two cars for demonstration; have one move slowly for passing.

1. Maintain safe following distance.

2. Check for adequate passing distance.

3. Check traffic.

4. Signal left turn.

5. Sound horn, accelerate and move into left lane.

6. Maintain proper lane as you pass.

7. Check rear view mirror for car you are passing -- when you can see it in your rear view mirror, signal right, and pull back into the right lane.

8. Adjust your speed -- cancel signal if necessary.

B. Testing: Use final check sheet provided for each student.

III. Materials.

A. Loud speaker.

B. Cars parked in position before class.

C. Flags placed on range.

D. Model of range.

E. Have final check sheets ready for distribution.

IV. Suggestions for the instructor.

A. Using the range model, explain the passing maneuver.

B. Explain final check sheet.

C. Keep all exercises in use and cars moving.

V. Evaluation.

A. Check daily progress charts.

Lesson VIII

I. Objectives.

A. Complete final testing.

B. Additional information if time permits.

C. Students may practice those skills in which they need additional experience.

II. Procedure.

A. Finish the final testing today. Exercises to be covered are the "T", garage, parking on hill, angle parking, parallel parking and passing.

B. If time permits, the following skills might be demonstrated and explained.

1. How to start a car by pushing it.

2. "Rocking" a car in the event you become stuck.

III. Materials.

A. Loud speaker.

B. Cars parked in position before class.

C. Flags placed on the range.

D. Have final check sheets in all cars.

IV. Suggestions for the instructor.

A. Note those students still needing individual assistance.

1. Keep all cars moving.

2. Each exercise should be in use at all times.

APPENDIX C

PRACTICE DRIVING GUIDE MULTIPLE CAR AREA

I. Starting Procedure.

- A. Adjust seat correctly.
- B. Adjust mirrors correctly.
- C. Starting sequence.
  1. "P" or "N".
  2. Left foot on brake.
  3. Right foot on accelerator.
  4. Switch on to start and release.
  5. Select proper gear.
  6. Release hand brake.
  7. Traffic check.
  8. Signal.
  9. Final traffic check.

II. Turns.

- A. Left.
- B. Right.
  1. Slow down (proper braking technique).
  2. Proper lane.
  3. Signal well in advance.
  4. Hand over hand.
  5. Turn into correct lane.

6. Slight gas pressure approximately 1/2 - 3/4 through turn.

7. Recovery.

III. "T"

A. Signal.

B. Enter in proper lane.

C. Stop 3 inches from front flag.

D. Back to rear flag - right arm over seat - look to rear.

E. Stop 3 inches from rear flag.

F. Leave exercise via correct lane.

G. Stop before entering street.

IV. "Y" Turn.

A. Signal.

B. Enter via correct lane.

C. Bring car to <u>full stop</u> on right side of street.

D. Signal for left turn.

E. Driver looks over left shoulder to rear <u>before</u> moving to left.

F. Driver makes full left turn <u>hand over hand</u>.

G. Stop car just before reaching other side.

H. Let car roll forward slowly (creeping).

I. Turn steering wheel while car is moving.

J. Move to rear - turning steering wheel full right (hand over hand).

K. Look to rear.

L. Stop before reaching curb.

M. Straighten wheel as car moves remaining distance towards curb (slowly).

N. Move car forward turning left, hand over hand.

O. Stop and signal before leaving.

V. "X"

A. Signal.

B. Enter via correct lane.

C. Hand over hand steering (left).

D. Stop 3 inches from front flag.

E. Back to rear - straight line.

F. Turn - both hands on wheel.

G. Straight line backing after turn.

H. Crossed yellow line(s)

I. Stop 3 inches from rear flag.

J. Stop - signal when leaving.

VI. Figure "8".

A. Signal.

B. Maintain steady speed.

C. Too fast.

D. Too slow.

E. Hand over hand steering.

F. Crossed yellow lines.

G. Stop and signal before leaving.

VII. Garage.

A. Signal before entering.

B. Back to rear - right arm over seat - slowly.

C. Stop - check right and left.

D. Both hands on wheel - turn into correct lane.

E. Look to rear as long as car continues to move to the rear.

F. Straighten wheels just before stopping rearward movement.

G. Clear lane - move ahead.

VIII. Lane Changing.

A. Check mirror(s).

B. Signal.

C. Look over right or left shoulder (blind spot check).

D. Accelerate moderately on lane change.

E. After gaining lane, adjust speed, cancel signal if necessary.

IX. Parking on Hill.

A. Signal.

B. Stop correct distance from curb.

C. Turn wheels in or out depending on grade.

D. Do not strike curb.

E. "P" or "N".

F. Parking brake.

G. Switch off.

X. Angle Parking

A. Check mirrors - slow down.

B. Move slightly to left - do not cross center line.

C. Signal.

D. Move car into stall - hand over hand - good spacing - do not hit curb.

(Leaving)

E. Right arm over seat and look to rear.

F. Move car slowly, straight back.

G. Driver checks right and left continuously as car moves to rear.

H. Start turning movement - hand over hand.

I. Check left front for clearance.

J. Turn into correct lane.

K. Look to rear as long as car moves to the rear.

L. Straighten wheels just before car stops moving.

M. Clear lane.

XI. Parallel Parking

A. Approaches in correct lane.

B. Slows down.

C. Check mirror(s).

D. Starting position - 2 feet away and parallel to other car - backs of front seats even.

E. Continue until the back of your front seat is aligned with check point # 1, an imaginary point on the car to your right, approximately 2 feet from the end of the left rear fender. At this point your steering wheel should be turned full right. Pause, as you continue to the rear maintaining the full right steering position.

F. Pause, as you reach check point # 2, the back of your front seat is aligned with the tail light of the car to your right.

G. Continue backing slowly and straighten wheels.

H. Pause at check point # 3, the right corner of your dash is aligned with the left tail light of the car to your right.

I. As you continue to the rear, turn steering wheel slowly hand over hand to the left; check right front fender clearance and look to the rear. Just before stopping, straighten wheels.

J. Shift to drive and center your car in the parking space. Wheels should be parallel to, and approximately 4-6 inches from the curb.

XII. Passing.

A. Checks traffic to rear.

B. Signals - horn as needed.

C. Accelerates 10-15 miles per hour faster than car being passed.

D. Makes pass - stabilized in lane.

E. Check rear view mirror.

F. Signal and move into lane when car being passed comes into rear view mirror - check visually over shoulder.

G. After returning to lane - adjust speed - cancel signal if necessary.

APPENDIX D

Multiple Car Program

Assignment Card

Student	Date	Car Assign.	Remarks

A B C D E F G H I J K L

APPENDIX E

Multiple Car Program Skill Test

Name _____ Period _____

Date _____

Total Score _____ Instructor _____

I.	Starting Procedure.	6 Points
	A. Enter car via curb side	1 pt. _____
	B. Adjusts seat and mirrors	2 pts. _____
	C. Selection of gear - "P" or "N"	1 pt. _____
	D. Foot on brake	1 pt. _____
	E. Switch on to start and release	1 pt. _____
		Total _____
II.	Moving the Car.	15 Points
	A. Left foot on brake	3 pts. _____
	B. Selects proper gear	2 pts. _____
	C. Releases parking brake	2 pts. _____
	D. Traffic check	3 pts. _____
	E. Signal	3 pts. _____
	F. Proper acceleration	2 pts. _____
		Total _____
III.	Turns.	13 Points
	A. Slow down	2 pts. _____
	B. Proper position	3 pts. _____

C. Signal 3 pts. _____

D. Hand over hand 1 pt. _____

E. Turns steering wheel when car is not moving (neg. check). 1 pt. _____

F. Turns into proper lane 1 pt. _____

G. Recovery 2 pts. _____

Total _____

IV. "T" 15 Points

A. Signal for entry 3 pts. _____

B. Enters via proper lane 1 pt. _____

C. Stops proper distance from flag # 1 2 pts. _____

D. Correct backing technique 3 pts. _____

E. Stops proper distance from flag # 2 2 pts. _____

F. Leaves via correct lane 1 pt. _____

G. Stops before entering street 3 pts. _____

Total _____

V. "X" 16 Points

A. Signal for entry 3 pts. _____

B. Enters via correct lane 1 pt. _____

C. Hand over hand steering (L) 1 pt. _____

D. Stops correct distance from flag # 1 2 pts. _____

E. Correct backing technique 4 pts. _____

F. Turns steering wheel when car is not moving (neg. check) 1 pt. _____

G. Stops correct distance from flag # 2 2 pts. _____

H. Stops before entering street 2 pts. _____

Total _____

VI.	Garage	16 Points	
	A. Signals for entry	3 pts.	_____
	B. Correct backing technique	2 pts.	_____
	C. Stops - traffic check	4 pts.	_____
	D. Turns into correct lane	2 pts.	_____
	E. Turns steering wheel when car is not moving (neg. check)	1 pt.	_____
	F. Looks to rear while car moves to rear	3 pts.	_____
	G. Clears lane - moves ahead	1 pt.	_____
		Total	_____
VII.	"Y" Turn	20 Points	
	A. Signals for entry	3 pts.	_____
	B. Brings car to full stop - proper lane	2 pts.	_____
	C. Traffic check	3 pts.	_____
	D. Signal (left)	3 pts.	_____
	E. Correct turning procedure	2 pts.	_____
	F. Stops car just before reaching other side, permits car to roll forward slowly straightening wheels as he does so.	1 pt.	_____
	G. Moves to rear - correct turning procedure	2 pts.	_____
	H. Stops before reaching curb - backs car slowly, straightening wheels as he does so.	1 pt.	_____
	I. Moves car forward turning left hand over hand.	1 pt.	_____
	J. Stops - signals before leaving.	2 pts.	_____
		Total	_____

VIII.	Parking on Hill	10 Points
	A. Signal	3 pts. _____
	B. Stops correct distance from curb	1 pt. _____
	C. Turns wheels in or out depending on grade	3 pts. _____
	D. "P" or "N"	1 pt. _____
	E. Parking brake set - switch off	2 pts. _____
		Total _____
IX.	Angle Parking	20 Points
	A. Traffic check	2 pts. _____
	B. Car position	1 pt. _____
	C. Signals	3 pts. _____
	D. Moves car into stall - good spacing; does not strike curb	4 pts. _____
	E. Backs out (straight)	1 pt. _____
	F. Pause - checks traffic	3 pts. _____
	G. Checks left front fender clearance	2 pts. _____
	H. Turns into proper lane - looks to rear	2 pts. _____
	I. Straightens wheels before car stops moving	1 pt. _____
	J. Clear lane	1 pt. _____
		Total _____
X.	Parallel Parking	27 Points
	A. Traffic check - signal	3 pts. _____
	B. Starting position	2 pts. _____
	C. Check point # 1	2 pts. _____
	D. Check point # 2	2 pts. _____
	E. Check point # 3	2 pts. _____

F.	Fender check	2 pts. _____
G.	Centers car in stall	2 pts. _____
H.	Proper distance from curb	2 pts. _____
I.	Clearing stall	2 pts. _____
J.	Traffic check - signal	4 pts. _____
K.	Fender check	2 pts. _____
L.	Turns correctly into proper lane	2 pts. _____
		Total _____

XI. Lane Changing — 10 Points

A.	Traffic check (mirrors)	2 pts. _____
B.	Signals	3 pts. _____
C.	Visual check (blind spot)	3 pts. _____
D.	Enters new lane correctly	2 pts. _____
		Total _____

XII. Passing — 15 Points

A.	Traffic check	3 pts. _____
B.	Signal - horn as needed	3 pts. _____
C.	Proper acceleration - makes pass	2 pts. _____
D.	Mirror check - signal	3 pts. _____
E.	Returns to lane	2 pts. _____
F.	Adjusts speed - cancels signal if necessary	2 pts. _____
		Total _____

APPENDIX F

ELEMENTARY SKILLS TEST

A. STARTING PROCEDURE
   1. Adjusts seat correctly
   2. Adjusts mirrors correctly
   3. Starting sequence
      a. "P" or "N"
      b. Left foot braking
      c. Right foot on accelerator
      d. Switch on to start and release
      e. Selects proper gear
      f. Releases hand brake
      g. Traffic check
      h. Signal
      i. Final traffic check

B. TURNS
   LEFT
   RIGHT
   1. Slow down (proper braking technique)
   2. Proper lane
   3. Signals well in advance
   4. Hand over hand
   5. Turns into correct lane
   6. Slight gas pressure coming out of turn
   7. Recovery

APPENDIX G

REPORT OF DRIVING TEST

First	Middle or maiden	Last name	License No.

Place	Hour	Day	Month	Registration	Class

[ ] Original	[ ] Change class	[ ] Acceptable	[ ] Violation	[ ] Unsafe act
[ ] Re-exam.	[ ] Review exam	[ ] Needs training	[ ] Accident	[ ] Incomplete

Notes

Examiner

VEHICLE HANDLING		Good	Needs train.
Start	Car readiness		
	Loc'n controls		
	Motor operat'n		
Quick stop			
Backing	Speed		
	Lane		
Parking	Signal		
	Positioning		
	Backing		
	Placement		

ROAD PROBLEMS		Good	Needs train.
Stop signs	Braking		
	Placement		
Traffic lights	Braking		
	Placement		
Left turns	Lane		
	Speed		
	Signal		
	Turn		
	Waiting		
Left turn	Lane		

Turn about	Positioning		
	Maneuvering		
Stop on up grade	Braking		
	Wheel turn		
Start on up grade	Signalling		
	Brake control		
	Motor oper'n		
Posture	Body		
	Arms		
SCORE	%	COUNTS	

TRAFFIC PROBLEMS		Good	Needs train.
Following	Distance		
	Observation		
	Placement		
Overtaking	Judgment		
	Signal		
	Speed		
	Return		
Being overtaken	Speed		
	Yielding		
Use of horn	Helpful		
	Unnecessary		
Right of way	Yielding		
	Taking		
SCORE	%	COUNTS	

at signal	Speed		
	Signal		
	Turn		
	Waiting		
Left turn from one-way street	Lane		
	Speed		
	Signal		
	Turn		
	Waiting		
Right turn	Lane		
	Speed		
	Signal		
	Turn		
Blind intersect'n	Speed		
	Placement		
Multiple lanes	Placement		
	Changing		
One way street	Placement		
	Changing		
Other signs	Observation		
	Action		
Attention	Starts		
	Back & turn		
	Left turn		
	Parking		
	Other		
SCORE	%	COUNTS	

Exhibit 9. Driving test score sheet meeting general recommendations for examining method and standards. This may be combined with report of other tests in examination, with an appointment memo or with application blank.