THE FEASIBILITY OF USING SELECTED STUDENT DATA BASES FOR THE ASSESSMENT AND EVALUATION OF DRIVER EDUCATION PROGRAMS IN THE STATE OF MINNESOTA

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ABSTRACT

THE FEASIBILITY OF USING SELECTED STUDENT DATA BASES FOR THE ASSESSMENT AND EVALUATION OF DRIVER EDUCATION PROGRAMS IN THE STATE OF MINNESOTA

By

Jerome W. Witherill

The search for a method of evaluating high school driver education nationally has been ongoing for some time, but without much success. Differences in programs, instructors, available data and the environment from one location to the next have produced such variance that comparisons are nearly, if not totally, impossible.

The prime difficulty in these evaluative efforts have been the development and maintenance of adequate criterion data such as violations, accidents, and the circumstances surrounding each and both.

This study used criterion data generated from five sources in an effort to provide an adequate data base for comparing the relative efficacy of driver education program types and for determining the correlates of successful driving among late-adolescent drivers. The sources were:

1. School records
2. Local police records
3. State Motor-vehicle records

4. Court records, and

5. Driver self-reports

The students were randomly selected from those enrolled in summer driver education programs in Duluth, Minnesota. Twenty-five males and twenty-five females were selected each year from each of the three treatment types (traditional, range and simulation) offered for the years 1967-1969.

Chi-square tests of significance were used to test hypotheses concerning treatment and sex effects. A correlation matrix was used to determine the strengths of association for correlative data. Cross tabulations and content analysis were used to study interagency data bases, student responses and accident records.

The findings of the study were the following:

Data Sources

1. Only 65 percent of the accident reports available from all sources were obtainable from state driver license records. Of the reports available from the state, however, 53 percent were not obtainable from other sources.

2. Eighty-three percent of the citation reports available from all sources were obtainable from state driver license records. Of the citation reports available from the state, 40 percent were not available from other sources.

3. Local police records contain 68 percent of the accident reports available from all sources, and of the local police reports, 52 percent are not obtainable from other sources.

4. The local court records contain 60 percent of the total of citation reports from all sources, but only 17 percent of the local court reports are not obtainable from other sources.

5. Most of the subjects (91%) were easily contacted and asked to answer the questions of the phone survey.

Treatment Comparisons

6. The acquisition of citations was not significantly affected by treatment type (traditional, range, and simulation).

7. Involvement in accidents was not significantly affected by treatment type (traditional, range, and simulation).

Sex Comparisons

8. Females acquired significantly fewer citations than did males. This may be qualified by the significantly greater exposure: (1) number of days of driving per week, (2) number of miles driven per week, (3) percent of night time driving, (4) percent of weekend driving, and (5) motorcycle miles driven of the male driver.

9. Females acquired significantly fewer accidents than did males. This also may be qualified by the significantly greater exposure: (1) number of days of driving per week, (2) number of miles driven per week, (3) percent of night time driving, (4) percent of weekend driving, and (5) motorcycle miles driven of male drivers.

Demographic Data Comparisons

10. Involvement in accidents was significantly related in a negative direction to driving experience as defined by days driven per week, percentage of night driving, and percent-

age of weekend driving (as these variables increase, accidents decrease), and was significantly related in a positive direction to motorcycle miles driven (as this variable increases, accidents increase).

11. Drivers from larger families had significantly more accidents than drivers from smaller families.

12. Involvement in accidents was significantly related in a positive direction to the acquisition of citations. This may be qualified by the inclusion of citations received at the accident with the citation data.

13. The acquisition of citations was significantly related in a negative direction to driving experience as defined by days driven per week, and percentage of weekend driving, and in a positive direction to motorcycle miles driven.

Student Suggestions

14. The most frequently stated suggestions for classroom instruction were (a) more practical information, (b) use more "scary" films and (c) more information about accidents.

15. The most frequently stated suggestions for on-the-street instruction were directed toward more driving experience, specifically winter driving, parking, city driving, and the use of standard shift cars.

Accident Records

16. In 25 (40%) of the accident reports, skidding was listed as an apparent contributing factor.

17. Inattentive driving (19%), illegal or unsafe speed (16%), and failure to yield (16%) were identified as the most common driver faults in accident reports.

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By

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CHAPTER I

THE NATURE OF THE PROBLEM

Introduction

Historically, driver education is one of the newest and fastest growing disciplines in the school curriculum. Since the first course was offered at Gilbert, Minnesota, in 1923 (29), driver education has developed to its present state where 81 percent of the potential schools in the 50 states offer at least a minimum program of 30 clock-hours of classroom instruction and 6 clock-hours of on-the-street instruction or the equivalent substitution of range or simulation instruction (42). In fact, driver education has become so accepted as a part of the school curriculum that, in contrast to the usual policy of strict church-state separation, many states provide financial support to driver education in both private and parochial schools (24).

Throughout this explosive growth of driver education, as now, little research has been conducted to provide methods or techniques for program evaluation. Educators have relied on the past, economics, "common sense," or whatever seemed applicable from their experience in other phases of education to determine what driver education should be.

Today, as never before, vast quantities of driver behavior data are being collected by state agencies and

stored in computers. These data are available to the schools and can be retrieved from the computer in a matter of minutes or seconds. Schools themselves have improved their record keeping systems in an effort to document student demographic information. These tremendous reservoirs of data can serve as meaningful inputs to direct schools in their program improvement.

In addition to these data, each year hundreds of thousands of students complete driver education and shortly thereafter are called upon to perform in the real world the basic skills taught them. Their perceptions, ideas, and feelings about the adequacy of the driver education instruction they received, along with their personal experience in the performance of the driving task, could be an invaluable aid for program improvement.

Unfortunately, few, if any, schools use the above data sources for improving their programs. Because Duluth, Minnesota is no exception to this situation, it was important that a comprehensive study be made to determine the value of existing data and student responses as a technique for evaluating and improving existing programs.

Background of the Need

The gravity of the highway safety problem is without parallel. Each year more than 50,000 people are killed in the United States and 2,000,000 people receive disabling injuries

as the result of highway crashes. Related costs approximate 12 billion dollars annually (1). In Minnesota in 1972 1,031 persons lost their lives and more than 39,000 people were injured in traffic crashes (1). The Duluth police department reported 24 people killed and more than 970 people injured in their city that year (4).

Education, more specifically driver education, remains among the major countermeasures for solving the highway crash problem (28). Since the 1930's, driver education programs have expanded rapidly in the nation's school systems. They have grown at a rate 2-1/2 times that of any other subject introduced into the school curriculum. From the school year of 1947-48 to that of 1970-71, the number of public schools providing driver education has increased from about 3,000 to an estimated 15,000. During this same time, the number of students enrolled in driver education courses has increased from 200,000 to an estimated 2,500,000 (42).

As the number of programs and students increased, new approaches and techniques of instruction were sought to improve the efficiency and the quality of instruction. The multiple-car range, born in the City of Chicago in the mid-1930's, has become popular in the last 10 years and is presently being used in more than 464 schools throughout the country. Simulation, developed in 1953, has grown in popularity even faster than range programs and is presently being used in 1,011 schools in the country (42).

Duluth's driver education program has experienced a growth rate similar to that of the nation. From a modest beginning of 250 students in 1948, the program has grown to include more than 2,000 students per year. Moreover, the instructional techniques have changed from the traditional program of classroom and on-the-street instruction to include multiple-car range and simulation phases.

This rapid expansion of driver education in Duluth and other cities has created numerous and varied "growing pains." These growing pains have resulted in a quantitative response; it is now time to address the issue of quality.

Given the problems of growth and the national demand for accountability of education, the need for investigating more effective driver education has never been greater. There has never been a better time to assess driver education programs and implement improvements where needed.

Importance of the Study

A question (which is frequently debated) about driver education is, "Should driver education be included in the school curriculum?" Studies concluding that school-trained drivers are better drivers than non-school-trained drivers are cited by those who support driver education. Studies that conclude just the opposite--that nonschool-trained drivers are better drivers than school-trained drivers--are referred to by

the critics of driver education. McGuire and Kersh have found, after reviewing the studies supporting each side, that the lack of scientific methodology makes the findings suspect on both sides of the issue (24).

Intuitively it can be concluded that all people are trained in learning to drive. Some people receive their training from a teacher, some from a relative, some from a friend or private school, but everyone does receive training. The question now becomes, "Where and how can driver education best be accomplished?"

The answer to the first part of the question--where--has been answered by the incentives presently being offered for selecting school driver education. The average driver education student is 16 years old. Since most states have a provision for a lower licensing age if the applicant has successfully completed an approved driver education program, the 16-year old is eligible to be licensed 1 or 2 years earlier than would otherwise be possible.

Another decided advantage for the student who takes driver education is that, in virtually all the states, students who have successfully completed the driver education course are eligible for reduced insurance premiums. This economic feature also motivates parents to encourage their children to enroll in driver education, and seems to be one of the sustaining reasons for local support of driver education programs.

Special financial support of driver education is also provided by most states. This has been a major incentive for schools to continue and expand their programs.

These incentives alone would seem to guarantee a place for driver education in the school curriculum. Its position has been made even more secure, however, by its nationwide recognition in the Highway Safety Act of 1966 (Public Law 89-564), which is a national attempt to promote and encourage schools to increase their efforts to highway safety, which states, "There is a national need for the improvement of public and private driver education and for making them more available." The act further provides for financial help to the states for implementation of these programs (28).

The position of driver education in the school has been established. Now efforts need to be directed toward providing the bext programs possible. Ongoing assessment and evaluation are musts for every driver education program, not only to provide direction for program improvement, but also to answer the demands for accountability that have accompanied the local, state, and national support.

Purpose and Objectives

The purpose of this study was to determine the feasibility of using selected student data bases for the assessment and evaluation of driver education programs in the State of Minnesota. A random sample of Duluth driver education students who enrolled in the laboratory instruction phase of

driver education in the summers of 1967, 1968, and 1969 served as subjects. The students' education records were obtained from the Duluth public school system; student driving records were obtained from the Minnesota Department of Public Safety, the St. Louis County Probate Court, and the Duluth Police Department; and a phone survey was conducted to obtain student demographic data, driving experience, and opinions. The specific treatment and criteria variables are discussed in greater detail in Chapter III.

The six primary objectives were:

1. To complete a feasibility study by using interagency data sources for studies of the relative efficacy of driver education.
2. To compare the relative efficacy of range, traditional and simulation driver education practices as traffic safety countermeasures.

   Hypotheses:

   Ho_1 There is no significant difference in the number of citations attributable to treatment type.

   Ho_2 There is no significant difference in the number of accidents attributable to treatment type.

3. To compare the driving behavior of males and females.

   Hypotheses:

   Ho_3 There is no significant difference in the number of citations attributable to sex differences.

   Ho_4 There is no significant difference in the number of accidents attributable to sex differences.

4. To secure data which would contribute to the

assessment and evaluation of driver education in Minnesota by ferreting out predictive relationships between demographic variables and accident and citation data. Hypotheses:

Ho_5 There is no significant relationship between citations or accidents and demographic variables such as, attitude, grade-point average, driving days per week, miles driven per week, percentage of night driving, percentage of weekend driving, model year of car driven, year of completion of classroom instruction, number of brothers, number of sisters, and number of cars in family.

5. To present suggestions offered by students for improving classroom and on-the-street instruction.

6. To investigate accident records for information that could be used for program improvement.

Definition of Terms

Age:	The age of the subject in months as of September 15, 1970.
Attitude:	The on-the-street instructor's rating of the subject at the completion of instruction using a five-point scale: exceptional, good, average, below average, poor.
Classroom phase:	The portion of the driver education program that is taught in the classroom setting.
Crash/Accident:	An unplanned event resulting in death, injury, property damage, or inconvenience involving the use of a motor vehicle.
Driving experience:	An estimate of the average number of miles driven per week since being licensed.
Driving experience, days/week:	An estimate of the average number of days per week that some driving is done.
Driving experience, night:	An estimate of the percentage of driving that is done at night (7 p.m.--7 a.m.).

Driving experience, weekend: An estimate of the percentage of driving that is done during the weekend (Friday, 7 p.m.--Monday, 7 a.m.).

Driving experience, motorcycle: An estimate of the total miles driven operating a motorcycle.

Exposure: That small segment of the total exposure data dealt with in this investigation: number of days of driving per week, number of miles driven per week, percent of night time driving, percent of weekend driving, and motorcycle miles driven.

Laboratory phase: The phase of driver education employing "real" driving experiences. Included within this definition are simulation, off-street driving ranges, and on-the-street driving experiences conducted singly or in conjunction with each other.

Minimum standards: The minimum number of hours accepted by the State of Minnesota for classroom and laboratory instruction. Present driver education standards conform to the national standards: 30 hours of classroom and 6 hours of on-the-street instruction. Minnesota also provides for the substitution of at most 3 hours of on-the-street instruction on the ratio of 1:2 with multiple-car range instruction and on the ratio of 1:4 with simulation instruction.

Multiple-car range: The multiple-car method permits several automobiles to be operated simultaneously on a special off-street facility, under the direction of one or more teachers positioned outside the vehicles. The teacher typically communicates with students by radio.

On-the-street phase: The phase of instruction conducted on public streets using a dually controlled automobile to provide actual traffic experience.

Scholastic average: The grade-point average of all subjects taken 9th grade through highest grade achieved as of September 15, 1970.

Simulation: A teaching-learning device using electronic driving components, programmed motion pictures, and an instructional response system in a classroom setting.

Traditional driver education:	A program that uses the standard 30 hours of classroom instruction and 6 hours of on-the-street instruction.
Traffic accident:	The traffic accidents (crashes) reported in this study refer to those reported to the Minnesota Department of Public Safety, which include all accidents resulting in injury to or death of any person or total property damage to an apparent extent of $100 or more and/or any accident reported to or investigated by the Duluth Police Department.
Unique data:	Data available at only one source.

Organization of Remaining Chapters

Chapter II contains a review of the literature. The review of the literature consists of descriptions of the goals and objectives of driver education, utilization of accident and citation records, the status of driver education, effectiveness of driver education, and research grants sponsored by the National Highway Traffic Safety Administration for evaluating driver education.

Chapter III contains a detailed description of data collection process as well as the techniques used for analyzing these data.

Chapter IV contains the findings based on the statistical test results and student interviews.

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

CHAPTER II

SELECTED REVIEW OF LITERATURE

Five general sources of literature relevant to this study were reviewed: (1) literature that describes the goals and objectives of driver education, (2) literature examining the utility of accident and citation records, (3) literature on the status of driver education, (4) literature on the effectiveness of driver education, and (5) literature on research contracts for the evaluation of driver education that have been sponsored by the National Highway Traffic Safety Administration (formerly Highway Traffic Safety Bureau).

Goals and Objectives of Driver Education

The goals and objectives of driver education have been described in the Driver Education Standard 4.4.4 by the National Highway Traffic Safety Administration (NHTSA). This standard states that a student enrolled in a driver education program should be provided with ". . . a course of instruction designed to train him to drive skillfully and as safely as possible" (28). This definition is of particular relevance because states are required to meet this standard to qualify for federal highway funds.

A popular driver education textbook, Let's Drive Right, has similarly defined the goals of driver education. The

authors state that a course of instruction in driver education must be ". . . dedicated to the idea of helping young people save their lives" (18, Preface).

A more general definition of the goals and objectives of driver education was set forth by the National Education Association (NEA) in their publication, Practices and Policies. In this publication, driver education is described as a program bent toward ". . . achieving a desirable pattern of behavior in our society" (30, p. 3). This more general description was also used by the Automotive Safety Foundation in its recent publication, A Resource Curriculum in Driver and Traffic Safety Education (35). This publication refers to secondary school driver education as ". . . one of the direct forces influencing operator behavior . . ." (35, p. 4).

Since students of driver education are being educated to participate as motor vehicle operators in the total transportation systems, the goals of the system have relevance for driver education. The Institute of Traffic Engineers in its publication, An Introduction to Highway Transportation Engineering, has defined the goals of our transportation system as ". . . safe, efficient, and convenient movement of goods and people" (23, p. 9).

Utility of Accident and Citation Records

The definitions of driver education state either explicity or implicity that accidents and citations are measures of success or failure of the programs. The result

is that evaluation of driver education should, if not must, include assessment of accident and violation experience of the graduates of the program.

There are, however, limitations in using the number of accidents and the number of violations a person has had as a measure of program success because of differences in enforcement indices, variation in adjudication of cases, and differences in record keeping from one locale to another.

In addition, complications exist from other factors such as the multiplicity of enforcement agencies and their differences, the insurance rate structure, and the definition of what constitutes a reportable accident from one state to another. For example, an accident in which there is $100 or more property damage is required to be reported in Minnesota, while in Wisconsin there must be at least $200 of property damage for an accident to be reported.

As a result of these and other questions concerning accident and violation records, a number of studies have been undertaken to determine the utility of these records as criteria of driver performance or for identifying potentially hazardous drivers. Hakkinen (17) analyzed accident records to investigate the problem of criterion reliability. He concluded that accident records for an eight-year period are desirable for use as a reliable criterion for validating performance tests. Forbes (15), re-analyzing data from a study of over 29,500 drivers, found that by comparing accident

records of one three-year period to a succeeding three-year period, conclusions differed markedly from previous interpreations of accident records analyzed by the total time period only.

The instability of accident records has been reported by Burg (8) who found that a large proportion of drivers with accidents in a succeeding three-year period were different from those with accidents in the preceding three years. He did, however, state that driving record information becomes more reliable as the period of time over which it is accumulated increases. Campbell (9) also reported instability of accident records of the North Carolina Department of Motor Vehicles when he found 80.7% of the drivers who had an accident in one two-year period were accident free during the second period. This study further revealed that many people who do experience accidents have no record of traffic violations in the prior two years.

In other studies to identify potentially hazardous drivers Tarrants (41) pointed out that several studies have indicated accident and violation rates may be influenced by exposure, age, sex, socioeconomic status, education, and intelligence. Harrington (20) used a sample of 13,415 drivers in the 16-17 year old age group in a longitudinal study to determine the safety advantage gained by raising the minimum licensing age from 16 to 18 years of age. It was reported that no matter how the accident trend was adjusted for mileage,

the resulting rate showed a steady decrease across years (accidents decrease as mileage increases).

The question of accident proneness is the topic of a summary (Pech, McBride, and Coppin, (33)) of nine studies conducted under the auspices of the California Department of Motor Vehicles. The initial focus of the studies was on accident and citation stability. In conclusion, the authors argue that accident frequencies are not direct measures of an individual's driving behavior. Rather, they are highly dependent on the behavior of others and various random contingencies.

Bishop (7) reported a study in which he attempted to group "errors" rather than individual categories of accident causation. One hundred-nineteen drivers under the age of 30 who had experienced accidents were interviewed to obtain descriptions of the accidents. Accidents were classed under eight error categories, the general findings being that most accidents were caused by failures in psychological areas (attention, attitude toward chances of accident involvement, drinking and driving, emotion, perception-judgment) rather than by physical or operational skills (emergency driving situations, factors involved in operating a motor vehicle, fatigue).

In reviewing a large number of studies using accident and violation records, Leon Goldstein (16) pointed out one of the chief problems of using these data was the very low

occurence probabilities--most drivers never have more than one reportable accident, and the largest group of them have none during periods of time ordinarily available for research programs.

The use of accident and citation records as evaluative criteria is limited, but as was found by Berg (8) the value of these data improve over time. Also recognizing the limitations of accident and citation data each of the five National Highway Traffic Administration studies recommend the use of accident data as one of the measures of evaluating driver education programs.

Status of Driver Education

The literature indicates that current driver education programs for the nation's schools are far from standardized, and in some cases, exist in a form far from optimum. There is great diversity in course content, in the use of instructional aids, and in the nature and arrangements of various program elements. The scope of an individual course may range from fulfillment of only the minimum requirements necessary to prepare students for licensure, to a four-phased program which integrates classroom, simulation, multiple-car range, and on-the-street instruction.

Seals states that currently the most common offering in driver education is "30 and 6"; 30 hours of classroom instruction and 6 hours of "laboratory" instruction. The latter consists of opportunities for actual or simulated

driving experiences. The "30 and 6" time allocation is generally regarded as an acceptable minimum standard course, although increased time is more and more frequently being recommended (36).

According to the literature, course content and teaching techniques vary greatly among conventional "30 and 6" programs (5). Even greater disparity exists when the use of simulators and multiple-car ranges are taken into consideration. It is unlikely that this situation will change much in the immediate future. Currently, almost no data exist regarding the relative effectiveness of specific course content, of various teaching techniques, or of the various laboratory methods. Nor are data available that specify the optimum combination of the various laboratory techniques.

In addition, and perhaps one of the major reasons for the existing course differences, is the range of professional preparation programs for driver education teachers (21). State requirements differ vastly, and many instructors are required to meet only minimum standards. Most states require a minimum three to six semester hours of course credit in driver education, but the overall range is wide (13).

The NEA, in an attempt to strengthen this area, has recommended a teacher preparation curriculum for those intending to teach driver education. In 1968, however, only 68 of all universities and colleges with driver education programs conformed to these recommendations (32). NEA has also

established standards for university and college instructors of driver education. In 1968, slightly more than half of the active instructors met this standard (32).

Despite the many problems besetting driver education, and despite its present ambiguous state, the continued existence of driver education as part of the secondary school curriculum seems assured. Anticipated national enrollment in driver education for the 1971-72 school year was about two and one-half million students. It was expected that close to 100 percent enrollment of all eligible students would be attained in the 1972-73 school year (27). This prediction not only suggests that driver education is here to stay, but also points out the urgency of the need for all programs to engage in program evaluation to assure the best program possible for the students.

Effectiveness of Driver Education

The American Automobile Association (AAA) sponsored in 1945 one of the first effectiveness studies of driver education (12). In its study, the driving records of two groups of Cleveland, Ohio, high school students were compared. One group received high school driver education; the second group did not. The study concluded that driver education students have half as many accidents as do those students who have not had driver education.

This study received national recognition and frequently has been cited by the advocates of driver education. Several

other studies (Minnesota, 1955 (31); New York, 1963 (28); Illinois, 1963 (37); Oregon, 1963 (39); and Wisconsin, 1970 (40)) found that driver education students have better driving records than students who have not had driver education.

Coppin, Ferdun, and Peck (11) and McGuire and Kersh (25) have reported findings that are at variance with those described above. The conclusions of these studies raises serious questions about the effectiveness of driver education as a positive force in accident and violation reduction.

In studies conducted in California and Mississippi (25), McGuire and Kersh concluded that little or no difference can be found between driver-educated and nondriver-educated groups in either accident or violation frequency. "Data concerning the effects of high school driver education are negative" (25).

Where does the answer to the question of driver education effectiveness lie? Perhaps at some midway point between the divergent findings reported by various studies. A close scrutiny of much of the past and present research in driver education has exposed inadequacies in the design and in the reporting of the data in a majority of the studies. Their conclusions, therefore, may be held suspect (13).

National Highway Traffic Safety Administration

Recognizing the need and demand for evaluation of driver education, the National Highway Traffic Safety Administration (formerly Highway Traffic Safety Bureau) in 1967

awarded driver education research grants to four independent groups: (1) The American University, Washington, D.C. (3); (2) The Center for Safety, New York University, New York, New York (32); (3) Dunlap and Associates, Incorporated, Darien, Connecticut (13); and (4) Institute for Educational Development, El Segunde, California (22). These grants used funds established under the Highway Safety Act of 1966.

The groups, working independently but concurrently, investigated the problems of evaluating driver education and driver training programs. A final report, submitted to the bureau by each group, suggested plans for short-term and long-term evaluation, as well as recommendations for instruments to be used in specific areas of evaluation.

After the four reports were submitted to the Highway Traffic Safety Administration, a fifth contract was undertaken by another independent group, the National Academy of Sciences of the Highway Research Board, who subcontracted to the Educational Testing Service, Princeton, New Jersey (14). The task of this group was to synthesize the plans and instruments developed by the first four contract groups, and to develop plans for evaluating driver education programs on a national basis.

The National Highway Traffic Safety Administration hoped that the national plan could and would be adopted by all schools in the country. They felt that driver education programs would in this way be improved and

would then be able to demonstrate their ability as a traffic safety countermeasure. Because of the tremendous work that went into these five projects and the anticipated use of the final plan by schools throughout the country, a synopsis of each of the plans will be presented.

A Study on Evaluation of Driver Education, Washington, D.C., The American University, Development Education and Training Research Institute, July, 1968.

The American University report states that the objectives of its study was "to develop and recommend a plan or plans for evaluating the effectiveness of driver education programs, not only as they are currently being taught, but also as they might be taught" (3, p. 7). The study deals with three major concerns--an analysis of the evaluation problem, a proposed driver performance analysis, and the evaluation recommendations.

In the discussion of the evaluation problem, the authors include a brief exposition of the currently accepted, fundamental principles of evaluation.

The study continues with a brief discussion of criteria and measures. Then the authors outline what they consider an "ideal evaluation process." In essence,

this design would involve a large group of students who would be pre-tested to reveal pre-program characteristics and capabilities. "The students should then be randomly assigned to the various programs in such a way as to have matched groups of students in each program" (3, p. 19).

The American University researchers conclude their study with two recommended plans--a short-term evaluation plan and a long-term evaluation plan. The short-term plan is a survey of driver education courses and includes a proposed questionnaire for teachers. This questionnaire, "properly refined and pre-tested," would offer "subjective evaluation of the probable accident countermeasure relevance of the learning experiences provided students in existing courses" (3, p. 156). A preliminary questionnaire is included in the report.

The best feature of the plans presented in the study is recognition of the need to assess driver education programs on the nature of the driving process and on the course's behavioral objectives. The teacher questionnaire has some useable features, but for the most part it offers only a rather quick and ready method for cataloguing various driver

education courses throughout the country.

Driver Education and Training, New York City, New York, New York University, The Center for Safety, May, 1968.

The Center for Safety's proposed plan for evaluating the effectiveness of driver education deals first with the selection of variables: (1) evaluation criterion variables and (2) major related variables. The evaluation criteria are classified as short-term, intermediate, and long-term.

Short-term criterion variables are defined as those that can be used to measure the immediate effects of a driver education course. Two of these variables are driving performance via a simulator and driving performance via a road test. To develop the road test, the Center suggests three subprojects: determination of the criteria of good traffic driving performance, identification of the number and proportion of critical elements involved in good traffic driving performance, and a road test course layout to test the correctness of a driver's performance of the identified critical elements. The Center's other short-term criterion variables include self-rated driving performance, a test of driving knowledge, and a test of driving attitudes.

The second phase would be another series of questionnaires and tests and would immediately follow course completion. There would be student rating of the teacher's ability, a self-rating of his own driving ability, a knowledge test, a driving attitude scale, a personality

inventory, a test of his ability on the driving simulator, and tests of driving performance by means of a road test and of driving performance under stress conditions.

The third phase of testing would be done about two years after completion of the course. Essentially, tests given at this time would be the same as those given immediately after completing the course, except the teacher would not be rated. In addition, through the media of questionnaires and interviews, the students would supply biographical data, the number of accidents they were at least partially responsible for, the number of moving violations accumulated, and the number of "near misses" experienced.

The fourth phase of testing would be administered three to five years after completing the course and would be the same in content as that of the third phase.

A second evaluative possibility reported is a comparison of the relative cost effectiveness of alternative techniques employed within various types of traffic safety programs. It is suggested that there be a comparison of "various methods used with comparable classes by comparably educated and experienced teachers" (32, pp. 3-47).

One major weakness of the Center's design is that it calls for the evaluation of a domain that has not been defined except in the most general terms. In the main design, it is proposed that the critical elements of the traffic driving task be identified, but this is to be done only in a substudy

of the major design. In addition, since results are to be measured by the road test, presumably the critical elements to be identified would include only motor skills and no related knowledge and attitudes.

Driver Education and Training, Darien, Connecticut: Dunlap and Associates, Incorporated, May, 1968.

Dunlap and Associates began their research by establishing a driver education information base obtained through a survey of driver education and educational research literature and by field trips and visits to various driver education programs and recognized authorities in the field. Using this data base, the group undertook an investigation of selected previous studies.

The Associates' conclusion:

> While the overwhelming weight of "published studies are typically interpreted as strong endorsement for driver education, most of the studies had weaknesses in one or more areas . . . the findings across all studies are by no means consistent (13, pp. 16-17).

And since they found the same weaknesses present in advocates' and critics' studies, they conclude that "it is difficult to state with any confidence that driver education has had a demonstrated effect on accident experience" (13, p. 17).

Dunlap and Associates make recommendations for evaluating driver education. Primarily, they propose a short-term evaluation approach involving self-evaluation by the schools. The evaluation device suggested by the Dunlap group is the driver education section of Evaluative Criteria, an evaluation scheme used by the National Study of Secondary School Evaluation and one that is lauded in the study as an "excellent example of a carefully conceived and continuously revised evaluation program" (13, p. 6).

The Evaluative Criteria is a check list plan and is done by a staff member or members of a school and by members of a visiting committee. The check list requires five letters: E (extensive coverage), S (moderate coverage), L (limited coverage), M (missing), and N (coverage not desirable or applicable). Space is allowed for notes or qualifications.

Dunlap and Associates do not suggest a long-term evaluation plan. Due to present research regarding data bases and subsequent changes in all traffic-related systems, the group believes that:

> the only step which can be recommended with respect to a long-term evaluation plan is to develop a recommended driver education information base in the several states, at which time it would be possible to develop comparative evaluative studies (13, p. 49).

Driver Education and Training Project for the National Highway Safety Bureau, El Segundo, California: Institute for Educational Development, June, 1968.

During the study undertaken by the Institute for Educational Development, the group became convinced that the evaluation program of driver education must have a broader range than that which would be involved in determining the effectiveness of driver preparation programs. They believe that evaluation must be "directed at the generic question of the influences on the acquisition, maintenance and updating of driver proficiency" (22, pp. 1-4). Consequently, the institute proposes to ask:

> Given an explicit definition of driver performance variables, how, when and where can influences be brought to bear on improving driver proficiency that will provide an appropriate return on investment in the effort (22, pp. 1-4).

This approach makes identification of driver performance variables necessary, and the institute sees three distinct issues revolving about the variables: (1) What are the driver performance variables that contribute to effective driving in the real world? (2) To what extent and how can performance of these variables be influenced? (3) What interventions to influence driver proficiency are feasible?

The Institute provides three alternative plans: Plan I: Evaluating Program Characteristics; Plan II: Evaluating Driver

Proficiency; Plan III: Validating Program Effectiveness. After comparing the strengths and weaknesses of the short- and long-term implications of each of the plans, the group concluded that the three plans are not autonomous, but instead are complementary and iterative phases. Thus, they recommend that the three plans be implemented concurrently.

Evaluation of Driver Education and Training Programs, Princeton, New Jersey: Educational Testing Service, March, 1969.

Following the submission of the reports completed by the American University, Dunlap and Associates, New York University, and the Institute for Educational Development, work was begun on a fifth contract issued by the National Highway Traffic Safety Administration. This fifth report was granted to the National Academy of Sciences Highway Research Board, which appointed a project advisory committee and subcontracted to the Educational Testing Service (ETS), Princeton, New Jersey.

It was the task of ETS to analyze the reports made by the four independent contractors, to synthesize their recommendations and plans, and to integrate the strengths of each into a national evaluation design.

Among major findings reported by ETS in regard to the four contracted studies were the following: (1) No definitive statements can be made about the effectiveness or ineffectiveness of driver education. (2) All concurred on the difficulty of evaluating the effectiveness of driver education on accidents, especially in view of present accident recording systems. The usefulness of intermediate criteria as surrogates for real-world driving performance was recognized; however, all four reports emphasized that "driver education must aim at the ultimate development of driver proficiency in the real world, as reflected in efficient traffic flow as well as accident reduction" (14, p. 5). (3) There was general agreement on the vital need of the driving task analysis in the real world and of the subsequent development of more objective measures of driver proficiency and attitudes.

Six major activities are identified by ETS as elements of the overall long-term evaluation: (1) measures of driver performance; (2) measures of program characteristics; (3) research studies of program characteristics and driver proficiency tests; (4) different levels of criteria; (5) research studies of driver proficiency tests and real world

driving; and (6) overall evaluation of driver education and training programs. In each of these areas detailed suggestions are outlined.

Following the completion of the driver education evaluation research grants, the National Highway Traffic Safety Administration awarded a contract to develop and evaluate a safe driving performance curriculum for secondary school driver education. This contract was awarded on a competitive basis to Human Resources Research Organization (HumRRO) and Central Missouri State University in June, 1972. The project is structured in two phases. Phase I requires the development of a safe performance curriculum and the procurement of instructional materials for pilot testing. The curriculum is being designed as an accident countermeasure for novice drivers. Phase I was completed in mid-February, 1973. Phase II requires pilot testing the safe performance curriculum under conditions that allow for the best possible research controls. This phase was started in June, 1973, in the Kansas City Public Schools, Kansas City, Missouri. The pilot test is currently scheduled for completion in September, 1974.

Summary

The review of the literature reveals that the goal of driver education is safe driving behavior; that driver education programs vary tremendously throughout the country; and that the

evaluation of driver education programs has produced inconsistent findings.

Several studies indicate that accidents and citation records need to be a part of driver education evaluation. A number of studies, however, point out the weaknesses of using accident and citation data.

A summary of studies to evaluate driver education programs concluded that a national standard of evaluation is nearly, if not totally, impossible.

In spite of the problems, the need for evaluation is expressed in the following statement from the Report of the Secretary's Advisory Committee on Traffic Safety, U.S. Department of Health, Education and Welfare:

> . . . there is inadequate scientific information on the nature of the driving process and the factors affecting it, and on the ways in which information obtained from research in this area can be employed in making driver education as effective as possible for the different kinds of individuals. (27)

CHAPTER III

DESIGN AND METHODOLOGY

This study was designed to determine the feasibility of using selected student data bases for the assessment and evaluation of driver education programs in the state of Minnesota.

The procedures used in this study, following the approval of Mr. Richard Pearsen, Assistant Superintendent and Mr. Harry Brown, Director of Driver Education in the Duluth, Minnesota Public Schools, are explained as they relate to subjects, data collection and data analysis.

Subjects

The population for this study consisted of all students taking driver education in the Duluth public schools during the years 1967, 1968, and 1969 (about 2,000 students each year).

The samples of this study were 50 males and 50 females selected on a stratified random selection basis for 1967 and 1968. In 1969, 75 males and 75 females were selected, also using a stratified random selection.

The sample size for the smaller samples was determined by using the formula

$$n = \frac{N}{ND^2+1} \qquad (19)$$

when n = optimum sample.
N = population.
D = the proportion of the standard deviation of the population chosen at the 95 percent confidence level.

In this case, N was 2,000 each year. Arbitrarily, it was decided to sample statistics of minor population parameters within .10 of a standard deviation.

$$n = \frac{N}{ND^2+1}$$

$$= \frac{2,000}{2,000(.10)^2+1}$$

$$= \frac{2,000}{20.0+1}$$

$$n = 95$$

Accordingly, a sample greater than 95 should give the desired confidence.

Data Collection

The data for the study were obtained in the summer and fall of 1970 from five sources: (1) the Duluth public schools, (2) the Duluth Police Department, (3) the St. Louis County juvenile court, (4) the Minnesota Department of Public Safety, and (5) the students.

Duluth Public Schools

The subjects for the study were selected from the records kept by the Department of Safety and Driver Education.

For the years of 1967 and 1968, the students were randomly assigned to one of two treatment groups: range or traditional. From each of these groups, 25 boys and 25 girls were randomly selected for the study. The 1969 students receiving driver education were randomly assigned to one of three treatment groups: range, traditional or simulation. The subjects, 25 boys and 25 girls, were then selected randomly from each of the three treatment groups.

The records kept by the Department of Safety and Driver Education provided the driver's license number, treatment type, attitude (as defined by the on-the-street instructor), the year the subject received classroom instruction, age, address, and high school attended. Each subject's high school record, which is housed at the high school attended, was previewed to obtain the telephone number and the student's grade-point average. Then data were placed on the student profile sheet.

Duluth Police Department

The Duluth Police Department has a special accident investigation section that investigates and reports all accidents attended. The name of each driver involved is placed on a three-by-five card and alphabetized. The accident reports are then filed according to the location of the accident. Each subjects records were checked and the accident reports were obtained for those who had been involved in an accident. These data were placed on the student profile sheet.

St. Louis County Juvenile Court

Since many of the students were under age 18 at the time of receiving a citation, the adjudication of the charges and records are kept by the juvenile court. Permission was obtained from the court to review the files for subjects' traffic citation records. These data were also placed on the student profile sheets.

State Department of Public Safety

The driver's license record for each student was obtained from the Department of Public Safety. These data included accidents involved in and traffic violation convictions reported to the state. Each record was checked with the data from the Duluth Police Department and the juvenile court and all new data were then recorded on the student profile sheet.

Student

Subjects were contacted by phone to obtain driver experience data, the subject's feelings about the instruction received and the subject's recommendation for improving the program. These data were recorded on the student profile sheet.

Analysis

The student profile sheets were coded and keypunched for computer analysis. Data analysis was undertaken at the

University of Wisconsin Computing Center* using standard library programs.

Those analyses that did not require statistical programs were done manually (cross tabulation, content analysis) during the 1971-72 academic year.

Dr. Robert Clasen, Director of the Instructional Research Center at the University of Wisconsin served as a consultant for analyzing the data.

Feasibility Study of Interagency Data Sources

The data necessary to develop student profiles is located at five of society's major institutions: (1) the school, (2) the police department, (3) the courts, (4) the state government, and the home. Data on individual students (those selected at random from the total population of students taking driver education in the Duluth public schools during 1967, 1968, and 1969) were sought in all five institutions. The following are data factors obtained.

School--driver license number, treatment type, attitude (as defined by the on-the-street instructor), the year the subject completed classroom instruction, age, address, high school attended, grade-point average.

Duluth Police Department--accident involvements and reports.

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*Part of the cost for computer time was furnished by the University of Wisconsin Graduate Research Committee.

Courts--violations of subjects who were under age 18.

State--accident and violation data for each subject as recorded on their driver license record and the individual accident reports.

Subject--driving days per week, miles driven per week, percentage of night driving, percentage of weekend driving, miles of motorcycle driving, model year of car driven, number of brothers, number of sisters, number of cars in family, and the subjects recommendations for program improvement.

To determine the accessibility and quality of the data available, cross tabulation and comparability studies were made.

Comparability of Traditional, Range and Simulation Efficacy

To compare the relative efficacy of traditional, range, and simulation driver education practices as traffic safety countermeasures, two analyses were performed with respect to the relevant hypotheses.

Ho_1 There is no significant difference in the number of citations attributable to treatment type.

Ho_2 There is no significant difference in the number of accidents attributable to treatment type.

Since these data were basically dichotomous citation-noncitation, accident-nonaccident, and $treatment_1$-$treatment_2$-$treatment_3$, they were analyzed using a chi-square statistic to determine levels of significance. The level of significance was set at .05.

Comparability of Sex Effects

To compare the driving behavior (accidents and citations involvements) of male and female driver education students, two analyses were performed with respect to the relevant hypotheses.

Ho_3 There is no significant difference in the number of accidents attributable to sex differences.

Ho_4 There is no significant difference in the number of citations attributable to sex differences.

Since these data were basically dichotomous male-female, citation-noncitation, and accident-nonaccident, they were analyzed using the chi-square statistic to determine levels of significance. The level of significance was set at .05.

Correlative Data

To assess the impact of intervening variables: (1) attitude, (2) grade-point average, (3) driving days per week, (4) miles driven per week, (5) percentage of night driving, (6) percentage of weekend driving, (7) miles of motorcycle driving, (8) model year of car driven, (9) year

of completion of classroom instruction (10) number of brothers, (11) number of sisters, (12) number of cars in family, (13) number of citations, and (14) number of accidents, a correlation matrix (Pearson Product Moment) was calculated. The coefficient of correlation was used to determine the strength of association between continuous demographic data and citations and accidents. The level of significance was set at .01.

Ho_5 There is no significant relationship between citations or accidents and demographic variables such as attitude, grade-point average, driving days per week, miles driven per week, percentage of night driving, percentage of weekend driving, miles of motorcycle driving, model year of car driven, year of completion of classroom instruction, number of brothers, number of sisters, and number of cars in family.

Frequency Data of Student Suggestion

This section presents a frequency tabulation of the suggestions offered by the students for improving classroom and on-the-street instruction. At most, two different responses were recorded for any one subject for each of the two categories.

Accident Report Data--Contributing Factors

In this section an analysis of the apparent contributing factors listed on the accident reports is presented. The other accident report data--time of day, time of year, citations, injury, road type, traffic control, weather, road surface, road defects, and the use of seat belts--are reported in Appendix B.

Summary

In this chapter the design and methodology used to conduct the study were presented. The sample population was selected from the students enrolled in summer driver education at Duluth, Minnesota. Data was collected from the school district, local police files, local court files, the state driver license record file and the student responses to a phone survey.

A chi-square test of significance was used to test hypotheses concerning treatment and sex effects and a correlation matrix was used to determine the strength of association for correlative data. Cross tabulation and content analysis were used to study interagency data sources, student responses and accident records.

In the following chapter the findings of this study are presented.

CHAPTER IV

ANALYSIS OF DATA

The purpose of this study was to determine the feasibility of using selected student data bases for the assessment and evaluation of driver education programs in the state of Minnesota. The purpose was divided into six areas of study: (1) feasibility study of interagency data sources, (2) comparability of traditional, range and simulation efficacy, (3) comparability of sex effects, (4) correlative data, (5) frequency data of student suggestions, and (6) accident report data--apparent contributing factors.

In this chapter, data will be presented and each of the hypotheses recapitulated which either reject or fail to reject each hypothesis. These results will be discussed in Chapter V.

Feasibility Study of Interagency Data Sources

A driver education evaluation project involving interagency data sources for data collection in Duluth, Minnesota, is feasible. There are, however, fundamental limitations and qualifications to that feasibility.

Table 1 contains a 3 year summary of state-level and total accident and citation records available.

TABLE 1

STATE-LEVEL AND TOTAL ACCIDENT AND CITATION RECORDS AVAILABLE

Year	Ind. Records Checked	Type of Record	Total Data Available Local & State		Data Available at State		Unique Data to State	
			No.	%	No.	%	No.	%
1967	100	Accident	21	100	7	33	5	24
		Citation	33	100	30	91	18	55
1968	100	Accident	21	100	15	71	6	29
		Citation	31	100	27	87	13	42
1969	148	Accident	20	100	18	90	10	50
		Citation	23	100	15	65	4	17
Total	348	Accident	62	100	40	65	21	34
		Citation	87	100	72	83	35	40

Of the 62 total accidents for which data were obtained, only 40 accidents (65%) had been recorded at the state level. This may seem insignificant, but of these 40, 21 or 53 percent of these data were unique at the state level. In other words, 53 percent of the accident data kept at the state level are unique accident data. Obviously, then, it is not feasible to do an accident study without checking state data sources.

Of the 87 citations on which data were collected, 72 (83%) of the citation data were available at the state level. Thirty-five of these pieces of data (49%) were unique to state files; that is, they were not obtainable from any other source. Citation studies, then, are not feasible without checking state sources.

Conversely, in no instance (accident or citation) was the state a complete data source. Therefore, accident and citation studies demand that local data sources be checked as well.

If cost is not an issue, certain additional data are available at the state level with respect to licensing, accidents, and citations.

Such data are revealing from a summative as well as from an individual driver point of view.

1. Between 5 and 10 percent of drivers checked were involved in crashes each year.
2. Between 10 and 15 percent of drivers checked were involved in citation experiences each year.

Local Police Department Data. The accident data are generally well organized and kept by the local police departments. Unfortunately, they are data which require hand tabulation.

Table 2 presents data available from local police resources on accidents (citation data are available in the courts, locally, but not in the police records).

TABLE 2

LOCAL POLICE DEPARTMENT AND TOTAL ACCIDENT RECORDS AVAILABLE

Year	Ind. Records Checked	Type of Record	Total Data Available Local & State		Data Available Local Police Dept.		Data Unique to Local Police Dept.	
			No.	%	No.	%	No.	%
1967	100	Accident	21	100	17	81	14	67
1968	100	Accident	21	100	15	71	6	29
1969	148	Accident	20	100	10	50	2	10
Total	348	Accident	62	100	42	68	22	35

In total, 35 percent of the crash data available are available uniquely at the local police station; this data obviously must be used in complete accident studies.

Court. The juvenile court data can be obtained only on a limited basis. Juvenile court records are contained in files that must be individually hand-screened for each individual in the study.

Table 3 presents the summary of citation data available from the courts and uniqueness of data found there.

The 17 percent data available in the courts suggest that court data are also indispensable to accident and citation studies.

TABLE 3

LOCAL COURT AND TOTAL CITATION RECORDS AVAILABLE

Year	Ind. Records Checked	Type of Record	Total Data Available Local & State		Data Available Local Court		Data Unique to Local Court	
			No.	%	No.	%	No.	%
1967	100	Citation	33	100	15	45	3	9
1968	100	Citation	31	100	18	58	4	13
1969	148	Citation	23	100	19	83	8	35
Total	348	Citation	87	100	52	60	15	17

School. As suggested by Table 4, school data are available and readily accessible, but most of such data must be reviewed and transferred by hand. These data are kept at the high school attended.

Obviously, these are not accident and citation data, but many studies suggest that grade-point average is an important contributing variable where highway safety is concerned.(11).

Students/Home. Individuals, of course, carry unique data sets with them, particularly where attitudes, experiences, and perceptions are concerned. When these variables are at issue, data on them are readily available. Table 5 presents a summary of the data availability at Duluth schools.

TABLE 4

SUMMARY OF DATA AVAILABILITY AT SCHOOLS

School Record Data			
Year	Records Checked	Records Available	%
1967	100	100	100
1968	100	88*	88
1969	148	148	100
Total	348	336	97

*Some of the school records were burned in a school fire and could not be used.

TABLE 5

SUMMARY OF INDIVIDUAL DATA AVAILABILITY

Individual Data			
Year	Contacts Attempted	Contacts Made	%
1967	100	95	95
1968	100	92	92
1969	148	129	87
Total	348	316*	91

*One student refused to answer questions because of a pending court case. One parent refused to provide the telephone number of married daughter. Seven males were in service.

These results, while emanating from a Minnesota setting nevertheless can be generalized in the sense that they suggest that accident and citation studies that do not undertake several levels of data collection are very likely to be incomplete.

The feasibility of collecting data from all of these sources depends on money and time available.

Comparability of Traditional, Range and Simulation Efficacy

An attempt was made to compare the relative efficacy of range, simulation, and traditional driver education practices as traffic safety countermeasures.

Ho_1 There will be no significant difference in the number of citations attributable to treatment type.

Since these data were frequency counts, it was necessary to employ the chi-square statistic* (test of independence) to analyze them.

Table 6 contains the chi-square results for violations-nonviolations by treatment type (range, traditional, simulation) for a random sampling of students completing driver education in 1967, 1968, and 1969.

Perusal of Table 6 reveals that there is no significant dependent relationship (interaction) between treatment type and violations; therefore, the null hypothesis must be accepted.

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*George Ferguson, Statistical Analysis in Psychology and Education (St. Louis, McGraw-Hill, 1966), pp. 200-204, and 407.

TABLE 6

FREQUENCY COUNTS AND CHI-SQUARE VALUES FOR CITATIONS BY TREATMENT TYPES AND YEAR

Treatment	Number of People					
	1967		1968		1969	
	Citation	No Citation	Citation	No Citation	Citation	No Citation
Range	16	34	8	43	7	42
Traditional	8	42	11	38	8	41
Simulation	N.A.	N.A.	N.A.	N.A.	3	47
Statistical Values						
Sample size	100		100		148	
Chi-square value	2.69		0.37		2.78	
d.f.	1		1		2	
Critical chi-square values	3.84		3.84		5.99	
Level of significance	N.S.D.		N.S.D.		N.S.D.	

N.A. means not applicable--simulation was not offered in 1967 and 1968.

N.S.D. means no significant difference.

Ho_2 There is no significant difference in the number of accidents attributable to treatment type.

Since these data were also frequency counts, it was necessary to again employ the chi-square statistic to analyze them. Table 7 contains the chi-square for accident-nonaccidents by treatment type (range, traditional, simulation) for a random sampling of students completing driver education in 1967, 1968, and 1969.

Perusal of Table 7 reveals that there is no significant dependent relationships (interaction) between treatment type and accidents; therefore, the null hypothesis must be accepted.

Comparability of Sex Effects

Differences in driving behavior attributable to the variable of sex have often been cited.

Ho_3 There is no significant difference in the number of citations attributable to sex.

Since these data were frequency counts, it was necessary to utilize the chi-square statistic to analyze them. Table 8 contains the chi-square for violations by sex for a random sampling of students completing driver education in 1967, 1968, and 1969.

Table 8 reveals a significant advantage to female drivers over male drivers in terms of violations. Results for all three years, and the

TABLE 7

FREQUENCY COUNTS AND CHI-SQUARE VALUES FOR ACCIDENT BY TREATMENT TYPE AND YEAR

Treatment	Number of People					
	1967		1968		1969	
	Accident	No Accident	Accident	No Accident	Accident	No Accident
Range	13	37	10	41	7	42
Traditional	5	45	7	42	5	44
Simulation	N.A.	N.A.	N.A.	N.A.	5	45
Statistical Values						
Sample size	100		100		148	
Chi-square value	3.32		0.20		0.56	
d.f.	1		1		2	
Critical chi-square values	3.84		3.84		3.84	
Level of significance	N.S.D.		N.S.D.		N.S.D.	

N.A. means not applicable--simulation was not offered in 1967 and 1968.

N.S.D. means no significant difference.

TABLE 8

FREQUENCY COUNTS AND CHI-SQUARE VALUES FOR CITATIONS BY SEX AND YEAR

Sex	Number of People							
	1967		1968		1969		Total	
	Citation	No Citation	Citation	No Citation	Citation	No Citation	Citation	No Citation
Male	17	33	16	34	16	57	49	124
Female	7	43	3	47	2	73	12	163
Statistical Values								
Sample size	100		100		148		348	
Chi-square values	4.44		9.355		11.09		26.266	
d.f.	1		1		1		1	
Critical chi-square values	3.84		7.88		7.88		7.88	
Level of significance	p .05		p .005		p .005		p .005	

combined 1967, 1968 and 1969 years are significantly (p .05) in favor of female drivers.

To explain further this significant sex effect with respect to citations, it was decided to analyze the exposure variables available in this study to see whether the difference in citations could be, in part, a function of different exposure.

Data on five variables related to exposure: (1) number of days of driving per week, (2) number of miles driven per week, (3) percent of night time driving, (4) percent of weekend driving, and (5) motorcycle miles driven were analyzed.

The data check was sorted by sex and year. Means, standard deviation and t-tests were run on each of the variables by year and in total. These results are displayed in Table 9.

Inspection of the means in the total column of Table 9 reveals that males drove significantly more days ($p < .01$), significantly more miles ($p < .01$), and did more motorcycle driving ($p < .005$).

No significant difference was found in the percentage of miles driven at night or on weekends by sex.

MEANS, STANDARD DEVIATION AND t TEST RESULTS FOR EXPOSURE VARIABLES
BY SEX FOR COMBINED 1967-69

		Years 1967-69				
Variable	**Sex**	**N**	**Means**	**Standard Deviation**	**t Value**	**p**
Days Driving Per Week	Male	152	5.52	2.01	2.66	.01
	Female	133	4.85	2.26		
Miles Driven Per Week	Male	152	108.37	109.94	5.36	.001
	Female	133	51.52	58.30		
Percent of Night Driving	Male	152	42.15	23.93	1.44	N.S.D.
	Female	133	38.02	24.61		
Percent of Weekend Driving	Male	152	45.59	26.10	-0.46	N.S.D.
	Female	134	46.99	25.79		
Motorcycle Miles Driven	Male	152	219.87	377.49	5.97	.001
	Female	141	23.61	114.96		

p - significance level
N.S.D. - no significant difference

These data suggest the rival hypothesis that exposure--not sex--may be responsible for the differences found between males and females in terms of citation.

Ho_4 There is no significant difference in the number of accidents atrributable to sex.

Table 10 reveals that males were involved in significantly more accidents than female drivers. Results for 1967 and 1968 years, and the combined 1967, 1968, and 1969 years reveal that males were involved in significantly ($p<.05$) more accidents than their female counterparts.

Again, the results of the exposure data previously displayed in Table 9 suggests the rival hypothesis that exposure--not sex--may be at issue in the more favorable female accident rate.

Correlative Data

As noted in the review of the literature, demographic variables have frequently been associated with accident and violation data.

Ho_5 There will be no significant relationship between citations and accidents and such descriptive variables as attitude, grade-point average, driving days per week, miles driven per week, percentage of night driving,

TABLE 10

FREQUENCY COUNTS AND CHI-SQUARE VALUES FOR ACCIDENT BY SEX AND YEAR

Sex	Number of People							
	1967		1968		1969		Total	
	Accident	No Accident	Accident	No Accident	Accident	No Accident	Accident	No Accident
Male	15	35	14	37	12	61	41	133
Female	3	47	5	45	5	70	13	162
Statistical Values								
Sample size	100		100		148		348	
Chi-square values	8.20		3.95		2.58		16.15	
d.f.	1		1		1		1	
Critical chi-square values	7.88		3.84		3.84		7.88	
Level of significance	$p < .005$		$p < .05$		N.S.D.		$p < .005$	

N.S.D. means no significant difference.

percentage of weekend driving, motorcycle miles driven, model year of car used most often, year of completion of classroom phase, number of brothers, number of sisters, and number of cars in the family.

Analysis of these data required the generation of the inter-item correlation matrix displayed in Table 11.

While 47 correlations were found to be significantly different from zero[2] in the entire correlation matrix, interest here is primarily focused on the 12 that were related to gross numbers of accidents and violations:

1. Gross number of accidents are significantly ($p < .01$) correlated with
   a. Days driving per week -.300
   b. Percentage of night driving -.310
   c. Percentage of weekend driving -.254
   d. Motorcycle miles driven +.279
   e. Number of brothers +.662
   f. Number of sisters +.655
   g. Number of cars in family +.457
   h. Citations +.832

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[2]A test of the significance of correlation tests its magnitude in relation to zero whether the sign is positive or negative. (George Ferguson, Statistical Analysis in Psychology and Education (St. Louis, McGraw-Hill, 1966), pp. 185-186.)

TABLE 11

CORRELATION MATRIX SHOWING THE PEARSON PRODUCT MOMENT CORRELATION AMONG SELECTED DEMOGRAPHIC VARIABLES (N = 34)

	Atti-tude	GPA	Exp Da/Wk	Exp Mi/Wk	% Exp Night	% Exp Wkend	Mi Motcy	Mod Yr	Yr of Compl	No of Bro	No of Sis	No of Cars	No of Cit	No of Acc
Atti-tude	1,000													
GPA	-.148	1.000												
Exp Da/Wk	.098	.012	1.000											
Exp Mi/Wk	.171	.021	.654*	1.000										
% Exp Night	.174	.038	.557*	.713*	1.000									
% Exp Wkend	.116	.073	.295*	.596*	.564*	1.000								
Mi Motcy	.072	-.015	.437*	.647*	.551*	.469*	1.000							
Mod Yr	.123	-.162	.341*	.517*	.292*	.269*	.441*	1.000						
Yr of Compl	-.099	.049	.006	.095	.017	.037	.101	.119	1.000					
No of Bro	.113	-.037	.269*	.558*	.371*	.330*	.470*	.421*	.094	1.000				
No of Sis	.170	-.002	.352*	.613*	.407*	.391*	.514*	.432*	.083	.827*	1.000			
No of Cars	.270*	-.057	.301*	.500*	.347*	.266*	.438*	.463*	.077	.821*	.817*	1.000		
No of Cit	-.164	-.135	-.476*	-.121	-.121	-.271*	.382*	.150	-.112	.138	.119	.137	1.000	
No of Acc	-.095	-.079	-.630*	-.217	-.310*	-.254*	.279*	.246	-.201	.662*	.655*	.457*	.832*	1.000

*Denotes significance beyond $p < .01$ level.[1]

[1]George Ferguson, Statistical Analysis in Psychology and Education (St. Louis, McGraw-Hill, 1966), p. 413.

Negative correlation indicate that as these variables increase the numbers of accidents decrease, and positive correlation indicate that both variable and accidents increase together.

2. Violations are significantly ($p < .01$) correlated with

   a. Days driving per week -.476
   b. Percentage of weekend driving -.271
   c. Motorcycle miles driven +.382
   d. Accidents +.832

Again negative correlation indicate that as these variables increase the numbers of citations decrease, and positive correlation indicate that both increase together.

The implications of these findings will be reviewed later. The .832 correlation between accidents and citations, however, is unexpectedly high. McGuire (24) in his studies found only a .10 to .20 correlation of accident and citation records. This high correlation may be in part due to the inclusion of citations received at the accident with the citation data.

Frequency Data of Student Suggestion

Students were asked, in an open-ended question format, to list suggestions for the improvement of the driver education classroom and on-the-street aspects of the program. Table 12 contains the tabulation of suggestions.

Suggestions (67) for classroom improvement focused

TABLE 12

FREQUENCY COUNT OF SUGGESTIONS FROM STUDENTS FOR IMPROVEMENT OF CLASSROOM AND ON-THE-STREET ASPECTS OF DRIVER EDUCATION

	No. Responding	% of Responses
1. Classroom suggestions		
More practical information	51	32.9
Use scary movies	49	31.6
Emphasize accident problems	18	11.6
More time	9	5.8
How to change a tire	7	4.5
Speakers	7	4.5
More about auto mechanics	4	2.6
Do not use scary movies	3	1.9
More about vision (where to look and what to see)	3	1.9
More information about laws	2	1.3
Teach in tenth grade	1	.6
Provide state tests at school	1	.6
Total	155	99.8
2. On-the-street suggestions		
More time	45	19.9
Winter driving experience	36	15.9
More parking	32	14.2
More city driving experience	26	11.5
Using standard shift (stick or manual shift)	19	8.4
Night driving experience	16	7.1
More expressway experience	16	7.1
Defensive driving practice	13	5.8
More highway experience	8	3.5
Matching students--girls and boys	4	1.8
Friendlier instructors	4	1.8
Simulation experience	3	1.3
Lower the cost	2	.9
Offer the course during the day	1	.4
Play the radio	1	.4
Total	226	100.0

on accident information. The accident information included scary movies (49) which were taken of accident situations and accident problems (18). If the response "more practical information" is interpreted to include accident information, the number of suggestions for more accident information increases to 118 (76%).

The one thing that students remembered most often about the classroom phase of driver education were the "scary" films. The students felt that these films helped them realize the seriousness of driving and also made the classroom experience seem more meaningful. At the same time they stressed the value of the teacher--whether showing films or not--in what they learned in the classroom.

There were 198 (88%) suggestions for improvement of on-the-street instruction directed toward more experience.

The students felt that they had been forced to learn much of their driving on their own. They were especially critical of not having had sufficient time for on-the-street instruction and specifically of not having had winter driving experiences in driver education.

Accident Report Data--Apparent Contributing Factors

An investigation of the accident records was conducted to find information that could contribute to program improvement. The data were compared with similar data found in Accident Facts 1972 (1), and is reported in Appendix B. Reported here is the section of the reports

titled "apparent contributing factors." This category has direct input for programming because it points out the situation as it existed at the time of the accident.

In Table 13, inattentive driving (19%), illegal or unsafe speed (16%), and failure to yield (16%), are primary driver faults contributing to the accidents. It is also important to note that for 1967 and 1968 no identification was made in accidents related to improper turn. However, in 1969, in six (30%) accidents, this was identified as a contributing factor.

Skidding was identified as a contributing factor to the accident situation in 25 (40%) of the accidents. Also, and perhaps by contrast, the accident situation in 13 (21%) of the accidents was described as "beyond the driver's control."

Summary

The results of this study indicate that it is feasible to use interagency sources for data collection; that female drivers are involved in significantly fewer accidents and receive significantly fewer citations than do their male counterparts; that days driven per week, percent of night driving, percent of weekend driving are negatively correlated with accidents (as these variables increase, accidents decrease) and motorcycle miles driven, number of brothers, number of sisters, number of cars in family, and citations

TABLE 13

ACCIDENT APPARENT CONTRIBUTING FACTOR DATA SUMMARIES

Apparent Contributing Factors	Accidents							
	1967		1968		1969		Total	
	No.	%	No.	%	No.	%	No.	%
Driver faults	21	100	21	100	20	100	62	100
Inattentive	6	29	4	19	2	10	12	19
Illegal or unsafe speed	4	19	2	10	2	10	10	16
Failure to yield	3	14	2	10	5	25	10	16
Improper turn	--	--	--	--	6	30	6	9
Following too close	2	10	1	5	1	5	4	6
Over the center line	--	--	1	5	2	10	3	5
Illegal stop	1	5	2	10	--	--	3	5
Improper signal	--	--	--	--	1	5	1	2
Situation								
Skidded	10	48	6	29	9	45	25	40
Beyond driver's control	4	19	6	29	3	15	13	21
Poor vision	1	5	1	5	4	20	6	9
Other driver drinking	1	5	1	5	3	15	5	8
Slippery conditions	2	10	2	10	--	--	4	6
Defective equipment	1	5	1	5	1	5	3	5
Foot slipped off brake	2	10	--	--	--	--	2	3
Normal	1	5	1	5	--	--	2	3
No response	3	14	2	10	1		6	9

*No factor listed more than once on any one accident. However, two factors were stated for some accidents.

are positively correlated with accidents (as these variables increase accidents also increase); and that days driven per week, percent of weekend driving are negatively correlated with citations and motorcycle miles driven and accidents are correlated positively with citations. Study findings also indicate that students suggest more information about accidents be included in driver education programs. The need for information about accidents is supported by the findings that skidding and inattentive driving were the most commonly identified contributing factors in accident reports.

Significant differences were not found in comparing traditional, range and simulation treatments as measured by accidents and citations. These treatment types, however, may have different effects on driving behavior other than those included in the study.

CHAPTER V

SUMMARY, MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Summary

Driver education has become an offering in nearly every high school in the country, and seems destine to remain a permanent subject in the curriculum. The old issue of school educated drivers vs. non-school educated drivers is now a moot question. At the present time nearly 100 percent of the eligible students are enrolled in a high school driver education program. With this growth has come national attempts to answer the questions of effectiveness and accountability of driver education. Unfortunately, these efforts, for the most part, have been unsuccessful. The questions perhaps can be answered locally and in this way provide answers nationally.

The purpose of this study was to develop and analyze the profiles of driver education students to determine the feasibility of using these data for the assessment and evaluation of driver education programs. The specific objectives were:

1. To complete a feasibility study by using interagency data sources for studies of the relative efficacy of driver education.
2. To compare the relative efficacy of traditional, range, and simulation driver education practices as traffic safety countermeasures using interagency data sources.
3. To compare the differences in driving behavior attributable to sex.
4. To provide information on the nature of attitude, grade-point average, driving days per week, miles driven per week, percentage of night driving, percentage of weekend driving, miles of motorcycle driving, model year of car driven, year of completion of classroom instruction, number of brothers, number of sisters, number of cars in family for predicting number of citations, and number of accidents.
5. To determine the student suggestions for the improvement of classroom and on-the-street phases of driver education.
6. To investigate the accident records for information that could be used for program improvement.

A review of relevant literature was made. It included such topics as goals and objectives of driver education, utility of accident and citation records, status of driver education, effectiveness of driver education, and research contracts for the evaluation of driver education sponsored by the National Highway Traffic Safety Administration.

Student data bases were developed by collecting driver record information from the state, local police, and court agencies. Demographic data were collected from the school and through a phone survey of the students. The phone survey was also used to obtain student suggestions for program improvement. And, finally, each of the accidents incurred by this group in this time period was analyzed and tabulated.

The driver record data were organized into three sections: state accident and citation records, local police accident records, and local court citation records. These records were analyzed on the basis of records available and uniqueness of records.

Demographic data were divided into sections according to treatment type, sex, and continuous demographic data. Comparisons were then made with gross accidents and gross citations.

Student suggestions for classroom and on-the-street phases of their driver education were obtained in the phone survey and reported as frequency counts.

Each of the accident records was investigated and the results tabulated. The section of accident records titled "Apparent Contributing Factors" is presented with the other accident report data in Appendix B.

Major Findings of the Study

Data Sources

1. Only 65 percent of the accident reports available from all sources were obtainable from state driver license records. Of the reports available from the state, however, 53 percent were not obtainable from other sources.
2. Eighty-three percent of the citation reports available from all sources were obtainable from state driver license records. Of the citation reports available from the state, 40 percent were not available from other sources.
3. Local police records contain 68 percent of the accident reports available from all sources, and of the local police reports, 52 percent are not obtainable from other sources.
4. The local court records contain 60 percent of the total of citation reports from all sources, but only 17 percent of the local court reports are not obtainable from other sources.

5. Most of the subjects (91%) were easily contacted and asked to answer the questions of the phone survey.

Treatment Comparisons

6. The acquisition of citations was not significantly affected by treatment type (traditional, range, and simulation).
7. Involvement in accidents was not significantly affected by treatment type (traditional, range, and simulation).

Sex Comparisons

8. Males acquired significantly more citations than did females. This may be qualified by the significantly greater exposure: (1) number of days of driving per week, (2) number of miles driven per week, (3) percent of night time driving, (4) percent of weekend driving, and (5) motorcycle miles driven of the male driver.
9. Males acquired significantly more accidents than did females. This also may be qualified by the significantly greater exposure: (1) number of days of driving per week, (2) number of miles driven per week, (3) percent of night time driving, (4) percent of weekend driving, and (5) motorcycle miles driven of male drivers.

Demographic Data Comparisons

10. Involvement in accidents was significantly related in a negative direction to driving experience as defined by days driven per week, percentage of night driving, and percentage of weekend driving (as these variables increase, accidents decrease), and was significantly related in a positive direction to motorcycle miles driven (as this variable increases, accidents increase).
11. Drivers from larger families had significantly more accidents than drivers from smaller families.
12. Involvement in accidents was significantly related in a positive direction to the acquisition of citations. This may be qualified by the inclusion of citations received at the accident with the citation data.
13. The acquisition of citations was significantly related in a negative direction to driving experience as defined by days driven per week, and percentage of weekend driving, and in a positive direction to motorcycle miles driven.

Student Suggestions

14. The most frequently stated suggestions for classroom instruction were (a) more practical information, (b) use more "scary" films and (c) more information about accidents.

15. The most frequently stated suggestions for on-the-street instruction were directed toward more driving experience, specifically winter driving, parking, city driving, and the use of standard shift cars.

Accident Records

16. In 25 (40%) of the accident reports, skidding was listed as an apparent contributing factor.
17. Inattentive driving (19%), illegal or unsafe speed (16%), and failure to yield (16%) were identified as the most common driver faults in accident reports.

Conclusions

Based on the purpose stated for this study, the conditions under which it was conducted and the results from the analysis of the data, the following conclusions were made.

It is feasible to use selected student data bases for the assessment and evaluation of driver education in the state of Minnesota.

Data Sources

1. It is feasible to use interagency data sources for studies of relative efficacy of driver education.

Since neither the state nor the local records provided a complete data source, both state and local records should be used in driver education studies.

The use of a phone survey to contact students is an effective technique.

Treatment Comparisons

2. Different laboratory treatments as they are presently taught do not affect driver behavior with regard to accidents and citations.

The various treatment types used in the laboratory phase of driver education as presently conducted do not appear to have a different effect on driver behavior in terms of citations and accidents. These treatment types, however, may have different effects on driving behaviors other than those included in the study.

Sex Comparisons

3. Female drivers are better drivers than their counterpart male drivers, as defined

by their lower involvement in accidents and lower accumulation of citations.

The greater exposure of the male driver to traffic situations may account for their greater involvement in accidents and their greater accumulation of citations.

Demographic Data Comparisons

4. More experienced drivers are better drivers, as defined by their accident and citation records.

   Driving experience is an educational process and has a positive influence on traffic decision making.

5. The greater the family size and the greater the number of family cars, the poorer the driver will be as defined by accident involvement.

   This may be due to the differences in life style of larger families.

6. The more citations a person receives, the more likely he or she is to be involved in an accident.

   The high correlation of .832 between

accidents and citation provides a means of predicting people who are likely to become involved in accidents based on citation acquisition. This high correlation may be in part due to the inclusion of citations received at the accident with the citation data.

7. Persons who operate motorcycles are poorer drivers than non-motorcycle operators, as defined by their accident and citation records.

   The operation of a motorcycle can be used as a predictor of accident probability.

Student Suggestions

8. Students desire a real life approach to the classroom phase of driver education, rather than the more traditional academic approach.

   They feel that discussion and analysis of accident information would be helpful to them as drivers.

9. Students desire the best driver education program possible and have some valuable suggestions for improving the program.

They are particularly concerned about the need for more time in actual driving situations and their lack of winter driving, parking, city driving and stick shift driving experiences in the laboratory phase of the program.

Accident Records

10. Accident reports indicate specific areas of weakness in driver education programs.

The accident reports support the previously reported findings of a need for the study of accident situations in the classroom and the need for additional laboratory experience, especially those related to skid control.

Recommendations

The following recommendations are based on the evidence and conclusions derived from the study.

1. That driver education programs be encouraged to develop a data base using data from the state, local police and court offices, the school, and the students to evaluate and improve their programs.

2. That the laboratory phases of driver education be expanded beyond the minimal requirements and that experience provided include night driving, skid control, accident prevention, and emergency procedures.
3. The development of programs for special student situations and needs. These programs should include but should not be limited to motorcycle operators, students involved in accidents and/or who have received citations, or students with special family situations conducive to accident and citation involvements.
4. That post-driver education programs be provided in the 11th and 12th grades to assist the students with their learning after licensing, and that special programs be provided for students who receive citations.
5. That a close contact be developed and maintained between the school and the home to coordinate the student's driver education in both places. The driver education program should include materials and suggestions for parents as well as provide for person-to-person contact with each parent by the driver education teacher.
6. That student input be solicited in determining the curricula for driver education programs.

Recommendations for Further Research

As a result of the findings of this investigation, the following recommendations for further research are made.

1. Research should be conducted using several different personality instruments to determine if personality traits associated with accident involvement can be identified.
2. A study should be conducted to identify teacher differences associated with student performance.
3. A study should be conducted comparing driver education curricula developed utilizing student input with teacher-developed curricula on the basis of student performance.
4. A follow-up study could be conducted to determine if the students with the better driving records would continue to perform better at a later time.
5. A follow-up study should be conducted to determine if the high correlation found in this study for accidents and citations can be replicated in other locations.

Discussion

The findings of this investigation reveal that it is feasible to use selected student data bases as a technique for program evaluation and improvement. This finding would indicate that each school can accept the responsibility for its own program evaluation and improvement by developing and analyzing data available to the program. Evaluation comparison

could be one years' program with those of previous years. The suggestion for program improvement found through data analysis, or obtained from program graduates would have relevance for the local program. There are, however, limitations to the feasibility in that the data must be collected by hand and for large studies would require prohibitive amounts of hand labor. The use of random sampling would help overcome this limitation.

The results of the data analysis support the findings of Harrington which indicate that accidents decrease as mileage increases, and with Tarrants who found that exposure and sex factors influence accident and citation rates.

The finding of no significant difference at the .05 level in comparing treatment groups in terms of accident and citation records also support most previous studies which also fail to report significant differences. These findings may be the result of treatment approaches which are used to substitute for part of a previous program aimed at achieving only minimal performance. In other words, the various treatment types have the same goal; therefore, they might be expected to produce similar outcomes.

Analysis of the student responses and of the accident records support the need for additional actual driving experiences in present programs. If driver education hopes to have any appreciable impact as a traffic accident

countermeasure present programs will need to be expanded beyond the minimal levels presently existing (36).

The correlation (r=.83) between accidents and citations found in this study is surprisingly high. This may, in part, result from the inclusion of citations received at an accident with the citation data. In future studies, the correlation between accidents and citations should also be checked when not including the citations received at an accident in the citation data. If high correlations are consistantly found, violations might well be used in accident prediction.

Finally, the ongoing development of a local data base and analysis of these data will be a giant step in the direction of accountability. As each local program evaluates itself and strives to improve, driver education nationally will also be evaluated and improve.

REFERENCES CITED

1. Accident Facts, 1972. Chicago: National Safety Council, 1972.

2. American Automobile Association. Driver Training Reduces Traffic Accidents One-Half. Washington, D.C.: American Automobile Association, 1945.

3. The American University, Development Education and Training Research Institute, Washington, D.C. A Study on Evaluation of Driver Education. Contract Number FH-11-6594 for the National Highway Safety Bureau. United States Department of Transportation, 1968.

4. "Annual Report, 1972." Duluth, Minnesota: Duluth Police Department, 1972.

5. Arthur D. Little, Inc. The State of the Art of Traffic Safety. Cambridge, Massachusetts: Automobile Manufacturers Association, Inc., 1966.

6. Asher, W. J. "Do Driver Training Courses Produce Better Drivers? An Alternative Hypothesis." Traffic Safety Research Review, 1968, 12(1), 2-6.

7. Bishop, Richard W. "One Car Accidents and the Young Drivers." Safety and Traffic Division, Automobile Club of Michigan, 1963.

8. Burg, A. The Stability of Driving Record Over Time. Accident Analysis and Prevention, Vol. 2, 1970, pp. 57-65.

9. Campbell, B. J. "Who Really Causes the Accidents?" Traffic Safety, Vol. 71, No. 12, December, 1971, pp. 22-24.

10. Campbell, D. T., and Stanley, J. C. Experimental and Quasi-Experimental Design for Research. Chicago: Rand McNally, 1966.

11. Coppin, R. S., G. S. Ferdun, and R. C. Peck. The Teen-Aged Driver Report No. 21. Sacramento: State of California, Department of Motor Vehicles, 1965.

12. Driver Training Reduces Traffic Accidents One-Half. Washington, D.C.: American Automobile Association, 1945.

13. Dunlap and Associates, Incorporated. Driver and Education and Training. Contract Number FH-11-6595 for the National Highway Safety Bureau, United States Department of Transportation, 1969.

14. Educational Testing Service, Princeton, New Jersey. Evaluation of Driver Education and Training Programs. Contract Number FH-11-6961 for the National Highway Safety Bureau, United States Department of Transportation, 1969.

15. Forbes, T. W. The Normal Automobile Driver as a Traffic Problem. The Journal of General Psychology, 20, 1939, pp. 471-474.

16. Goldstein, Leon. Human Variables in Traffic Accidents: A Digest of Research. Traffic Safety Research Review, March, 1964, pp. 26-29.

17. Hakkinen, Sauli. Traffic Accidents and Driver Characteristics. Finland's Institute of Technology, Scientific Researches No. 13, Helsinki, 1958, pp. 198.

18. Halsey, Maxwell, Richard Kaywood and Richard A. Meyerhoff. Let's Drive Right. Glenview, Illinois: Scott, Foresman and Company, 1972.

19. Hansen, N. M., W. N. Harwitz, and W. G. Masorb. Sample Survey Methods and Theory. Volume I. New York: John Wiley, 1963, p. 127.

20. Harrington, D. The Young Driver Follow-up Study, An Evaluation of the Role of Human Factors in the First Four Years of Driving. California Department of Motor Vehicles.

21. Hartman, Charles Henry. "Teacher Preparation Programs in Driver Education in Colleges and Universities of the United States." Ph.D. dissertation, Michigan State University, 1961.

22. Institute for Educational Development, El Segundo, California. Driver Education and Training Project for the National Highway Safety Bureau. Contract Number FH-11-6561 for the National Highway Safety Bureau, United States Department of Transportation, 1968.

23. An Introduction to Highway Transportation Engineering. Washington, D.C.: Institute of Traffic Engineers, 1968.

24. McGuire, F. L. and R. C. Kersh. An Evaluation of Driver Education: A Study of History, Philosophy, Research Methodology, and Effectiveness in the Field of Driver Education. Berkeley: University of California Publications, 1969.

25. _____. "An Experimental Evaluation of Driver Education in the United States." Unpublished manuscript, University of California, California College of Medicine, 1968.

26. Minnesota Department of Education. Traffic and Safety Education. Report prepared by the Traffic Safety Division of the Minnesota Department of Education, St. Paul, 1969.

27. Moynihan, D. P. Report of the Secretary's Advisory Committee on Traffic Safety. Washington, D.C.: United States Department of Health, Education and Welfare, 1968.

28. National Highway Safety Bureau. Highway Safety Program Manual, Driver Education. Washington, D.C.: Department of Transportation, 1969.

29. National Commission on Safety Education. History of Driver Education in the United States. Washington, D.C.: National Education Association, 1966.

30. _____. Policies and Practices for Driver and Traffic Safety Education. Washington, D.C.: National Education Association, 1964.

31. Neal, J. G. Comparison of Driving Records of High School Students in Minnesota with Varying Degrees of Training over a Five Year Period. St. Paul: Minnesota Department of Education, 1955.

32. New York University, The Center for Safety, New York City. Driver Education and Training. Contract Number FH-11-6560 for the National Highway Safety Bureau, United States Department of Transportation, 1968.

33. Peck, R. C., McBride, R. S., and Coppin, R. S. The Distribution and Predictions of Driver Accident Frequencies. Accident Analysis and Prevention, 1971, 2, pp. 243-299.

34. Rainey, R. W., J. J. Conger, and C. R. Walsmith. "Personality Characteristics as a Selective Factor in Driver Education." Highway Research Board Bulletin, No. 285, 1961, 23-28.

35. A Resource Curriculum in Driver and Traffic Safety Education. Washington, D.C.: Automotive Safety Foundation, 1970.

36. Seals, T. A. "An Evaluation of Selected Driver and Safety Education Courses." Ph.D. dissertation, Florida State University, 1966.

37. Secretary of State of Illinois. An Appraisal of the High School Driver Education Program. Springfield, Illinois: University of Illinois, 1963.

38. State of New York. An Evaluation of the Driving Records of High School Driver Education Students in New York State. New York: Department of Motor Vehicles, 1963.

39. State of Oregon. Oregon High School Driver Education Study. Salem, Oregon: Department of Motor Vehicles, 1963.

40. State of Wisconsin. Driver Record Study of Baraboo, Reedsburg and Tomah Driver Education Programs. Madison, Wisconsin: Department of Transportation, 1970.

41. Tarrants, W. E. The Role of Driver Education in Traffic Safety. National Highway Safety Bureau, 1969, p. 7.

42. 21st Annual Driver Education Achievement Program. Washington, D.C.: Insurance Institute for Highway Safety, 1969.

BIBLIOGRAPHY

BIBLIOGRAPHY

Books

Accident Facts, 1972. Chicago: National Safety Council, 1972.

American Automobile Association. Driver Education for the Youth of the Nation. Washington, D.C.: The Association, 1966.

Arthur D. Little, Inc., The State of the Art of Traffic Safety. Cambridge, Massachusetts: Automobile Manufacturers Association, Inc., 1966.

Best, J. W. Research in Education (2nd ed.) Englewood Cliffs, New Jersey: Prentice-Hall, 1970.

Campbell, D. T. and Stanley, J. C. Experimental and Quasi-Experimental Designs for Research. Chicago: Rand McNally, 1966.

Halsey, Maxwell, Richard Kaywood and Richard A. Meyerhoff. Let's Drive Right. Glenview, Illinois: Scott, Foresman and Company, 1972.

Hansen, N. M., W. N. Harwitz, and W. G. Masorb. Sample Survey Methods and Theory. Volume I. New York: John Wiley, 1963.

An Introduction to Highway Transportation Engineering. Washington, D.C.: Institute of Traffic Engineers, 1968.

Krathwohl, D. R. and Payne, D. A. Defining and Assessing Educational Objectives. In Robert L. Thorndike (Ed.), Educational Measurement. (2nd edition) Washington, D.C.: American Council on Education, 1971.

Mager, R. F. Preparing Instructional Objectives. Palo Alto, California: Fearon Publishers, 1962.

McGuire, F. L., and R. C. Kersh. An Evaluation of Driver Education: A Study of History, Philosophy, Research Methodology, and Effectiveness in the Field of Driver Education. Berkeley: University of California Publications, 1969.

National Commission on Safety Education. History of Driver Education in the United States. Washington, D.C.: National Education Association, 1966.

A Resource Curriculum in Driver and Traffic Safety Education. Washington, D.C.: Automotive Safety Foundation, 1970.

21st Annual Driver Education Achievement Program. Washington, D.C.: Insurance Institute for Highway Safety, 1969.

Manuals, Reports, and Studies

American Automobile Association. Driver Training Reduces Traffic Accidents One-Half. Washington, D.C.: American Automobile Association, 1945.

The American University, Development Education and Training Research Institute, Washington, D.C. A Study on Evaluation of Driver Education. Contract Number FH-11-6594 for the National Highway Safety Bureau. United States Department of Transportation, 1968.

"Annual Report, 1972." Duluth, Minnesota: Duluth Police Department, 1972.

Burg, A. The Stability of Driving Record Over Time. Accident Analysis and Prevention, Vol. 2, 1970.

Coppin, R. S., G. S. Ferdun, and R. C. Peck. The Teen-Aged Driver Report No. 21. Sacramento: State of California, Department of Motor Vehicles, 1965.

_____. The 1964 California Driver Record Study, Part V--Driver Record by Age, Sex and Marital Status. State of California, Department of Motor Vehicles, June, 1965.

Crancer, A. An Evaluation of Driver Training Based on Accident and Violation Rates. Division of Research, Administrative Services, Olympia, Washington, May, 1967.

Dunlap and Associates, Incorporated. Driver and Education and Training. Contract Number FH-11-6595 for the National Highway Safety Bureau, United States Department of Transportation, 1969.

Educational Testing Service, Princeton, New Jersey. Evaluation of Driver Education and Training Programs. Contract Number FH-11-6961 for the National Highway Safety Bureau, United States Department of Transportation, 1969.

Edwards, D., Hahn, C. P., and Fleishman, E. A. Evaluation of Laboratory Methods for the Study of Driver Behavior: The Relation Between Simulator and Student Performance. American Institutes for Research, Accident Research Center, Silver Springs, Maryland, 1969.

Hakkinen, Sauli. Traffic Accidents and Driver Characteristics. Finland's Institute of Technology, Scientific Researches No. 13, Helsinki, 1958.

Harrington, D. The Young Driver Follow-up Study, An Evaluation of the Role of Human Factors in the First Four Years of Driving. California Department of Motor Vehicles.

Hartman, C. H. Driver Education in the Schools. ASF Monitor (Number 2) Washington, D.C.: Automotive Safety Foundation, October, 1969.

Institute for Educational Development, El Segundo, California. Driver Education and Training Project for the National Highway Safety Bureau. Contract Number FH-11-6561 for the National Highway Safety Bureau, United States Department of Transportation, 1968.

Kemper, W. A. A Teenage Pattern. Marketing Research Division of Allstate Insurance Companies, May, 1960.

Lauer, A. R. Road-user characteristics: age and sex relation to accidents. Highway Research Board Bulletin 60. National Academy of Sciences, National Research Council, 1962.

McKnight, J. and Adams, B. B. Driver Education Task Analysis, Volume I: Task Descriptions. Human Resources Research Organization, Alexandria, Virginia, Contract Number FH-11-7336 for the National Highway Traffic Safety Administration, United States Department of Transportation, July, 1970.

Minnesota Department of Education. Traffic and Safety Education. Report prepared by the Traffic Safety Division of the Minnesota Department of Education, St. Paul, 1969.

Moynihan, D. P. Report of the Secretary's Advisory Committee on Traffic Safety. Washington, D.C.: United States Department of Health, Education and Welfare, 1968.

National Commission on Safety Education. Policies and Practices for Driver and Traffic Safety Education. Washington, D.C.: National Education Association, 1964.

National Education Association, National Commission on Safety Education. A Critical Analysis of Driver Education Research. Washington, D.C.: National Education Association, 1957.

National Highway Safety Bureau. Highway Safety Program Manual, Driver Education. Washington, D.C.: Department of Transportation, 1969.

Neal, J. G. Comparison of Driving Records of High School Students in Minnesota with Varying Degrees of Training over a Five Year Period. St. Paul: Minnesota Department of Education, 1955.

New York University, The Center for Safety, New York City. Driver Education and Training. Contract Number FH-11-6560 for the National Highway Safety Bureau, United States Department of Transportation, 1968.

Peck, R. C., McBride, R. S., and Coppin, R. S. The Distribution and Predictions of Driver Accident Frequencies. Accident Analysis and Prevention, 1971

Secretary of State of Illinois. An Appraisal of the High School Driver Education Program. Springfield, Illinois: University of Illinois, 1963.

State of New York. An Evaluation of the Driving Records of High School Driver Education Students in New York State. New York: Department of Motor Vehicles, 1963.

State of Oregon. Oregon High School Driver Education Study. Salem, Oregon: Department of Motor Vehicles, 1963.

State of Pennsylvania. The Effectiveness of the Driver Education Program in Pennsylvania, 1950-1959. Harrisburg, Pennsylvania: Department of Public Instruction, 1960.

State of Wisconsin. Driver Record Study of Baraboo, Reedsburg and Tomah Driver Education Programs. Madison, Wisconsin: Department of Transportation, 1970.

Tarrants, W. E. The Role of Driver Education in Traffic Safety. National Highway Safety Bureau, 1969.

Periodicals

Algaier, E. and Williams, S. A. Effectiveness of a driving simulator. Traffic Safety Research Review, 1959.

Asher, W. J. "Do Driver Training Courses Produce Better Drivers? An Alternative Hypothesis." Traffic Safety Research Review, 1968.

Campbell, B. J. "Who Really Causes the Accidents?" Traffic Safety, Vol. 71, No. 12, December, 1971

Comrey, A. L. A factor analysis of variables related to driver training. Journal of Applied Psychology, 1958, 42.

Forbes, T. W. The Normal Automobile Driver as a Traffic Problem. The Journal of General Psychology, 20, 1939.

Goldstein, Leon. Human Variables in Traffic Accidents: A Digest of Research. Traffic Safety Research Review, March, 1964.

_____. The Case Against Driver Education. Journal of Safety Research. 1969.

Kreml, F. M. Mobility Without Mayhem--The Report of the President's Task Force on Highway Safety. Traffic Safety, 1971.

Orzeske, J. Accident Involvement Rates by Age and Sex of Driver. Research News. Chicago Area Transportation System, November, 1962.

Tarrants, W. E. The Role of Driver Education in Traffic Safety. Journal of Traffic Safety Education, January, 1971.

Tillman, W. A. and Hobbs, S. E. The Accident-Prone Driver, A Study of Psychiatric and Social Background. American Journal of Psychiatry, 1949.

Unpublished Material

Bishop, Richard W. "One Car Accidents and the Young Drivers." Safety and Traffic Division, Automobile Club of Michigan, 1963.

Hartman, Charles Henry. "Teacher Preparation Programs in Driver Education in Colleges and Universities of the United States." Ph.D. dissertation, Michigan State University, 1961.

Heath, E. D. The Relationships Between Driving Records, Selected Personality Characteristics and Biographical Data of Traffic Offenders and Non-Offenders. Unpublished doctoral dissertation, New York University, New York, 1957.

McGuire, F. L., and R. C. Kersh. "An Experimental Evaluation of Driver Education in the United States." Unpublished manuscript, University of California, California College of Medicine, 1968.

Rainey, R. W., J. J. Conger, and C. R. Walsmith. "Personality Characteristics as a Selective Factor in Driver Education." Highway Research Board Bulletin, No. 285, 1961.

Richards, W. T. An Analysis of University Problems and Needs in the Professional Preparation of Traffic and Safety Specialists. Unpublished doctoral dissertation, University of Wisconsin, Madison, 1970.

Schulz, A. J. The Construction of an Attitude Scale for Male Adolescent Motor Vehicle Traffic Offenders and Non-Offenders. Unpublished doctoral dissertation, New York University, New York City, 1969.

Seals, T. A. "An Evaluation of Selected Driver and Safety Education Courses." Ph.D. dissertation, Florida State University, 1966.

Smith, D. J. A Comparative Study of Accident and Violation Records of High-School Trained and Non-High-School Trained Drivers in Pueblo, Colorado. Unpublished Master's thesis, Colorado College, Colorado Springs, 1954.

APPENDIX A

DATA REPORT FORMS

Instructions

Subject Profile Sheet

Accident Report

Instructions

School information is to be recorded directly from the school data cards onto the subject profile sheets.

The interview data will be recorded as given by the subject to each question asked. The following is the phone survey introduction:

> "Hello. May I please speak to _ (student's full name?_ (Student's first name), my name is Jerry Witherill and I am on the faculty of the University of Minnesota-Duluth. I am conducting a study for the Duluth public schools to find ways to improve the driver education programs and to collect data for my doctoral dissertation. Would you mind answering some questions that will help in this study? All answers that you give will be strictly confidential and will be in no way associated with your name. Do you have any questions before we begin? Some of the questions will be difficult to answer; just answer as best you can.
>
> "Thank you for your help and please don't hesitate to call me at the university. My number is _____ if you have any questions. Good-bye."

The citation and accident data will be transferred directly from the state, local police, and local court data sheets onto the student profile sheets.

The accident data will be transferred from the Duluth Police Department accident report onto the study accident report form. For the accident reports from the state the data will be grouped by year without reference to a specific subject.

Subject Profile Sheet

School Information

Name_____Sex M___ F___Birth date_____

School_____Operator's license no._____

Phone no._____Address_____

Date of 30-hr. Classroom Instruction_____School_____

Attitude: Excellent___Good___Average___Below Average___Poor__

Type of Lab Instruction: Trad.__Range__Sim.__Date Completed__

Handicaps_____

Instruction Comments_____

School GPA_____

Interview

Driving Experience

1. On the average how many days a week do you drive?_____
2. About how many miles do you drive a week?_____
3. What percentage of your driving was done in or near Duluth?
4. What percentage of your driving was done outside St. Louis County?_____
5. What percentage of your driving was done at night?_____
6. What percentage of your driving was done on the weekend?__
7. What is the major reason you drive?_____
8. Do you own your own car? Yes__Make_____Year_____No____
9. Have you ever owned a car? Yes__Make_____Year_____No____
10. Whose car do you drive most often? Parent__Make____Year__; Relative__Make____Year___; Friend__Make____Year____; Other____Make____Year___.

11. Have you ever driven a motorcycle? Yes___No___

12. About how many miles have you driven a motorcycle?_____

13. Do you own a motorcycle? Yes___Make_____Year____No_____

14. What type of motorcycle driving do you do most often?
Trail____City_____County_____Other_____

Family Information

15. Father's occupation_____

16. Mother's occupation_____

17. Number of brothers_____Number of sisters_____

18. Number of family cars_____

19. Do you work? Yes____No____Type of work_____

20. Do you drive as part or all of your work? Yes___No____

Driver Education

21. How do you feel about the classroom instruction you had?
Liked__Indifferent__Didn't like__No response__

22. What suggestions would you make for improving the classroom phase of driver education?_____

_____

23. How do you feel about the behind-the-wheel instruction you had? Liked__Indifferent__Didn't like__No response__

24. What suggestions would you offer for improving the behind-the-wheel instruction you had?_____

_____

25. How do you feel about the (range-simulation) instruction you had? Liked__Indifferent__Didn't like__No response__

26. What suggestions would you offer for improving the range-simulation instruction you had?_____

_____

Driver License Record

27. Citations
State 1._____ 2._____

3._____ 4._____

Local 1._____ 2._____

3._____ 4._____

28. Accidents
State 1._____ 2._____

3._____ 4._____

Accident Report

Name_____Driver License_____Date_____

Location of accident_____Time_____

Seat belts installed? Yes__No__ Used? Yes__No__

Situation

1. Injury? Yes__No__No Response__
2. Physical condition of driver: Had been drinking__Had not been drinking__Normal__No response__
3. Road type: 4 or more divided__2 lanes marked__2 lanes unmarked__4 lanes__No response__
4. Traffic controls: None__Stop sign__Signal__No response__
5. Road character: Straight__Curve__No response__
6. Weather: Clear__Cloudy__Snowing__Raining__No response__
7. Road surface: Dry__Icy-slippery__Wet__No response__
8. Road design: One-way__Two-way__No response__
9. Road defects: Yes__No__No response__
10. Apparent contributing factors_____

    _____

11. Citation? Yes__No__No response__
12. Type of accident_____
13. Diagram:

APPENDIX B

ACCIDENT REPORT DATA

The complete summation of the accident report data is being presented in the appendix to provide additional resource information for Duluth and other programs who may wish to use accident report data for program evaluation and improvement. Where possible, the data presented will be compared with data reported by the National Safety Council in Accident Facts 1972 edition (1).

Time of Day

Time of Day	Study Accidents: No. of Accidents 1967 M	1967 F	1968 M	1968 F	1969 M	1969 F	% of Total	Accident Facts 1972 (Page 50) % of All Accidents
12 noon-3 p.m.	2	-	4	-	4	1	17.8	16.7
3 p.m.-6 p.m.	4	1	6	3	5	1	32.2	24.6
6 p.m. - 9 p.m.	4	2	2	2	2	2	22.6	15.2
9 p.m.-12 mdnt.	3	-	-	-	3	-	9.7	10.9
12 mdnt.-3 a.m.	2	-	-	-	1	-	4.8	7.0
3 a.m.-6 a.m.	-	-	-	-	-	-	0.0	2.7
6 a.m.-9 a.m.	2	-	1	-	-	1	6.5	10.4
9 a.m.-12 noon	-	-	1	-	-	-	1.6	12.5
No response	1	-	2	-	-	-	4.8	----
Total	18	3	16	5	15	5	100.0	100.0

Citations

Citations	Study Accidents: No. of Accidents 1967 M	1967 F	1968 M	1968 F	1969 M	1969 F	% of Total
Yes	2	1	1	-	1	-	8.1
No	16	2	15	5	14	5	91.9
Total	18	3	16	5	15	5	100.0

Road Surface

Road Surface	Study Accidents: No. of Accidents 1967 M	1967 F	1968 M	1968 F	1969 M	1969 F	Study Accidents: % of Total	Accident Facts (Page 59): % of Total
Dry	9	2	7	3	9	4	54.8	69.9
Wet	4	-	1	-	3	1	14.5	18.8
Icy-slippery	3	-	5	2	3	-	21.0	10.9
No response	2	1	3	-	-	-	9.7	0.4 Other
Total	18	3	16	5	15	5	100.0	100.0

Type of Accident

Type of Accident	Study Accidents: No. of Accidents 1967 M	1967 F	1968 M	1968 F	1969 M	1969 F	Study Accidents: % of Total	Accident Facts (Pages 46 & 47): % of Total
Parked	2	-	3	-	1	-	9.7	11.3
Off-the-roadway	3	-	-	-	-	-	4.8	11.9
Right-angle	6	2	6	4	9	4	50.0	19.9
Rear-end	7	1	6	1	4	1	32.3	31.0
Head-on	-	-	1	-	1	-	3.2	5.6
No response	-	-	-	-	-	-	0.0	20.3 Other
Total	18	3	16	5	15	5	100.0	100.0

Seat Belts

	Study Accidents				Accident Facts (Page 53)
Seat Belts	No. of Accidents			% of Total	% of Total
	1967	1968	1969		
Installed-unused	4	3	5	19.4	50.0
Installed-used	1	1	2	6.5	40.0
Not installed	4	3	1	12.9	10.0
No response	12	14	12	61.2	---
Total	21	21	20	100.0	100.0

Traffic Controls

	Study Accidents							Accident Facts (Page 48)
Traffic Controls	No of Accidents						% of Total	% of Total
	1967		1968		1969			
	M	F	M	F	M	F		
None	11	1	7	4	8	4	56.5	34.5
Stop sign	2	1	4	1	2	1	17.7	
							35.4	12.8
Signal	4	1	2	-	4	-	17.7	
No response	1	-	3	-	1	-	8.1	52.7 Other
Total	18	3	16	5	15	5	100.0	100.0

Time of Year

Study Accidents

Time of Year	No. of Accidents						% of Total
	1967		1968		1969		
	M	F	M	F	M	F	
Summer (June, July, Aug)	5	-	3	2	5	2	27.5
Fall (Sep., Oct., Nov.)	6	1	3	1	5	1	27.4
Winter (Dec., Jan., Feb.)	5	1	6	1	5	-	29.0
Spring (Marc., Apr., May)	2	1	2	1	-	2	12.9
No response	-	-	2	-	-	-	3.2
Total	18	3	16	5	15	5	100.0

Injury

Study Accidents

Injury	No. of Accidents						% of Total
	1967		1968		1969		
	M	F	M	F	M	F	
Yes	3	2	5	1	1	1	21.0
No	15	1	11	4	14	4	79.0
Total	18	3	16	5	15	5	100.0

Physical Condition of Driver

Study Accidents

Physical Condition of Driver	No. of Accidents						% of Total
	1967		1968		1969		
	M	F	M	F	M	F	
Had been drinking	1	-	-	-	1	-	3.2
Had not been drinking	6	1	8	3	8	-	41.9
Normal	6	1	5	2	6	2	35.5
No response	5	1	3	-	-	3	19.4
Total	18	3	16	5	15	5	100.0

Road Type

Study Accidents

Road Type	No. of Accidents						% of Total
	1967		1968		1969		
	M	F	M	F	M	F	
4 or more divided	2	-	-	-	2	-	6.5
2 lanes marked	4	-	5	2	9	4	38.7
2 lanes unmarked	6	1	-	1	2	1	17.7
4 lanes	5	1	8	2	2	-	29.0
No response	1	1	3	-	-	-	8.1
Total	18	3	16	5	15	5	100.0

Road Character

Study Accidents

Road Character	No. of Accidents						% of Total
	1967		1968		1969		
	M	F	M	F	M	F	
Straight	16	2	10	4	12	5	79.0
Curve	1	-	3	1	1	-	9.7
No response	1	1	3	-	2	-	11.3
Total	18	3	16	5	15	5	100.0

Weather

Study Accidents

Weather	No. of Accidents						% of Total
	1967		1968		1969		
	M	F	M	F	M	F	
Clear	12	2	11	4	12	4	72.6
Cloudy	1	1	-	-	1	-	4.8
Snowing	1	-	1	-	-	-	3.2
Raining	1	-	1	1	2	1	9.7
No response	3	-	3	-	-	-	9.7
Total	18	3	16	5	15	5	100.0