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ABSTRACT

Instructional modules for driver education programs were prepared to improve safe driving knowledge, attitudes, and performances of 16- to 18-year-old drivers. These modules were designed to provide supplementary instruction in five content areas critical to the safe and efficient operation of motor vehicles by young drivers--speed management, alcohol, restraint usage, hazard perception (pedestrian and cyclist hazards only), and energy efficient driving. Research activities determined what should be taught and how knowledge, attitudes, and behaviors should be communicated for maximum efficiency. Ten instructional modules were prepared--three in the area of alcohol, four on restraint usage, and one each in the other three content areas. An evaluation of module effectiveness indicated that the speeding module, the restraint modules, and an alcohol module focusing on the need to intervene when others are in drinking-driving situations were capable of improving behavior. The other two alcohol modules and the fuel-efficiency module improved knowledge and attitudes but failed to induce behavioral change. Neither was behavioral improvement observed in connection with the hazard perception module. (Forty tables and eight figures are provided.) (YLB)

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National Highway Traffic Safety Administration

Supplemental Driver Safety Program Development Volume I—Development Research and Evaluation

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16. Abstract

This report describes the preparation and evaluation of instructional modules designed to supplement driver education program experiences of young (16-18) drivers. The project was limited to examining five subjects critical to this audience: speed management, alcohol, restraint usage, hazard perception (pedestrian and cyclist hazards only), and energy-efficient driving.

Research activities were conducted to determine what should be taught and how knowledges, attitudes, and behaviors should be communicated for maximum effectiveness. Ten instructional modules--3 in the area of alcohol, 4 on restraint usage, and 1 each in the other three content areas--were prepared.

Modules were evaluated for their effectiveness. These tests indicated that the speeding module, the restraint modules, and an alcohol module focusing on the need to intervene when others are in drinking-driving situations were capable of improving behavior. The other two alcohol modules and the fuel-efficiency module demonstrated an ability to improve knowledges and attitudes, but failed to demonstrate a capacity to induce behavioral change. Behavioral improvement also was not observed in connection with the hazard perception module.

In the final phase, the restraint modules were subjected for further evaluation, along with two other restraint programs developed outside this contract. Print materials developed within this project are presented in the second volume of this report.

17. Key Words
Driver education, restraint use, drinking and driving, alcohol safety, speeding, fuel efficiency, hazard perception.

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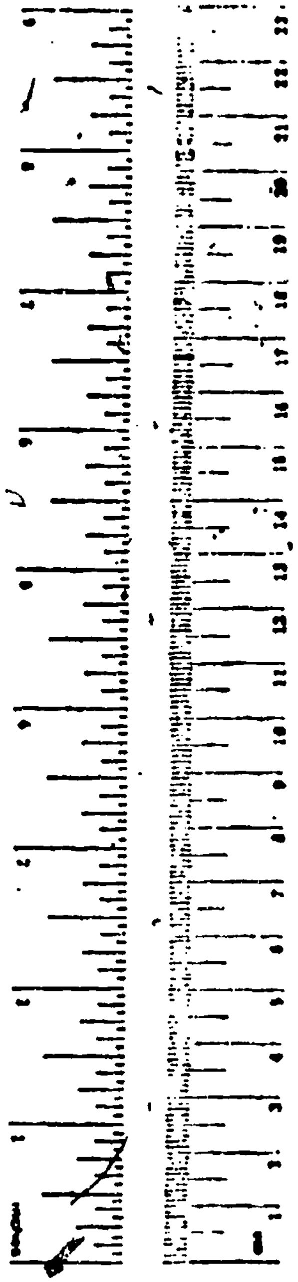
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in²	square inches	6.5	square centimeters	cm²
ft²	square feet	0.09	square meters	m²
yd²	square yards	0.8	square meters	m²
mi²	square miles	2.6	square kilometers	km²
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft³	cubic feet	0.03	cubic meters	m³
yd³	cubic yards	0.76	cubic meters	m³
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm²	square centimeters	0.16	square inches	in²
m²	square meters	1.2	square yards	yd²
km²	square kilometers	0.4	square miles	mi²
ha	hectares (10,000 m²)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m³	cubic meters	35	cubic feet	ft³
m³	cubic meters	1.3	cubic yards	yd³
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

°F: -40, 0, 32, 40, 80, 98.6, 120, 160, 200, 212

°C: -40, -20, 0, 20, 37, 40, 60, 80, 100

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PREFACE

This report describes the preparation and evaluation of instructional modules designed to supplement driver education experiences for young drivers. The work was performed by the National Public Services Research Institute under contract to the National Highway Traffic Safety Adminstration (Contract No. DOT-HS-9-02284).

Dr. Kenard McPherson was Principal Investigator for the duration of the project. Mr. Michael F. Sheets served as Project Director during the initial phase of the project. Mr. Curtis W. Goode was selected by the Project Standing Advisory Panel of driver educators to work as Project Director during the Phase II pilot testing. Ms. Karen J. Ribler directed the project through its final phase of evaluation. Dr. A. James McKnight, Co-Principal Investigator, was responsible for directing the evaluations carried out in Phases II and III of this project. Mr. Philip R. Durham and Mr. A. Scott McKnight assisted with the data collection and analysis during the final phase of the project. Dr. McPherson developed the instructor materials for all modules prepared under this contract. Mr. James R. Weidman developed the student materials. Ms. Jill Perrott edited all instructional materials and oversaw their production. Mrs. Ruth T. Freitas and Mr. C. Eugene Fasnacht provided support throughout the project and typed this manuscript.

The authors wish to express their thanks to Mr. Michael F. Smith of the National Highway Traffic Safety Administration, who served as Contract Technical Manager throughout the entire project. The authors also wish to acknowledge the assistance of numerous individuals without whose support and assistance this project never could have been completed successfully. While it would be impractical to mention all of those people who made major contributions to this project, it would be unconscionable not to take this opportunity to thank the members of the project Standing Advisory Panel and other individuals whose cooperation made possible project pilot testing and field testing of the modules. Project Standing Advisory Panel members were:

- Dr. Maurice E. Dennis, Texas A & M University.
- Mr. Robert Roush, Iowa Department of Public Instruction.
- Dr. Willis L. Valett, University of Wisconsin.
- Mr. Neal H. Rathjen, Milwaukee Pu[illegible]ic Schools.
- Mr. Jay K. Smith, Mesa Public Schools.
- Dr. Robert L. Marshall, Central Missouri State University.
- Dr. William D. Cushman, American Driver and Traffic Safety Education Association.
- Dr. Don L. Smith, Michigan State University.
- Mr. Michael Smith, National Highway Traffic Safety Administration.

Individuals who were instrumental in lining up participating schools and arranging for the smooth administration of pilot tests include:

- Mr. Charles Greenwalt, A & M Consolidated High School, College Station, Texas.
- Mr. Owen Crabb, Maryland State Department of Education.
- Mr. Calvin M. Faulkner, Coordinator, Driver Educati[illegible]more, Maryland.
- Mr. [illegible]en Klecan, Baltimore Polytechnic Institute.
- Mr. [illegible]erry Summons, Department of Human Services, Bowie, Maryland.
- Mr. John M. Hagan, Bowie (Maryland) Senior High School.
- Mr. Harvey Bowman, Driver Education Supervisor, Prince George's County, Maryland.
- Mr. Rex Holiday, Assistant Driver Education Supervisor, Prince George's County, Maryland.
- Mr. Alvin M. Francis, Hazelwood Central High School, Florissant, Missouri.
- Mr. Larry Lake, Riverview Gardens (Missouri) High School.
- Mr. Gerald Reynolds, West Hazelwood (Missouri) High School.
- Mr. Aubrey Tindall, Pattonville (Missouri) High School.

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- Dr. Robert Baldwin, Dr. Robert L. Marshall, and Dr. Pat Patterson of the Missouri Safety Center, Central Missouri State University.
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- Mr. Robert Roush, Consultant, Driver Safety Education, Iowa Department of Public Instruction.

- Mr. Eugene Kleinow, Chief of Police, Mason City (Iowa) Police Department.
- Mr. Roger Roskins, Principal, and Ms. Dot McKasson, Counsellor, of L&M High School, Letts, Iowa.
- Mr. Don Moody, Principal, and Mr. Thomas Menke, Teacher, Hempstead High School of Dubuque, Iowa.
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- Mr. Ron Bradford, Teacher, and the entire Student Council of East Lansing (Michigan) High School.
- Dr. Don L. Smith, Highway Traffic Safety Center of Michigan State University.
- Mr. Tony Waldron, Principal, of Haslett (Michigan) High School.
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- Mr. William Pugh, Principal, Stonewall High School, Manassas, Virginia.
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- Ms. Agnes K. Mical, Driver and Traffic Safety Education, Glassboro (New Jersey) State College.

The authors would like to express particular thanks to Mr. John Harvey and Ms. Michele Forman of the Vermont Department of Education who not only provided all necessary administrative support for conducting Phase III activities in Vermont but also trained the observers for all evaluation sites in that state.

The materials developed through the efforts described in this report are contained in a separate volume entitled "Supplemental Driver Safety Program Development, Final Report: Vol. II, Pilot and Field Test Module Materials." These materials include:

- Instructor's Guides for three alcohol traffic safety education modules.
- Instructor's Guides for five safety restraint modules.
- Instructor's Guide for a speed management module.
- Instructor's Guide for a pedestrian/cyclist hazard perception.
- Three student manuals for use in alcohol, safety restraints, and speed management modules.

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INTRODUCTION

The goal of work described in this report was to determine the effectiveness of various short instructional programs (modules) in improving the safe-driving knowledges, attitudes, and performances of 16-18-year-old drivers. The modules prepared and examined within the project were not intended to constitute--separately or in aggregate--a comprehensive traffic safety education program. Rather, they were intended to provide supplementary instruction in five content areas critical to the safe and efficient operation of motor vehicles by young drivers.

PROJECT PHASES AND ACTIVITIES

To reach the primary goal, project work was carried out through three phases. The activities undertaken to achieve these objectives are briefly summarized in the following paragraphs.

Phase I -- Identification of Training Needs

Staff reviewed existing literature and conducted original research to identify the instructional needs of young drivers not being met by existing traffic safety education programs. To complement this activity--designed to establish the content appropriate to supplemental modules--staff reviewed evaluative literature and held discussions with leading traffic safety education authorities to determine the instructional methods best suited to communicate this content effectively to young drivers. Project staff then canvassed traffic-safety-related organizations to ascertain their institutional requirements and capacities to deliver to young drivers supplemental modules of the type indicated by the foregoing research as being desirable. At the conclusion of this phase, prototype modules--incorporating existing instructional materials wherever possible--were prepared for pilot testing.

Phase II--Pilot Testing of Experimental Modules

Experimental modules obtained/developed at the conclusion of Phase I were delivered in secondary schools and evaluated for their potential to improve critical knowledges, attitudes, and behaviors among 16-18 year olds.

Phase III--Evaluation of Restraint Use Modules

Safety belt module materials used in the pilot tests were refined. These modules and others developed independent of this project were then evaluated and compared to determine the degree of behavioral change each induced among 16-18 year olds.

CONTENT AREAS

Project work focused on five content areas critical to safe and efficient driving. These areas were:

- o Alcohol
- o Speed
- o Restraint Use
- o Hazard Perception
- o Fuel Efficiency

These areas were selected for module development and evaluation because of research findings which indicated these to be high pay-off topics--topics critical to the safety of young drivers and/or topics currently not being adequately addressed by instructional programs. The need for supplemental instruction in these areas is briefly reviewed in the remainder of this introductory section of the report.

YOUNG DRIVER DEFICIENCIES

Young drivers are at greater risk in traffic than any other age group. Though constituting only 22% of all licensed drivers in the U.S., drivers aged 24 or younger are involved in 39% of all highway crashes. This same disproportionate involvement prevails in the area of fatal crashes--38% of which involve youthful operators.

Research has identified a variety of factors contributing to younger drivers' overinvolvement in crashes. Three of the most critical factors--particularly in terms of their contribution to fatal crashes--are alcohol use, excessive speed, and failure to wear safety belts.

Alcohol

Drinking/driving is a major cause of severe accidents, regardless of driver age. Studies (e.g., Neilson, 1969; Waller, et al., 1970; Perrine, et al., 1971; Filkins, et al., 1970) have consistently shown that 50-60% of the drivers killed in crashes had levels of blood alcohol associated with impairment--i.e., greater than .05% BAC--at the time of their crashes. A 1969 study by Baker found that, of fatally injured drivers judged to be "at fault," almost three-quarters of those aged 14-24 had alcohol in their systems at the time of the crashes.

What distinguishes younger drivers from older operators in terms of drinking/driving is that relatively small amounts of alcohol create great dangers for younger drivers. Among 16- and 17-year-old males, BACs of less than .05% produce a more than sevenfold increase in "normal" accident risks (Zylman, in Perrine, ed., 1974). This high-risk level is unmatched by any other age group short of a BAC of .10%+ (typically, the legally recognized level of outright intoxication).

Speed

Speeding is another major contributor to highway fatalities which cuts across age groupings. Again, however, speeding appears to be an especially severe problem among younger drivers: McFarland and Moore (1960) cite a 1956 California study showing excess speed to be the prime factor in nearly half (44.4%) of teen-aged drivers' "at fault" accidents. Goldstein's 1973 research review notes other studies which find speeding to be the dominant characteristic of crashes involving youthful drivers.

Compared to older drivers, youthful drivers are prone to speed more excessively, as well as more frequently. Research (e.g., Creative Consumer Research, 1978) supports the common wisdom: The younger the driver, the faster he is apt to drive. This observation usually is made with respect to driving done on the open road--e.g., freeways and expressways. But, speeding in urban and residential areas also is particularly characteristic of youthful drivers. The tendency to exceed speed limits goes far toward accounting for the overinvolvement of young drivers in fatal crashes. Driving far above the pace set by others on the road increases the chances of having a crash in the first place. Additionally, the risks of dying, should a crash occur, increase disproportionately in relation to the increase in impact speeds. The chances of dying in a crash double as impact speed increases from 45 MPH to 60 MPH, for example. The chances of dying double again as speed increases from 60 MPH to only 70 MPH.

Restraint Use

Whether or not younger drivers are less likely than older operators to use safety belts is a moot question. Early surveys (e.g., National Analysts, Inc., 1971) found 16- to 24-year-old drivers to constitute the age group least likely to "always" use restraints and most likely to "never" wear belts. More recent surveys (e.g., Opinion Research Corporation, 1980) indicate little or no significant differences in belt usage rates across driver age groups. It should be noted, however, that the Opinion Research survey found teenaged passengers to be wearing belts at a significantly lower rate than that exhibited by "adult" passengers.

Even if young occupants' record of belt use is no worse than older occupants', it may be argued that their need to use belts is greater, because of their excessive crash risks. Young drivers are more likely than others to be involved in crashes, especially the more severe types of accidents: alcohol-related accidents, accidents involving excessive speeds, and night-time accidents. The more severe the accident, the more critical becomes the use of restraints.

Hazard Recognition

The primary way in which drivers learn to recognize hazards is through exposure to hazardous conditions. For example, a driver sees a bicyclist suddenly dart across the road and learns that bicycles, because of their easy maneuverability, are something of a hazard.

If experience is the primary teacher of hazard recognition, then it is likely that young, inexperienced drivers, are less able to recognize hazards than are more experienced drivers. Few people who have ridden with young, inexperienced drivers would doubt that there is a relationship between experience and the ability to recognize hazards. Unfortunately, data capable of confirming or refuting this logical hypothesis are absent. Accident data shed little light on the subject. When crashes occur, it is not possible to state validly whether the drivers involved failed to recognize a hazard, didn't see it in the first place, or saw it, recognized it, and ignored it. While some research efforts have attempted to measure hazard recognition and relate it to experience, they have been largely stymied by difficulty in generating a valid measure of hazard recognition.

Despite the absence of supporting data, the conjecture that young drivers are less able than more experienced drivers to recognize hazards in the driving environment has sufficient logical and anecdotal support to warrant an effort to identify the deficiencies in this regard and to overcome them through instruction.

Fuel Efficiency

The inclusion of fuel efficiency in the list of content areas that define the scope of the project is not based upon any belief that young drivers are less fuel-efficient than experienced drivers. Rather, it is included because of research showing that in-vehicle instruction is capable of leading to more fuel-efficient driving. This research is summarized in a recently-completed report by McKnight, et al (1982). The only means of providing in-vehicle instruction to large numbers of drivers is through high school driver education, which reaches in the neighborhood of three million prospective drivers each year. There is no other instructional system that provides in-vehicle instruction to more than a handful of drivers.

THE POTENTIAL AND PROBLEMS OF EDUCATION COUNTERMEASURES

Traditionally, education has been looked upon as a promising means of helping young people cope with the dangers of driving. As most of the nation's 16-18 year olds attend high school, educators have an opportunity to provide information and experiences that will develop safe-driving knowledge, attitudes, and skills among teenagers who are about to become--or have recently become--drivers.

The institution of high school driver education is unmatched as an information delivery system for 16-18 year olds. Currently, high school driver education is available in more than three-fifths of the nation's public, private, and parochial secondary schools, providing more than 100 million hours of instruction to more than two million young people annually. But, while a truly viable "delivery system" is in place, driver educators have long felt that they have not been provided with the educational tools--the program materials--needed to conduct maximally effective programs for young people. Dissatisfaction with currently available programming is focused on three interrelated areas: inadequate research support, inappropriate content, and unsatisfactory timing.

Inadequate Research Support

Educators complain that research-derived information seldom is "packaged" into products usable within the classroom. Historically, research efforts have culminated in omnibus driver education programs--e.g., "model systems"--whose implementation is often thwarted by: (1) inability of the programs to accommodate local needs and constraints, and (2) procurement and operating costs that exceed resources available.

The research community often faults these programs for their lack of an empirical justification for the content and methods specified for use. It is the consensus of researchers that (1) a greater effort should be made to draw instructional content from research data concerning young driver accidents, and (2) programs thus derived should be evaluated for their ability to change driver behavior <u>before</u> they are used in a full-bore demonstration or distributed to schools.

Inappropriate Program Content

Currently, programs for 16-18 year olds encompass a broad range of safe driving instruction. Few attempt to align objectives with the causes of accidents in general or those involving young drivers in particular. Such an approach is needed if education is to be maximally effective.

Five areas peculiarly important to young drivers already have been identified. Their treatment in programs now available may be summarized as follows:

<u>Alcohol</u>--A relatively large number of educational materials have been developed to help teenagers uncouple drinking and driving. Some are suitable for more general use in high schools, but are over-long to be fit into most driver education programs. Additionally, there is no evidence that any have succeeded in influencing driver attitudes or behavior.

<u>Speed</u>--Many materials promoting compliance with the 55 MPH limit are available, but--again--their effectiveness is unknown. As for materials dealing with the principles of speed management--controlling speed to accommodate variables such as visibility, weather, and traffic conditions, as well as legal limits--none prepared for high school application has been based on an analysis of factors underlying speeding by young drivers.

<u>Restraint Use</u>--Some existing materials have been based somewhat on studies of the reasons offered by young drivers for not wearing safety belts. Many others, however, are not rooted in research. And none have been rigorously evaluated for their ability to influence usage rates among young drivers.

<u>Hazard Perception</u>--While accidents involving pedestrians or two-wheelers are relatively few in number, they frequently result in fatalities. Over the last decade, much has been learned about the causes of such accidents and how they may be avoided. Yet, there has been no concerted effort to incorporate this new knowledge into educational programs.

Fuel-efficiency--While many materials were developed in this area shortly after the 1973 oil embargo, most were admittedly stopgap measures, meant to hold the line until more became known about the content and methods appropriate to fuel-efficient instruction. The stopgap measures have never been replaced with programs that have been evaluated for their effectiveness.

These subjects are inadequately addressed in existing programs for the simple reason that they are relatively new study areas, and there is usually a long lag-time between conducting research and translating research results into educational program materials.

Unsatisfactory Timing

Traffic safety instruction in secondary schools is almost the exclusive province of driver education classes. Usually, then, there is a lapse of time between receipt of traffic safety instruction and the acquisition of a license--signalling the start of extensive driving. A study of California drivers found that less than half were licensed within six months after completing driver education (Jones, 1973).

This time lag means that many 16-18 year olds have little opportunity to put into practice the safe driving principles and skills learned until many months after they have received instruction. It also means that instruction is completed before students have had a chance to hone--through extensive on-street operation--the motor and perceptual skills critical to safe driving. For many driving tasks, students may not be ready to benefit from instruction until they have mastered these skills.

One partial solution to the latter problem--scheduling advanced courses for some time after licensure--suffers from the lack of incentive for students to participate. While participation in such courses might be made mandatory in certain instances (e.g., school policy making school parking facilities available only to students who enroll in an advanced course), the authors are unaware of any school which does, in fact, provide incentives for advanced driver training. Indeed, only a handful of schools in the country even offers an advanced safe driving course to students. A number of schools do have informal "clubs" and other extracurricular activities providing driving instruction. But such programs reach only a miniscule fraction of the total young driver population.

PHASE I--IDENTIFICATION OF TRAINING NEEDS

The objectives of the initial phase of the project were to:

- o identify critical knowledge, attitude, and performance deficiencies among 16-18 year olds in the five content areas to be addressed by supplemental modules.
- o identify the instructional approach and methods to be employed in the supplemental modules.
- o assess the potential of private organizations and schools to deliver supplemental instruction to young drivers outside the high school driver education classroom.
- o select and/or develop modules that address young driver training and program implementation requirements.

IDENTIFICATION OF YOUNG DRIVER DEFICIENCIES

The ability of any educational program to foster safe and fuel-efficient driving behaviors depends upon its ability to lead participants to attain critical knowledge, attitude, and skill objectives. However, deficiencies may be identified only when the status quo is compared against some standard of optimum performance. Thus, the initial thrust of project efforts was to identify instructional objectives appropriate for each content area to serve as a resource/standard for determining youth deficiencies. The approach required:

- o Identifying appropriate content area objectives.
- o Determining the knowledge, attitude, and performance level of 16-18 year olds.
- o Formulating instructional objectives for modules with potential to improve young driver performance.

Identification of Appropriate Objectives

A comprehensive analysis of research data pertaining to young drivers and their performance was conducted to derive specific objectives pertinent to young driver training needs and to establish corroborating evidence of the criticality of attaining these objectives. Three types of data were analyzed:

- o Accident Data--A survey was made of in-depth accident reports, and summaries based upon these reports to identify those behavioral accident antecedents that were characteristic of youth-involved accidents to a greater extent than accidents involving other age groups.

- Performance Data--Studies in which the performance of young drivers was measured were reviewed to identify specific deficiencies in measured skill, knowledge, and attitude.

- Unsafe Practices Data--Studies reporting upon observed unsafe practices exhibited by young drivers were reviewed to identify those specific practices most often performed unsafely.

Formulation of Appropriate Objectives

On the basis of these analyses, appropriate objectives were formulated for each of the five designated content areas. Three types of objectives were specified:

- Performance Objectives--The "real-world" behaviors that define safe and efficient driving.

- Knowledge Objectives--Information that either enables or motivates drivers to operate safely and efficiently.

- Belief Objectives--Attitudes, views, and opinions which promote and support specific desirable performances.

As passengers often influence a driver's actions, objectives were formulated for passengers as well as drivers where applicable.

Selection of Appropriate Objectives

Objectives were selected as possible standards for identifying youth training needs when they met all of the following criteria:

1. Critical to safe or efficient performance.

2. Currently not taught by most driver education programs (i.e., are above and beyond basic learn-to-drive content).

3. Reflect performances, knowledges, skills, or beliefs which don't appear to be held by young drivers.

4. Likely to improve young drivers' behavior (i.e., does not require young drivers to adopt wholly unrealistic behavior patterns such as not drinking at all, nor require them to adopt a behavior which they already exhibit).

Organization of Objectives

The objectives selected for potential inclusion in the supplemental materials to be developed were divided according to the five content areas addressed in this project. Each of these groupings is discussed below.

Alcohol

In recognition of the potential efficacy of exploiting the peer relationships typical in drinking/driving situations involving young people, objectives in the area of drinking and driving were organized around two basic categories of behavior: self-directed behaviors, and other-directed behaviors. Each category of behaviors was divided into subsets of related behaviors, such as "avoid reaching an impaired level," "avoid driving at an impaired level." Each subset contained specific behavioral criteria (objectives), as shown in Figure 1.

FIGURE 1

ALCOHOL/DRIVING OBJECTIVE CATEGORIES

Self-Directed

Avoids Reaching an Impaired Level

- Sets limit in advance
- Controls rate of consumption
- Keeps track of drinks consumed
- Stops at pre-set limit
- Avoids mixing drinking and drugs
- Allows for the effects of emotions
- Resists social pressure to drink
- Accounts for the effects of various physical states

Avoids Driving at an Impaired Level

- Selects others to serve as drivers
- Uses public transportation
- Rides with others
- Limits distance to drinking location
- Recognizes when too impaired to drive
- Delays departure when impaired
- Resists social pressures to drive

Avoids Riding with an Impaired Driver

- Makes alternate travel arrangements
- Determines if driver is impaired
- Rides with a sober driver
- Resists pressure to ride with an impaired driver

Other-Directed

Lessens the Probability Others will Become Impaired

- Plans events to control consumption
- Controls dispensing of alcohol
- Avoids applying social pressure to drink
- Stops drinking of impaired drivers
- Provides information to others

Lessens the Probability of Others Driving at an Impaired Level

- Makes alternate travel arrangements
- Prevents driving by impaired persons
- Cares for impaired drivers

Lessens the Probability of Others Riding with an Impaired Driver

- Arranges alternate travel method
- Informs others of hazard
- Prevents others from riding with an impaired driver
- Alleviates social pressures

Supporting knowledge and belief objectives were identified for each behavioral objective category. These supporting objectives took into consideration (1) the inexperience of most young drinkers, and (2) the influence which peers may exert upon young drinkers in a drinking situation. Attitude and knowledge objectives focused on how young people can avoid driving while intoxicated or help others avoid driving while impaired. They also addressed how young people can avoid riding with an impaired driver themselves and help others avoid the same hazardous situation. Knowledge objectives also called for guidance on how to limit drinking to avoid reaching a stage of impairment, and how to keep track of the amount of alcohol consumed.

Speed

Young drivers need to understand the safety/risk implications of speeding. They also need to understand the rationale for adopting safe speed management techniques. Addressing the issue of speed in this manner may bring about a change in attitudes which might predispose some young drivers to drive too fast. Figure 2 presents a breakdown of speed objectives.

FIGURE 2

SPEED OBJECTIVE CATEGORIES

Adjusts speed for visibility
Adjusts following distance for speed and visibility
Anticipates visibility reduction on hills and curves
Adjusts speed at intersections
Encourages drivers to maintain safe and lawful speeds
Makes proper adjustments for freeway exists and entrances
Stays within speed limits

Supporting knowledge and belief objectives were established for each behavorial objective. These supporting objectives were geared primarily to achieve an appreciation of risks and social responsibilities associated with speeding.

Restraint Use

Restraint usage boils down almost entirely to a single objective--fastening the restraint--doing it oneself and encouraging others to do so. While there are a few additional performances (maintaining and adjusting restraints), almost all of the information and instruction directed at drivers in the area of restraint use is directed toward motivating drivers to do one thing.

Underlying the single behavior of fastening a belt is a much broader array of knowledges intended to motivate performance. These knowledges are summarized in Figure 3.

FIGURE 3

RESTRAINT USE KNOWLEDGE OBJECTIVES

Statistics--The relation of restraint use to the likelihood of injury or fatality in crashes.

Dynamics--The dynamics of restrained and unrestrained bodies in a crash.

Myths--The facts countering commonly held misconceptions about safety belts, including those concerning survivability in low speed crashes, egress in fire and submersion crashes, comfort, and the urge of manliness.

Control--The effect of restraints on ability to control the vehicle.

Hazard Perception

Much research in accident analysis is devoted to identifying hazardous situations and the factors which contribute to their resulting in crashes. Accident types (situations) identified in this research provided the basis for the objectives.

The contract under which the project was carried out focused specifically upon the perception of hazards presented by three types of road users: motorcyclists, pedestrians, and bicycle/moped riders. Bicyclists and moped riders have been lumped together because all available evidence indicates that moped riders act in much the same way as bicyclists in traffic. Additionally, the size, conspicuity, and handling characteristics of mopeds closely resemble those of bicycles.

Performances, knowledges, and beliefs that would help passenger vehicle drivers interact more safely with the three categories of road users identified were specified. Within each situation, objectives were identified for recognizing cues and responding to conflicts or cues. Objectives were specified to aid a motorist's understanding of the kinds of situations which give rise to accidents because recognition of these situations is, in itself, a cue for a correct response.

The hazard perception objectives were specified in terms of the characteristics of the situation and the location of the potential hazard in relation to the passenger vehicle (the driver's point of view). A breakdown of the situations addressed by the hazard perception objectives appears in Figure 4.

FIGURE 4

HAZARD PERCEPTION OBJECTIVE CATEGORIES

MOTORCYCLES

Hazards Ahead

Motorcycle following lead vehicle turning left--driver oncoming

Motorcycle following lead vehicle turning left--oncoming driver turning left

Motorcycle following lead vehicle turning left--driver following in adjacent lane

Driver following motorcycle

Hazards from the Sides

Motorcycle merging into traffic

Motorcycle entering from the roadside

Crossing paths at intersection

Operating alongside motorcycle

Passing motorcycle

Conflicts with Other Vehicles

Large vehicle preceding motorcycle--driver following

Maintaining space around motorcycle

Conflicts Caused by Roadway

Motorcycle's path obstructed

Problems caused by weather

Motorcycle response to road design

PEDESTRIANS

Hazards Ahead

Walking along a rural roadway

Hazards from the Side

Pedestrian dart-out

Midblock dash

Intersection dash

Checking mailboxes

Conflict Situations

Multiple threat situations

Merge/turning vehicle

Roadside Distraction/ Blocked View

Vendor/Ice cream truck

Disabled vehicle

Bus-related

BICYCLES/MOPEDS

Hazards Ahead

Motorist overtaking bicyclist

Misjudgment of bicyclist's evasive action

Bicyclist's path obstructed

Unexpected left turn across vehicle path

Hazards from the Sides

Intersection rideout

Midblock rideout

Conflict Situations

Merge/turning vehicle

Left-turning vehicle

Right-turning vehicle

Energy-Efficient Driving

Objectives for this content area were divided into four categories:

- Vehicle operation
- Vehicle selection
- Vehicle use
- Vehicle maintenance

Existing data were reviewed to determine what young drivers currently know, do, and believe relative to fuel-efficient driving. The content of existing programs was reviewed as well to determine what is being communicated. On the bases of these reviews, the performance objectives presented in Figure 5 were stipulated. Supporting knowledge and belief objectives were identified for each category as well.

Prior research allowed those general areas of performance and knowledge in which younger drivers were deficient to be identified so as to serve as objectives for instructional programs. The next step was to identify the specific deficiencies in knowledge, skill, and attitude needed to be overcome in order for young drivers to attain the stated objectives.

Identification of Appropriate Measures

The first step in the effort to identify specific deficiencies was to determine what types of measures were appropriate for assessing attainment of objectives in each of the five content areas.

Candidate Measures

Measures capable of being employed to assess deficiencies in driving can be divided into the following categories:

Knowledge--Measures to assess an individual's possession of, and/or ability to recall, specific items of information. Knowledges are generally assessed through paper-pencil tests presenting questions that can be answered correctly only by individuals possessing the information sought.

Attitudes--Measures designed to assess an individual's beliefs[1] concerning those aspects of driving concerning which informed

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1 Measurement of attitudes can also involve assessment of feelings and behavioral intent. However, it is beliefs that educational programs generally attempt to modify.

FIGURE 5

ENERGY-EFFICIENCY OBJECTIVE CATEGORIES

Vehicle Control

Starting

- Avoids pumping accelerator
- Optimizes warmup
- Avoids revving engine
- Warms up while driving

Acceleration

- Selects optimum acceleration
- Shifts efficiently
- Avoids accelerating on hills

Speed

- Operates in fuel-efficient range
- Maintains steady speed

Braking

- Anticipates conditions requiring braking
- Changes lanes to avoid braking
- Coasts to avoid braking

Vehicle Use

Minimizes unnecessary trips

Consolidates/combines trips

Rideshares

Uses alternatives

- Mass transit
- Walk/bicycle
- Telephone

Vehicle Selection

Matches size to need

- Vehicle
- Engine

Selects fuel-efficient options

- Transmission
- Axle
- Fuel type

Minimizes accessories

- Power (brakes)
- Weight (air conditioning)
- Drag (racks)

Vehicle Maintenance

Maintains tire pressure

Maintains fuel consumption records

Optimizes tuneups

Uses appropriate lubricants

individuals have different beliefs. Attitudes are generally assessed through presentation of opinions to which individuals respond by indicating their acceptance or rejection.

Skill--Measures of an individual's ability to carry out the perceptions, mental activities, or motor responses required in a particular performance. Skills are generally assessed through performance in carrying out actual or simulated tasks designed to require individuals to perform to the maximum of their capability.

Practice--Measures of an individual's tendency to perform activities as a matter of everyday practice. Generally, practices are assessed by having individuals perform actual tasks under conditions that characterize everyday performance.

Selection of Measures

Application of the various types of measures to the five content areas depended upon the assumed nature of deficiencies within each of the areas. What was believed to be the appropriate application of measures to each of the content areas is summarized in Table 1 below.

TABLE 1

APPLICATION OF MEASURES TO CONTENT AREA

Content Area	Knowledge	Attitude	Skill	Practice
Alcohol	X	X		
Speed	X	X		
Restraint Use	X	X		
Hazard Perception	X		X	
Fuel Efficiency	X	X	X	X

The following paragraphs will discuss the factors involved in selecting appropriate measures for each content area.

Alcohol--Measures of knowledge and attitude appeared to be the most appropriate to assessment of deficiencies in use of alcohol. Prior research established clearly that there was much that young drivers did not know about responsible use of alcohol and that many young drivers harbor attitudes that are inconsistent with responsible alcohol use. Skill, at least in the sense in which it is here defined, does not appear to play a significant role in responsible alcohol use. Assessment of drinking practices was ruled out for two reasons. First, since much of the population concerned is under the legal drinking age, any attempt to assess practices would be an invitation to self-incrimination. Secondly, there is not much that could be done in education to alter practices except through overcoming knowledge and attitude deficiencies.

Speed--Like responsible use of alcohol, the responsible use of speed seems little influenced by skill in operating the vehicle. Rather, speeding is most likely to result from ignorance of, or unhealthy attitudes toward, the hazards presented by excess speed. While young drivers certainly vary in their speeding practices, it would be very difficult to assess these practices, due to the tendency of drivers to comply with the speed limit when they know they are being observed. Surreptitious observation of drivers would permit measurement of speed. However, it would be very difficult to identify individual drivers in order to differentiate ages.

Restraint Use--Again, there is no "skill" involved in fastening a safety belt. Deficiencies in safety belt use appear to be the result of ignorance and unfavorable attitudes. Since there is only one behavior involved, and deficiencies in that behavior are fairly well established, measures of actual safety belt use did not appear particularly useful.

Hazard Perception--The perception of hazards involves both knowing what elements of the environment represent hazards and the ability to perceive those hazards while driving. Measures of both knowledge and skill are therefore appropriate. Most drivers who know a situation is hazardous and are able to recognize it will respond carefully. Hazard perception doesn't seem to be proved by unfavorable attitudes or unsafe practices. In fact, people characteristically respond to a recognized hazard before they become truly conscious of it.

Energy Efficiency--All four of the characteristics discussed underlie energy-efficient driving. Because concern for energy efficiency is a phenomenon of the most recent decade, there is a lot that people do not know about the subject. While most of the population is favorably disposed toward fuel efficiency in general, there are varying attitudes toward specific fuel efficiency issues. These in turn lead to practices that are not entirely consonant with fuel efficiency. While most fuel-efficient behavior is not dependent upon skill, some of those involving vehicle operation do demand skills, which have been the basis for the in-vehicle training that has been given.

Development of Measures

Having identified the types of measures that needed to be prepared, development of specific measures was undertaken. For purposes of discussion, the measures can be divided into two general categories:

o Paper-pencil measures of knowledge and attitude.

o Performance measures of skill and practice.

Paper-Pencil Measures

A set of paper-pencil measures was developed for assessment of knowledge and attitude. The use of multiple choice measures was dictated by two considerations:

Quantification--To prioritize the correction of deficiencies, it was necessary to quantify the extent of deficiency, something that is possible only with the objectivity of multiple choice measures.

Administration--Reliable measurement of a wide range of deficiencies required an extensive testing program. The data processing requirements were manageable only with multiple choice items.

Knowledge items involved three-alternative multiple choice tests. The use of three alternatives was dictated by the general inability to generate more than two plausible foils for each item. Development of knowledge items adhered to guidelines established in a previous NHTSA project (McKnight and Green, 1976).

Attitude items consisted of a statement of an issue accompanied by three to four opinions representing different attitudes toward that issue. Respondents selected the opinion that was closest to their own belief. This type of item was believed to have two advantages over the more traditional Likert type of item in which individuals expressed varying degrees of feeling toward a single opinion. First, it provided more efficient measurement in that, the selection of one out of four opinion statements was roughly the equivalent of four Likert type of items. Secondly, it separated the nature of an individual's belief from strength of feeling, something that is highly subject to response bias and not particularly useful in establishing education objectives.

Where items of the type described were available from prior studies, they were selected for use in this project's deficiency instruments. For example, items sampling young drivers' knowledges and beliefs in the area of drinking/driving were drawn from the Youth Alcohol Criterion Measure developed through a previous NHTSA project (McKnight, et al., 1979). In some cases, existing items were reconfigured either to match the formats adopted or to eliminate obvious flaws in item construction. In cases where no suitable existing items were found for a knowledge or attitude to be tested, project staff developed new items. The means through which deficiency testing items were generated in each content area is presented in Table 2.

TABLE 2

GENESIS OF KNOWLEDGE/ATTITUDE DEFICIENCY TEST ITEMS

	Drinking/ Driving	Speeding	Restraint Usage	Hazard Perception	Energy-Efficiency
Knowledge	E	D/E	D	D	E/M
Attitude	E	D/E	D/M		D

E = existing items used without modification
M = existing items, modified by project staff
D = items developed by project staff

Items used in the knowledge and belief measures sampled from all of the optimum objectives targeted for deficiency testing. (No attitude items were developed in the area of hazard perception, for reasons already discussed.) In all, some 310 items were generated. These were broken out into six knowledge measures of about 35 items apiece and two belief measures of roughly 50 items apiece. Each knowledge instrument sampled equally from each of the five content areas. One attitude instrument measured attitudes about speed and fuel economy; the other measured drinking/driving and safety restraint beliefs.

Prior to actual data collection, each measurement item underwent a developmental evaluation and final revision. Knowledge and belief measures were tested among students from Groveton High School in Alexandria, Virginia, and James Robinson High School in Fairfax County, Virginia. At least 15 students completed each instrument. Data obtained from this test were analyzed, and the measures were revised according to the results.

Performance Measures

Performance measurements involved operating an actual vehicle in response to tasks calling for application of required skills in normal operating practices. The vehicle operation had to occur under conditions in which the driver's responses could be reliably measured.

The instrument used to measure young driver performance in the areas of hazard perception and energy-efficiency was NHTSA's driver performance measurement and analysis system (DPMAS). The measurement, display, and recording capabilities of the DPMAS are described in another NHTSA report (Klein, et al., 1976). From the driver performance variables measurable by DPMAS, project staff selected those relevant to successful performance in the areas of hazard perception and fuel-economy. Staff then determined the criterion whereby each performance would be measured.

For the purposes of this study, performance data were recorded on video tape. Two cameras were used: one placed within the DPMAS; the other located outside the vehicle and focusing on the scene ahead of the driver. The cameras were connected to produce a split-screen image on tape, allowing the real-time measurements displayed by the DPMAS to be correlated with developments in the external environment. In addition to the video tape, an observer was located in the rear seat of the DPMAS-equipped vehicle. The observer logged certain performance data on a form. The performance variables and measurement criteria are presented in Table 3.

For the purposes of economy, the collection of performance data in the assessment of young driver deficiencies was combined with a data collection effort conducted as part of the development of the Automobile Driver On-Road Performance Test under another NHTSA project (McKnight, A. James and Kenard McPherson, "Automobile Driver On-Road Performance Test, Final Report." 1981). The combined data collection effort involved measurement of many variables other than those shown in Table 3.

TABLE 3

PERFORMANCE MEASURES

MEASURE	CRITERION
Hazard Perception	
Brake actuation time	Latency of response to hazard
Velocity	Speed change in response to hazard
Negative acceleration	Rate of deceleration in response to hazard
Lateral position	Position change in response to hazard
Energy Efficiency	
Positive acceleration	Attainment of optimum acceleration
Accelerator position	Acceleration on hills Revving
Brake application	Conserving momentum
Velocity	Maintaining steady speed Operating within optimum speed range
Gallons consumed	Overall fuel consumption

Project staff specified the driving situations in which these variables were to be measured:

Situations used in hazard perception testing reflected the situations encompassed in the optimum objectives--e.g., motorcycle turning left, driver oncoming. As prior research established that cues and correct responses are similar among situations described for pedestrians, bicyclists, and motorcyclists, test situations were devised so that recognition of cues and responses could be measured for one situation, and the results then generalized to other, similar situations.

The energy-efficient driving situations allowed for measurement of performance of skills such as: accelerating from a standing start, maintaining adequate following distance, and anticipating traffic flow disruptions.

The performance measures were given a non-site developmental evaluation. Project staff laid out the test routes. This involved rehearsing staged situations and determining locations where spontaneous situations would most likely occur. Measurement variables were specified in accordance with the final course design.

Selection of Testing Sites

The aim of the testing was to measure--as needed--the knowledge, attitude, and performance deficiencies of 16-18 year olds in the five content areas. The greatest constraint on knowledge/attitude testing was the need to gain access to a large number of 16-18 year olds. The greatest constraint on performance testing was the need to use the instrumented vehicle (a DPMAS-equipped 1978 Chevrolet Impala) to obtain the requisite measure of driver skill.

Knowledge/Attitude Test Sites

The most obvious means of gaining access to the sample population was to work through secondary schools. It was determined that the knowledge and attitude measures would be administered within schools whose administration and driver education staff volunteered to participate in the research activity.

The project Standing Advisory Panel helped identify candidate schools. From among the volunteers, project staff selected sites that differed in:

- o the type of driver education program offered
- o the density and complexity of prevailing traffic conditions
- o the severity of climate.

Site selection was responsive to these three variables for the following reasons:

<u>Type of Driver Education Program</u>--Since the sample population was to be accessed primarily through driver education teachers, the common bond among the sample was exposure to driver education. To

make sure that all types of program exposure were represented by the sample, schools offering two-phase (classroom instruction and on-street training), three-phase (classroom instruction, on-street training, and simulation training) and four-phase (classroom instruction and on-street, simulation, and range training) programs were selected as test sites.

Traffic Conditions--As urban sites typically present drivers with more traffic, a greater "mix" of vehicles, and more complex traffic situations than do rural sites, it is possible the nature and magnitude of deficiencies among young drivers in urban areas differ from those in rural areas. For instance, urban youth might be better acquainted with difficulties in perceiving pedestrians and two-wheel traffic because of more frequent exposure to these hazards. Or, the lack of heavy traffic in rural areas may give drivers there more opportunity to speed and less exposure to in-traffic speed management techniques. Thus, both rural and urban sites were selected.

Mild vs. Harsh Climate--Those who live in milder climates may come in contact with pedestrian and two-wheel traffic year-round. Such increased exposure might help young drivers in these areas develop better hazard perception skills. Thus, care was taken to select schools in harsh, as well as mild, climates.

Ultimately, a total of 14 data collection agencies, located in 10 States, were selected. The agencies, listed in Appendix A, provided access to students in 25 schools which differed greatly across the three variables considered in the site selection process.

Performance Test Site

The test vehicle is maintained by the Texas Transportation Institute (TTI) at College Station, Texas. Consequently, the driving range at TTI and the streets of College Station were the site for the in-vehicle tests. The sample population was drawn from A&M Consolidated High School students and other residents of College Station.

Stratification of Sample

The paper-pencil measures and performance measures were administered to two different samples. Each sample was stratified into the following three categories:

Pre-Education--Students who were just entering driver education.

Post-Education--Students who were completing, or had just completed, high school driver education programs.

Post-Licensing--Drivers who had completed driver education and been licensed for at least nine months.

This sample stratification allowed the origin of specific deficiencies to be identified. The purpose of administering tests to the pre-education group was to find out the levels of knowledge and attitude with which students entered driver education, that is, what students acquire on their own beforehand. Administration of performance measures to students in this category was, for obvious reasons, not feasible. Deficiencies that appeared only among the post-education sample pointed to shortcomings in driver education that were overcome through experience. Deficiencies shared by both driver education students and licensed drivers were evidence of the inability of driver education or experience to lead to attainment of objectives. Assuming the subject matter was covered in driver education, as most were, it would suggest that students were not at that point "ready" to benefit from instruction and would indicate the need for supplementary instruction to lead to attainment of objectives. Deficiencies that appeared only among the licensed drivers would provide evidence of deterioration in knowledge, attitude, skill, or actual practice and suggest the need for supplemental instruction to reinforce instruction received in driver education.

The sample stratification is summarized in the diagram on the next page.

Administration of Measures

Following their development, measures were administered at the test sites and to the samples of drivers previously described. This section will briefly describe the procedures used in administering the measures.

Administration of Paper-Pencil Measures

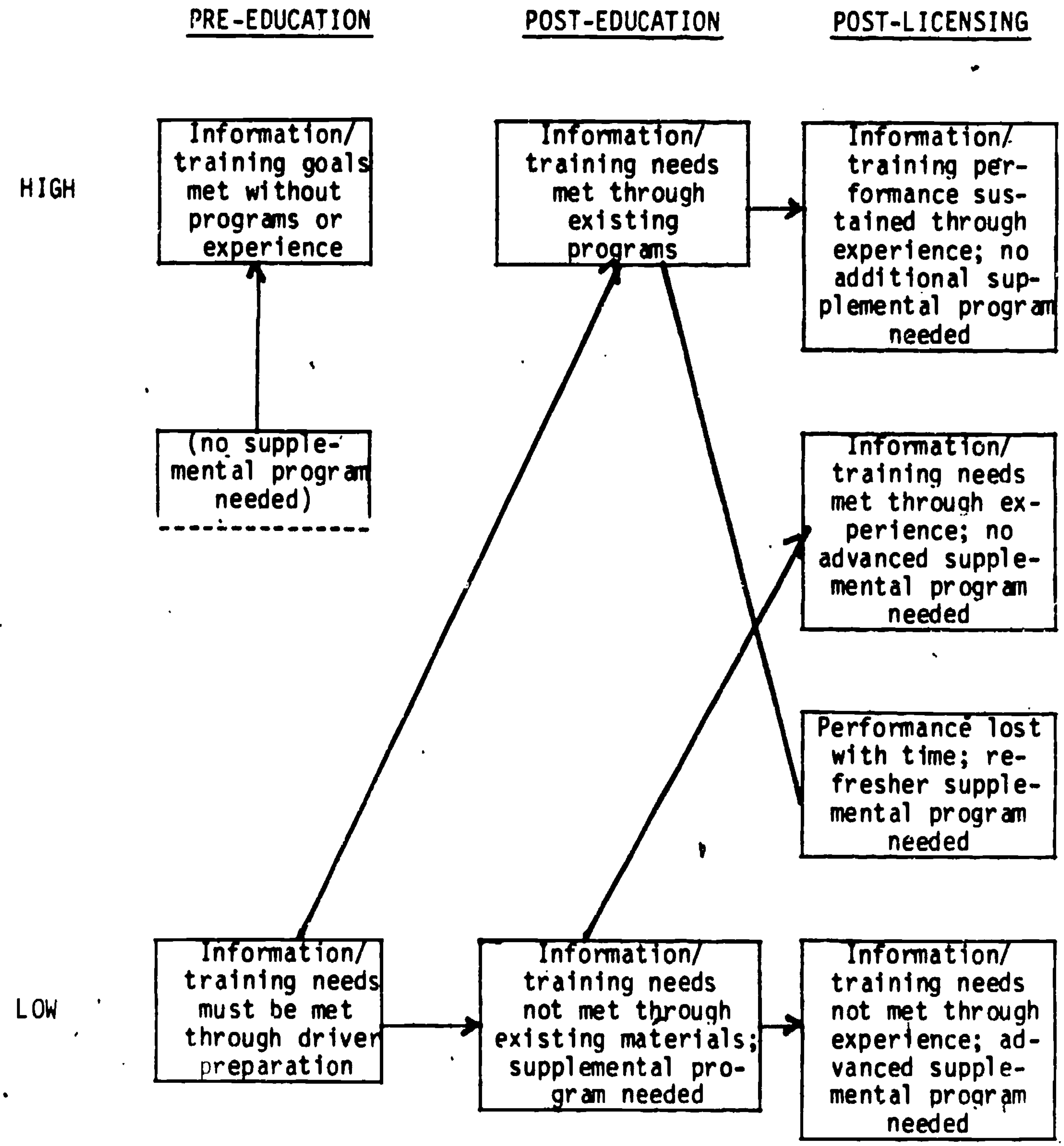
Final knowledge and attitude instruments were administered in the 25 participating schools. Teachers administered the instruments to students during class periods or assemblies. Students provided biographical data on the forms, allowing project staff to stratify returns according to the sample subgroups already discussed. To ensure confidentiality and to encourage candid responses on the attitude measures, students were asked not to put their names on the instruments.

Performance Test Procedures

The performance measures were administered to a sample consisting of 10 driver education students and 10 licensed drivers. Accompanying the subjects in the DPMAS vehicle were two people from TTI: the Test Conductor, seated in the right front seat and responsible for giving route directions to the subject, and the Test Recorder, seated in the rear seat and responsible for recording manually the fuel use readings displayed by the DPMAS at various choice points along the ride.

The subjects navigated three routes during performance testing: a controlled off-street route, a controlled street route, and an open street route. The two controlled routes were designed to permit assessment of

IDENTIFICATION OF INFORMATION/TRAINING NEEDS



skill. The open street route was intended to assess both skill and normal driving practices.

Controlled Off-Street--This route was designed to permit assessment of skill in fuel-efficient driving. Each subject drove a one-mile, closed-loop course four times, twice in each direction. The course consisted of gentle and sharp curves, 90-degree intersections, and one location where drivers had to stop at a stop-sign. Driving was controlled entirely by signs to prevent performance from being influenced by instruction from TTI personnel in the vehicle. The performances studied included acceleration, cruising, and deceleration from speeds of approximately 30 mph and 45 mph.

Controlled Street--This route was designed to permit assessment of skill in hazard perception. Each subject drove through the campus of Texas A&M University in light traffic conditions. Along this route, subjects encountered the 11 hazardous situations staged for measurement purposes. The performances studied included release of accelerator, braking, speed selection, and separation from hazard.

Open Street--This route was intended to permit assessment of both skills and practices in fuel efficiency as well as hazard perception skills. Each subject drove a 19-mile route consisting of urban, suburban, and rural driving.

Subjects were given a five-minute warm-up period to familiarize themselves with the DPMAS vehicle prior to the test runs. The first 14 miles were driven under "test" conditions, with subjects told to operate "as safely and as fuel-efficiently" as possible. This portion of the test was intended to measure skill. At the 14-mile point, the subject was informed that the test was over and directed to drive back to the starting point. (There was only one logical route back.) Unknown to the subject, however, the video recorder and all response recording equipment were left on. This portion of the test was intended to measure normal operating practices.

The video tapes capturing the DPMAS-generated read-outs and the moving scene ahead of the driver were forwarded to NPSRI for analysis following completion of the tests.

Analysis Methods Used for Knowledge/Attitude Measures

Of the some 30,000 instruments distributed, 6,747 were completed and returned in usable form. While more instruments were returned, many had to be disregarded for one or more of the following reasons:

- Biographical data omitted--precluding categorization by subject sub-group.

- Unqualified subject--student did not fit in any one of the sub-groups.

- Incomplete form--student did not finish a significant amount of the form.
- Improper form--student violated directions for completing the form or completed the form frivolously (e.g., marked the first response for each item).

The number of usable instruments returned is broken out by content area and sample population in Table 4.

TABLE 4

DISTRIBUTION OF KNOWLEDGE AND ATTITUDE MEASURES RETURNED BY SAMPLE POPULATIONS

Form	SAMPLE POPULATION Pre-Ed	Post-Ed	Post-Lic	Total
1	245	398	97	740
2	252	399	99	750
3	265	347	105	717
4	351	343	39	733
5	276	385	119	780
6	206	385	112	703
7A	221	287	112	620
7B	220	281	103	604
8A	178	275	101	554
8B	178	260	108	546
	2,392	3,360	995	6,747

FORM

1-6: KNOWLEDGE ACROSS ALL CONTENT AREAS

7A: ATTITUDE/SPEEDING

7B: ATTITUDE/FUEL-EFFICIENT DRIVING

8A: ATTITUDE/DRINKING-DRIVING

8B: ATTITUDE/RESTRAINT USAGE

Instruments were returned in numbers sufficient to identify specific knowledge or attitude deficiencies among the total sample and sample sub-populations.

A percentage response for each item was calculated across the entire sample. Percentages were calculated for the correct answer and each of the two foils for each knowledge question and for each of the four options available in each attitude item.

The deficiency standard employed in the analysis was a correct response rate of 80%. This standard was established because:

- The knowledges measured were highly critical to safe and efficient driving.

- The content areas are such that partial knowledge (incompletely correct answers) is not helpful to drivers and may, in fact, create problems.

- Even though full knowledge does not guarantee safe performance, a little knowledge is far less likely to lead to desired behaviors.

The same standard was employed in identifying attitude deficiencies. However, the scoring for "safe" vs. "unsafe" response was relaxed in instances where the second-best response--while not the safest in absolute terms--indicated a strong predisposition toward the desired behavior. For example, a speeding attitude item querying subjects on what they would do if passengers were trying to make the driver go faster offered as two of the four possible responses: "ask the passengers to stop" and "insist that the passengers stop." While "insisting" would be the safer of the two responses, both were accepted as a safe response. By way of comparison, a drinking item about what it takes to have a good party had only one acceptable safe response: "It doesn't matter if noone drinks alcohol." The next "safest" response--"some people should drink alcohol"--would not indicate a tendency toward the desired behavior.

The number of items answered correctly or safely was tallied separately for each of the three sample subgroups, both by categories of objectives within each content area and by the overall content area.

The analysis methods used in conjunction with the performance deficiency measures are described in the appropriate sections of the discussion of Results.

General Results of Deficiency Testing

Analysis of knowledge and attitude measures revealed widespread deficiencies among young people in all content areas. Of the 195 knowledge and attitude items analyzed, only one garnered more than 80% correct responses. That item revealed that more than 80% of the subjects in all three subgroups knew safety belts could provide protection in a crash regardless of the speeds involved. On no other item did the pre-education group achieve an 80% correct or safe response rate. One or both of the other groups did register an 80% correct or safe response rate on 10 other items (eight knowledge items and two attitude items).

Overall, there was evidence that driver education contributed to a gain in knowledge and an improvement in attitude. Driving experience also seemed to produce a very slight increase in knowledges relating to alcohol and speed. However, the gain in knowledge evidenced by the post-licensing group as compared to the post-education group was of not as great a magnitude as that evidenced in comparing post- to pre-education subgroups.

Attitude deficiencies showed either no change or a negative shift from post-education status to post-licensing status. The negative shift was most pronounced in the area of restraint usage, where a major improvement in attitude observed among the post-education subgroup was completely dissolved among the post-licensing group. A similar though not quite so severe shift toward undesirable attitudes was observed in the alcohol content area.

Overall, knowledge deficiencies were least pronounced in the alcohol area. To a lesser extent, this also held true for attitude deficiencies. The energy-efficient driving area revealed the greatest deficiencies both in knowledge and in attitude.

The performance measures (for both hazard perception and fuel-efficient driving) revealed essentially no differences between the post-education and post-licensing subgroups. Both groups responded correctly to hazards in only 50% of the situations encountered. A uniform lack of skill in energy-efficient techniques was observed among both groups.

More specific discussions of the results are presented, by content area, in the following paragraphs.

Alcohol Deficiencies

Results of knowledge and attitude deficiency testing are presented separately and followed by a brief discussion.

Knowledge Deficiencies

The average percentages of correct responses on knowledge items are presented in Table 5.

TABLE 5

ALCOHOL KNOWLEDGE MEASURES: PERCENTAGE OF CORRECT RESPONSES BY CONTENT CATEGORY AND GROUP

Content Category	# of Items	GROUP Pre-ed.	Post-ed.	Post-Lic.
Effects on body	5	53%	69%	73%
Effects on driving	5	53%	63%	69%
Controlling drinking	8	43%	56%	59%
Crash risks	2	65%	70%	75%
TOTAL	20	50%	63%	67%

The general trend of progressively higher knowledge levels from pre- to post-education to post-licensing status is observed within each content category. Subjects appeared to possess relatively less information critical to controlling drinking than other types of information. Specifically, there was a relatively low level of understanding of the concept that "a drink is a drink." About two-thirds of the pre-education group thought a shot of liquor contained significantly more alcohol than a can of beer or a glass of wine. The same proportion did not know that mixing alcohol with soda will neither increase nor decrease the effects of alcohol significantly. (Most thought it would decrease the effects.) Only half of the post-education and post-licensing sub-groups chose the correct answers to these questions.

Subjects demonstrated a relatively greater understanding of the importance of time to drinking. In fact, three of the eight knowledge questions in which at least one sub-group surpassed the deficiency standard were devoted to this area. Specifically, more than 80% of the post-licensing subjects knew that time--rather than exercise, fresh air, coffee, or food--is the route to sobriety and that the time it takes alcohol to leave the body can't be changed. More than 80% of the post-education sample knew exercise and fresh air were ineffectual as means of sobering up, and about 75% of them held the other knowledges concerning time.

Also, more than 80% of the post-licensing group, about three-quarters of the post-education group and some two-thirds of the pre-education group knew their accident risks were greater after just one or two drinks. Approximately two-thirds of the drivers in all three groups realized that young drivers are over-involved in alcohol-related crashes.

Attitude Deficiencies

The average percentages of "safe" responses to attitude items are presented in Table 6.

TABLE 6

ALCOHOL ATTITUDE MEASURES: PERCENTAGE OF CORRECT RESPONSES BY CONTENT CATEGORY AND GROUP

Content Category	# of Items	GROUP Pre-ed.	Post-ed.	Post Lic.
Controlling own drinking	9	51%	62%	56%
Responsibility to others	8	49%	53%	49%
TOTAL	17	50%	57%	53%

As can be noted from this table, the post-education group indicated a much greater willingness to control their own drinking than did their younger counterparts. Such willingness was dissipated among the post-licensing group, however. A marginal improvement in willingness to help others out of dangerous drinking/driving situations also was peculiar to the post-education group.

All three groups shied away from responses that strictly forbade drinking. For example, only about a third of the licensed group and about 40% of the members of the other groups indicated they would tell people not to bring alcohol to a party they were giving. And only a quarter of each group indicated they would flatly refuse to allow alcohol at a party where their friends would be driving. However, 63% of the pre-education group and 71% of the others indicated they would either refuse to allow alcohol or allow only small amounts at the party.

While most students appeared to reject the "if you drive, don't drink" approach, the majority indicated an awareness of the need to limit their drinking. More than 80% of the post-education group agreed it was always a good idea to set a limit on the number of drinks they will have. About two-thirds of the pre-education group and about three-quarters of the post-licensing group agreed on this point, as well. And, 79% of the post-education group believed it was very important to keep track of how many drinks they have when they know they will be driving. About 60% of the members of the other groups shared this belief. Whereas only about 40%, 60%, and 50% of the subjects in the "pre-ed," "post-ed," and post-licensing groups, respectively, indicated that a carpool driver should not drink at all, many others believed the driver should stop drinking before he felt any effects from the alcohol. The combined percentages of subjects selecting either of these attitudinal choices was 66%, 81%, and 85% in the "pre-ed," "post-ed," and post-licensing groups respectively.

On the issue of what constituted a reasonable limit, the general pattern of post-education subjects registering the safest attitudes and pre-education subjects the least safe was evident. Almost two-thirds of the former group, 60% of the post-licensing group, and 50% of the pre-education group indicated the belief that most people should be allowed to drive if they've had no more than one or two drinks (the safest selection available). However, about one-seventh of the "post-education" group, one-fifth of the post-licensing group, and one-quarter of the "pre" group believed it was okay for most people to drive after five or more drinks.

Responses also indicated that younger subjects (i.e., the "pre" group) felt somewhat more pressure to drink. Only 39% of them agreed that it was not important to drink at a drinking party. Two-thirds of the "post-education" group and 56% of the post-licensing group indicated it wouldn't matter if no one drank. Similarly, only 41% of the "pre" group said they don't have to drink to be "part of the group" at a drinking party, whereas 53% of the "post-education" group and 56% of the licensed group indicated this was the case. Importantly, one-fifth of the "pre" group indicated they had to "drink as much as everybody else" to be part of the group, whereas only 9% of the "post-education" group and 4% of the post-licensing group felt that way.

In general, the vast majority of subjects in all groups indicated willingness to intervene in others' drinking in so far as suggesting moderation or alternative travel arrangements. However, only half or fewer were of the opinion that they should press hard to intervene (e.g., "insist," "use force if necessary," or "do everything you can, no matter how hard you try"). Subjects appeared most loathe to intervene in drinking games. Only about a quarter of the post-education and post-licensing subjects were willing to even suggest stopping a drinking game. This attitude item was the only one where the "pre" group outscored the others. One-fifth of them indicated they would insist on stopping the game, and another 27% said they would suggest putting a halt to the game.

Discussion

Testing results revealed that while subjects, in general, felt it was important to control their own drinking, they were largely uninformed of facts that are essential to imposing meaningful control (e.g., the concept that a drink is a drink). The lack of fundamental knowledge is most pronounced--in this and every other area--among pre-education subjects.

While there was a general recognition that accident risks increase with just one or two drinks in the system, most subjects appeared to be willing to accept these risks. The general opinion seemed to be that, as long as a driver wasn't "feeling" the drinks, it was okay to drive. While it is possible that this attitude reflects a greater willingness to accept risks, it is equally likely that the attitude springs from a lack of understanding as to just how great a risk is generated by one or two drinks.

The results pertaining to intervention behavior were consistant with earlier surveys indicating a very high degree of willingness among young people to help friends who get in dangerous situations because of drinking. However, it appeared that, while subjects were willing to give "lip service" to others' problems, they were very chary of acting decisively to break up a dangerous drinking/driving situation.

In sum, the deficiency testing indicated that a supplemental alcohol program should:

- convey basic facts concerning alcohol and its effects on the body and on driving performance abilities.
- foster an appreciation of just how great an increase in crash risks is generated by alcohol--especially small amounts of alcohol.
- provide guidance on what to do to help others out of drinking driving situations and provide assurance that helping in this area is (1) worth a great deal of effort and (2) not something that will cause them to be looked down upon by their peers.

Speed Deficiencies

Results of knowledge and attitude deficiency testing are presented separately and followed by a brief discussion.

Knowledge Deficiencies

The average percentages of correct responses on knowledge items are presented in Table 7.

TABLE 7

SPEED KNOWLEDGE MEASURES: PERCENTAGE OF CORRECT RESPONSES BY CONTENT CATEGORY AND GROUP

Content Category	# of Items	GROUP Pre-ed.	Post-ed.	Post-Lic.
Speed Management	9	38%	54%	58%
Speed Limit	6	45%	57%	62%
Speed and Risk	2	42%	50%	46%
TOTAL	17	41%	54%	59%

The common pattern of a relatively large increase in knowledge from pre- to post-education groups, followed by a somewhat lesser increase among post-licensing subjects is evident in the content categories of speed management and speed limit. The same pattern was evident in one of the two questions posed in the speed/risk category. The proportion of subjects knowing that excessive speed is a factor in about half of all young-driver accidents was 48%, 56%, and 59% among "pre," "post-ed," and post-licensing subjects, respectively. What dragged down the average correct response rate among post-licensing drivers in this content category was that only 34% knew that about half of all drivers have accidents during their first three years of driving. By comparison, 38% of the "pre" group and 44% of the "post-ed" group knew accident risks were that high.

In the area of speed management, the most pronounced deficiencies among all groups occurred in the topic of stopping distance. Well below half of all subjects failed to understand that stopping distance increases geometrically with increases in speed. In the area of speed limits, about two-thirds of the sample (62% of the "pre," 69% of the "post-ed," and 72% of the post-licensing groups) knew that the 55 mph speed limit had helped save thousands of lives annually. However, half or more of each group thought they could save at least 10 minutes by making a 50-mile trip at 60, rather than 55 mph.

Attitude Deficiencies

The average percentages of "safe" responses are presented in Table 8.

TABLE 8

SPEED ATTITUDE MEASURES: PERCENTAGE OF CORRECT RESPONSES BY CONTENT CATEGORY AND GROUP

Content Category	# of Items	GROUP Pre-ed.	Post-ed.	Post Lic.
Speeding and Risk	5	51%	55%	55%
Speed limit	2	35%	45%	45%
Peer Influence	7	51%	51%	51%
TOTAL	14	49%	51%	51%

As the table indicates, there is little attitudinal difference among groups in any of the three major content areas. Fully 70% of the "pre" group and 80% of the other subjects believed that people could reduce the risks inherent in driving by not speeding. Yet more than 60% indicated they would speed if they were "a couple of minutes late." The vast majority also felt it could be safe to speed "when there is no one else around."

Half of all subjects said they believed it was never safe to speed. Yet, when presented a tempting situation (being the only driver on an expressway), barely one-quarter selected the safest response: "almost never safe to speed." Only a quarter of the "pre" group and a third of the other subjects believed speed laws should be strictly enforced.

A similar apparent discrepancy seemed to surface in the area of peer influence. While 70% of all subjects said they would not drive faster if their friends urged them to do so, only half of the licensed group and one-third of the other subjects identified "when alone" as the time when they are most likely to speed. Most selected "driving with a group of friends" as the time when they are most likely to speed. In answer to another question, less than half of each group indicated they would insist or ask other passengers in a car to stop their efforts to make the driver go faster.

Discussion

Both knowledge and attitude deficiencies were widespread in all content categories pertaining to speeding. Most subjects knew, and--in theory--believed that speeding increased their accident risks and that high-speed accidents could have serious consequences. However, they did not appreciate the degree to which speeding places young drivers in jeopardy. Specifically, the majority appeared to believe speeding was worth the increased risk if it meant saving a few minutes. Subjects consistently tended to overestimate the amount of time that could be saved by speeding and under-estimate the extent to which speeding increased stopping distance. Subjects also exhibited a deficient understanding of the concept of adjusting their speed to that of other traffic and the principles for adjusting speed to exit or enter expressways safely.

While subjects tended to deny caving in to peer pressure, most believed they were more prone to speed when accompanied by their friends. It appeared that about 30% of the subjects would speed when urged to do so by their friends (e.g., respond to overt peer pressure). However, an even larger percentage seemed to be motivated to speed by the mere presence of friends in the car (perceived peer pressure). As there seemed to be little willingness to intervene when others were driving fast or were urging a driver to drive fast, there did not appear to be much raw material to draw from in terms of focusing a supplemental program on peer intervention techniques. Compared to results obtained from similar questions asked in the alcohol area, far fewer subjects felt they would be supported in intervention efforts. Rather, about as many believed their friends would support those wishing to speed as believed they would receive support if they tried to discourage speeding.

Restraint Use Deficiencies

Results of knowledge and attitude deficiency testing are presented separately and followed by a brief discussion.

Knowledge Deficiencies

The average percentages of correct responses on knowledge items are presented in Table 9. As more than 80% of the subjects knew that safety belts reduce the chances of injury in crashes at all speeds, responses to that item were not calculated into this table.

TABLE 9

RESTRAINT KNOWLEDGE MEASURES: PERCENTAGE OF CORRECT RESPONSES BY CONTENT CATEGORY AND GROUP

Content Category	# of Items	GROUP Pre-ed.	GROUP Post-ed.	GROUP Post-Lic.
Effectiveness	4	47%	56%	53%
Adjustment	4	44%	51%	53%
Responsibility toward others	2	40%	43%	48%
TOTAL	10	44%	51%	52%

In general, pre-education subjects were slightly less informed on safety restraints than the other two groups. Driving experience appeared to generate no greater understanding of the effectiveness and proper use of restraints, beyond the modest advance achieved by students completing driver education.

Overall, about 60% of the total sample knew that people thrown out of a car in a crash were more likely to be killed or severely injured than those who remain in the car. Exactly 55% of each group knew that wearing a lap belt alone can lessen the impact of an occupant jackknifing into the dashboard, although it will not prevent the impact.

Subjects appeared to be susceptible to myths concerning the "dangers" of safety belts. Only about half (52%) of the pre-education group and two-thirds of the other subjects knew that people thrown out of a car in a crash are more likely to be killed or severely injured than those who remain in the car. Even more potent was the myth about being trapped by belts in a sinking or burning car. Only a quarter of the pre-education and the post-licensing groups rejected the notion that belts would prohibit or slow escape from these crashes. And 60% of the post-education group also fell prey to this myth.

While 78% of the total sample knew that properly adjusted headrest restraints could lessen neck injury, only about 40% knew what position constitutes "proper adjustment" for head restraints. Only 40% knew that wearing a safety belt too tight is better than not wearing a belt at all, and fewer still knew that a properly adjusted shoulder belt would fit somewhat loosely.

Less than a third of the total sample knew that unrestrained passengers are more frequently the source of crash injuries than are loose objects or safety belts themselves.

Attitude Deficiencies

The average percentages of "safe" responses are presented in Table 10.

TABLE 10

RESTRAINT ATTITUDE MEASURES: PERCENTAGE OF CORRECT RESPONSES BY CONTENT CATEGORY AND GROUP

Content Category	# of Items	GROUP Pre-ed.	Post-ed.	Post-Lic.
Self-Protection	10	44%	53%	44%
Responsibility Toward Others	10	46%	53%	44%
TOTAL	20	45%	53%	44%

As can be seen, a similar pattern exists for knowledge and attitude deficiencies among pre- and post-education groups. While the post-licensing group appeared to suffer no degradation in restraint knowledges, the improvement in attitude apparent among post-education subjects seems to be completely vitiated among this generally older group.

Subjects appeared to view safety belt use as relatively unimportant to them personally. Less than half felt that the condition of a car's safety belts should be a factor in deciding as to whether or not to buy a car. Fewer than one in six believed that, if they did buy a car with defective belts, they should have them repaired before driving the car.

Subjects ascribed "good" motivations to those who did use belts. Half overall--and three-quarters of the post-education group in particular--felt that adults and friends who used safety belts did so out of concern for safety. However, many felt such behavior to be overly cautious. Even though more than 80% knew belts could protect them in crashes occurring on short, low-speed trips, only about a third felt wearing belts on such drives was a reasonable precaution. Only about half of the pre- and post-education subjects--and but a quarter of the post-licensing group--felt adjusting belts properly was worth the time it took. Less than a quarter of all subjects felt it would be worth the trouble to dig belts out from under a car seat and wear them.

The fragility of subjects' perception of self-interest in wearing belts was perhaps most strongly indicated by responses to an item that required subjects to assume they had "taken the trouble" to buckle up and were then asked by a friend not to wear the restraint. Although three-quarters of the total sample indicated they would leave their belts on, 28% of the pre-education group and one-fifth of the other subjects felt they would, in fact, unbuckle.

While 62% of the pre-education group and more than three-quarters of the other subjects said they would feel at least partially responsible if a friend they were driving around with was injured as a result of not wearing a belt, this belief did not appear to lead them to feel that they should actually do something to encourage their friends to buckle up. Only about half felt it would be acceptable merely to ask friends to buckle up, and only about 40% said they would second someone else who asked others to buckle up.

Relatively few believed in the efficacy of a driver setting a good example. Only a quarter viewed a driver's failure to buckle up as a sign of lack of concern for passengers. And only slightly more than 40% of the pre- and post-education groups and a quarter of the post-licensing subjects felt that passengers seeing a driver buckle up would follow suit.

Discussion

Altogether, the results indicate that young drivers are not well informed about safety restraints. Indeed, many are misinformed about the "dangers" of restraint use. In addition to the need to eradicate misconceptions of this nature, the data indicated a strong need to educate and convince young drivers of the dangers posed to and by unrestrained passengers.

The need to develop restraint modules that would produce a much improved attitude toward belt use was obvious. Of equal importance to module development was recognition of the fact that the level of attitude improvement apparently engendered by driver education programs is not sustained among slightly older teenagers. Supplemental modules need to be designed with an eye to a longer-lasting, as well as far greater improvement in attitude.

Hazard Perception Deficiencies

Results of knowledge and performance deficiency testing are presented separately and followed by a brief discussion.

Knowledge Deficiencies

The average percentages of correct responses on knowledge items are presented in Table 11.

TABLE 11

HAZARD PERCEPTION KNOWLEDGE MEASURES: PERCENTAGE OF CORRECT RESPONSES BY CONTENT CATEGORY AND GROUP

Content Category	# of Items	GROUP Pre-ed.	Post-ed.	Post-Lic.
Recognition of Two-Wheeled Vehicle Hazards	26	40%	46%	44%
Response to Two-Wheeled Vehicle Hazards	13	48%	52%	53%
Recognition of Pedestrian Hazards	8	48%	54%	55%
Response to Pedestrian Hazards	2	40%	45%	40%
TOTAL	49	44%	49%	48%

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In general, young drivers appear to be aware that a key source of conflicts between pedestrians or two-wheeled vehicles and motor vehicles is failure of one party to see the second party. While subjects realized it was possible for a driver's view to be blocked, they were just as likely to ascribe his failure to see a hazard to "not paying attention" as they were to the presence of a physical obstruction of view.

Although subjects' ability to recognize hazardous situations developing was not impressive in any given scenario, they seemed least able to recognize the dangers inherent in a vehicle coming up upon another vehicle from behind. Specifically, the vast majority of subjects did not appear to anticipate that pedestrians or two-wheeled vehicle operators ahead of them might fail to hear them approaching, nor did the anticipate that a bicyclist coming from behind might attempt to pass them on the left at the same time they began a left-hand turn. Subjects also did not know to check to the right for bikes riding against traffic before they pulled into an intersection.

Certain knowledge deficiencies peculiar to motorcycle hazards were identified as well. Specifically, subjects tended to over-estimate the capabilities of both the motorcyclist and the motorcycle. All but 15% of the subjects viewed most motorcyclists as having good to excellent handling skills. The majority also believed that motorcycles can accelerate faster and stop more quickly than can cars. While three-quarters of the subjects knew that most motorcycle/automobile crashes occur as the result of the car driver not having seen the motorcyclist, only one-quarter of the subjects knew that the best way to spot a motorcyclist in traffic is to look over car roofs for the motorcyclist's helmet.

Performance Deficiencies

Video tapes of the subjects' performances were examined at three levels. The tapes were studied to determine whether or not subjects registered any response to the 11 hazardous situations encountered during the controlled off-street route. Subjects were considered to have responded if they either released the accelerator or initiated braking. These responses were elements of the "proper" response common among all hazards encountered. The tapes also were examined to determine whether drivers separated laterally from the hazards. Lateral separation was not held to be an essential response, however. If drivers slowed sufficiently to accommodate a hazard (e.g., to let a bicyclist pass a parked vehicle before being overtaken by the DPMAS vehicle), lateral separation would not be needed.

The analyses showed that there was very little difference in the responses of post-education drivers as compared to those of post-licensing drivers. Consequently, for the purposes of this discussion, the two subgroups have been collapsed into one.

Table 12 displays the result of the first analysis. It should be noted that, in some cases, the accelerator was already released or the brake already on at the time the hazard first appeared on the video tape. When this was the case, the subject was scored as "responding."

TABLE 12

HAZARD PERCEPTION PERFORMANCE DEFICIENCIES: PERCENTAGE RESPONDING PROPERLY TO HAZARD

Hazard	Release Accelerator	Initiate Braking
#1--motorcyclist passing lead vehicle in opposing lane (in front of DPMAS)	84%	53%
#2--motorcylist approaching obstacle in opposing lane (in front of DPMAS)	20%	10%
#3--bicyclist passing parked car (DPMAS overtaking)	74%	32%
#4--bicyclist approaching from right on cross street	100%	65%
#5--bicyclist on right roadside conversing with pedestrian on left side (DPMAS approaching)	47%	32%
#6--bicyclist in front of van on right roadside (DPMAS approaching)	100%	95%
#7--pedestrian, mid-block dart-out from right side of street	85%	60%
#8--pedestrian walking on right in roadway (DPMAS approaching from behind)	40%	10%
#9--pedestrian on sidewalk ready to cross from left	53%	32%
#10--pedestrian crossing from right, in front of stopping vehicle (DPMAS following vehicle)	95%	95%
#11--disabled vehicle on right roadside (DPMAS approaching)	49%	35%

As is evident from the Table, subjects did not fare well. More than 80% of the subjects were scored as responding appropriately for only five of the 11 hazardous situations. In only two of these situations (#6 and #10) did more than 80% of the drivers execute both desired responses: release accelerator and initiate braking. It should be noted, however, that in the other three "non-deficient" situations, more than half of the subjects did initiate braking as well as release the accelerator. The only hazards for which all subjects decreased velocity were #6--bicyclist entering road from behind van on right side; and #10-- pedestrian crossing from right in front of stopping vehicle. Because of the presence of the view-obstructing vehicles in both instances, it was not clear whether the subjects were responding to the "hazards" (cyclist and pedestrian), or to the vehicles themselves.

The hazards which revealed the greatest deficiency in response are #2, #5, and #11. Deficiencies also were identified in connection with hazards #3, #8, and #9. However, three-quarters of the subjects did release the accelerator in response to the bicyclist passing the parked car to the right of the DPMAS vehicle (hazard #3), and a similar percentage separated laterally from the pedestrian walking with traffic on the right side of the roadway (hazard #8), although few neither released the accelerator nor began braking in response to this hazard.

Hazards encountered during the open-road portion of testing were not identical to those staged, but they were similar enough to be compared. The most frequent hazard occurring on the open road was one similar to hazard #3, involving a bicyclist traveling in the same direction on the right side of the road. On the staged course, subjects responded correctly (by releasing the accelerator and separating laterally) 75% of the time. On the open road, in the normal traffic flow, they responded correctly only 50% of the time. Another commonly occurring hazard involved a bicylist approaching an intersection from the right. An appropriate response would be to release the accelerator, slow, and watch the bicyclist carefully. When this was staged, all subjects released the accelerator (or it was already off), and 65% initiated braking before passing the bicyclist. On-street, however, only a third of the subjects encountering this hazard responded correctly. This may reflect an expectation among the drivers that bicyclists will yield to traffic on higher speed, higher volume streets, more than they do on slower, lower volume streets.

Discussion

The results of both knowledge and performance testing were remarkably consistent. Overall correct responses in every category and every type of testing averaged around 50%. For example, the overall percent correct response recorded in the second anaylses averaged among all hazards encountered was 52%. In the analysis of open-road hazards, the correct response percentage was 57%. The finding that subjects tended to respond more consistently and more properly to hazards emerging from the right was deemed to be of little value in development of a supplementary training module. An instructional course could not very well focus on identifying and responding to hazards coming from the nine o'clock to twelve o'clock position. However, this finding did lead to the conclusion that it would be necessary to emphasize comprehensive scanning procedures, with special attention devoted to scanning for dangers coming from left front, left side, and behind.

Also evident was the need to provide instruction focused on both major areas of safe practice: identifying cues to potential hazards, and prescribing appropriate responses to the hazards perceived. Given the essential equivalency between the performances of post-education drivers and post-licensing drivers, it appeared that experience is not an effective teacher in the area of hazard perception and response.

Fuel Efficiency Deficiencies

Results of knowledge, attitude, and performance deficiency testing are presented separately and followed by a brief discussion.

Knowledge Deficiencies

The average percentages of correct responses are presented in Table 13.

TABLE 13

FUEL EFFICIENCY KNOWLEDGE DEFICIENCY MEASURES: PERCENTAGE OF CORRECT RESPONSES BY CONTENT CATEGORY AND GROUP

Content Category	# of Items	GROUP Pre-ed.	Post-ed.	Post-Lic.
Operation	18	33%	38%	40%
Selection	11	36%	37%	39%
Use	4	38%	40%	45%
Maintenance	1	45%	45%	45%
TOTAL	34	35%	38%	40%

The results are striking in several ways. First, knowledge in all four areas is relatively poor for all three groups. Indeed, they are the lowest of the five content areas tested. Tests of proportions conducted separately for each of the driver groups and for each of the content areas and a test conducted on the total table revealed no significant differences among the levels of knowledge and groups of respondents.

An item analysis conducted on each of the 34 knowledge items revealed no significant differences among the groups. While subjects' level of knowledge was uniformly low, the deficiency seemed most pronounced in the area of fuel penalties associated with the cold starts and cold weather and in the failure to recognize the major within-class differences of vehicle mpg ratings. In toto, the results indicate that the knowledge of most young people about fuel economy is relatively meager and neither present driver education programs nor accumulated driving experience increases that knowledge.

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Attitude Deficiencies

The average percentages of "fuel-efficient" responses on attitude items are presented in Table 14.

TABLE 14

FUEL EFFICIENCY ATTITUDE DEFICIENCY MEASURES: PERCENTAGE OF CORRECT RESPONSES BY CONTENT CATEGORY AND GROUP

Content Category	% of Items	GROUP Pre-ed.	Post-ed.	Post-Lic.
Vehicle Operation	7	25%	33%	35%
Vehicle Selection	3	38%	48%	42%
Vehicle Use	3	38%	42%	42%
TOTAL	13	32%	38%	38%

As can be seen from the table, subjects rarely selected the most fuel-efficient response, regardless of the content category tapped by the item. Deficiencies were somewhat more pronounced in the vehicle operation category, largely as the result of a rather widespread sentiment that efficient driving would produce fuel savings of little, if any, value. As nearly two-thirds of the total sample indicated the belief that fuel-efficient driving required little practice, it appears as though the common belief is that they could drive fuel efficiently if they wanted to, but that the savings would not be worth the extremely modest (as perceived) effort entailed in doing so.

A normal distribution of responses across the whole range of attitude levels (from least efficient to most efficient) was observed in the categories of vehicle selection and use. Apparently these are areas in which young people are willing to sacrifice fuel efficiency for other considerations (e.g., the pleasure of "just riding around with friends").

Performance Deficiencies

In the closed-loop course, the vehicle control task that most affected fuel consumption was acceleration after complete stops and when leaving curves. Results were analyzed to determine the relationship between fuel efficiency and rates of acceleration and to see whether the fuel consumption of the post-education post-licensed drivers differed.

It should be mentioned that the relationship discussed here between acceleration and fuel consumption (in terms of miles per gallon) is relevant only to vehicles with automatic transmissions. For cars with manual transmissions, the overriding determinant of fuel efficiency is the gear shifting technique used by the driver rather than the rate of acceleration.

The total amount of fuel consumed by each of the 20 drivers was recorded. The mean fuel consumption (in gallons) and standard deviation around that mean are presented separately for the novice and experienced drivers in Table 15.

TABLE 15

FUEL CONSUMPTION IN GALLONS BY NOVICES AND EXPERIENCED DRIVERS OVER A CLOSED COURSE

	Post-Ed.	Post-Lic.
Mean	.363	.361
S.D.	.040	.016
N.	10	10

Since there is no absolute criterion for "fuel-efficient" driving, it is impossible to determine whether the fuel consumption was high or low. What can be stated on the basis of these results is that there is no difference between the two groups in terms of mean fuel consumption. But there is a large difference between the two in terms of the interdriver variability ($F = 6.25$, $p < .01$). Variability among the post-education group was almost three times as high as among the other drivers. Among the former, the least efficient drivers consumed 70% more fuel than the most efficient. Among the post-licensing drivers, the least efficient consumed only 17% more fuel than the most efficient.

These data suggest that one of the effects of experience is to wash out initial individual differences and make behavior uniform and systematic. Although the analysis was cross-sectional rather than longitudinal, it is consistent with findings in other areas of driver behavior indicating that individual differences are large among novice drivers and small among experienced drivers (e.g., eye movement, Mourant and Rockwell, 1970).

The total fuel consumed by each driver over the five-mile route was calculated as well. The mean and standard deviation of fuel consumption for each of the two groups are presented in Table 16.

TABLE 16

FUEL CONSUMPTION IN GALLONS BY NOVICES AND EXPERIENCED DRIVERS OVER A STREET ROUTE

	Post-Ed.	Post-Lic.
Mean	1.71	1.68
S.D.	0.089	0.110
N.	10	10

53

As can be seen from the table, there were no significant differences between the two groups in mean or variance. A comparison of the means obtained in on-street and closed-course driving is meaningless because of the differing distances. However, a comparison of variability around mean consumption is a meaningful one. The standard deviations, shown in Table 16, when compared with those in Table 15, reflect increased variability for both groups. However, there is a much greater increase for the post-licensing group.

Among the post-education group, the least efficient driver consumed 21% more fuel than the most efficient driver. Among the other drivers, the least efficient consumed 25% more fuel than the most efficient. Comparisons of the variance and range of differences of the two groups of drivers on the two driving courses indicate that, in the absence of constraints imposed by other traffic, individual difference comes into play and the post-education population manifests a larger range of fuel-efficiency levels. In contrast, on-street driving imposes severe constraints on both groups of drivers and the range of fuel-efficiency levels among drivers in each group becomes smaller, reflecting the effect of the traffic environment more than the effect of the individual differences. It is probable that the remaining range of variations is due to momentary fluctuations in the traffic that are beyond experimental control. These results also suggest that the real-world traffic environment may greatly influence the level of fuel-efficiency and greatly reduce individual differences.

To determine whether the individual differences observed on the closed-loop course were carried over to on-street driving, the two measures of fuel consumption were correlated, yielding a Pearson correlation of .54. This means that approximately 25% of the variations among drivers in on-street driving may be accounted for by factors that are measured in an off-street course.

The data obtained on conservation of momentum in response to traffic controls, path obstructions, and upgrades were almost entirely qualitative. Any attempt to obtain quantitative data would have been extremely complicated and would have had to assume the homogeneity of various confounding variables, an assumption that probably would not have been warranted. The observations that were made revealed that the majority of both post-education and post-licensing drivers were totally inattentive to conservation of momentum. The drivers typically accelerated at the wrong times, often at a point where it was obvious that they would shortly have to brake.

Discussion

Of the five content areas in which testing was conducted, fuel-efficiency was the area in which the most profound and pervasive deficiencies were identified. The vast majority of subjects knew little about fuel-efficient driving techniques and failed to appreciate the extent to which vehicle selection, operation, and use patterns could affect their consumption of fuel.

It was also evident that subjects attached little importance to fuel conservation. Unlimited mobility rather than economy was the overwhelming concern in their view of personal transportation priorities. While fuel efficiency was accorded low priority in all content categories examined, the results suggested that one concern any supplemental module should key on would be attitude change regarding vehicle selection considerations. While attitude deficiencies were more profound in the vehicle operation area, the choice of vehicle is the single most critical decision affecting fuel consumption.

Performance testing indicated that on-the-road experience did not improve fuel-efficient driving skills. Neither post-education nor post-licensing drivers demonstrated fuel-efficient practices. Skills identified as deserving special emphasis in an instructional program were the ability to accelerate briskly and to conserve momentum in negotiating obstructions, climbing grades, and responding to traffic controls.

ASSESSMENT OF POTENTIAL FOR EXPANDED DELIVERY SYSTEM

One project objective was to identify delivery systems capable of supplementing driver education with programs aimed at young licensed drivers. As the primary goal of the project was to evaluate the educational effectiveness, rather than the institutional attractiveness of supplemental modules, the assessment of the potential of implementing the modules through an expanded delivery system was a necessarily limited endeavor--consisting of preliminary administrative analysis and a follow-up interview. Since these activities were conducted, NHTSA has conducted a more systematic and extensive examination of the potential for "networking" in the area of driver education.

For the purpose of this project, a number of potential delivery system organizations were divided into two classifications:

1. Supporting Organizations -Those organizations which can support a young driver education program by either enlisting the participation of other organizations or developing/ disseminating program material.

2. Direct Contact Organizations--Those organizations which can come into direct contact with the young driver population and administer educational programs.

Figure 6 lists organizations identified through this analysis within functional classifications:

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FIGURE 6

PRIMARY SOURCE DELIVERY SYSTEM IDENTIFICATION

SUPPORTING	DIRECT CONTACT
1. State Highway Safety Agencies	1. Licensing Agencies
2. State Supervisors of Driver Education	2. Adult Education
3. ADTSEA	3. Employers
4. Chambers of Commerce	4. Community Organizations
5. National Education Association	5. Mass Media
6. Automobile Manufacturers of America	6. Secondary Schools
7. Insurance Companies	7. Safety Councils
8. General Federation of Women's Clubs	8. Departments of Motor Vehicles
9. Automotive Information Council	9. American Automobile Assoc.
10. League of Women Voters	10. Service Organizations
11. Vendors of Education Material	11. Women Leaders for Highway Safety
12. HUFSAM	12. 4-H Clubs
13. Driver Education Leaders	13. Local Police
	14. Youth Traffic Safety Clubs

Preliminary Delivery System Analysis

Potential direct contact and supporting delivery systems were analyzed in light of the following characteristics:

> Audience--The specific population of young drivers served by direct contact delivery systems; the organizations which can be reached through supporting delivery systems.
>
> Activity--The general type of activity currently carried on by the delivery system.
>
> Effectiveness--An identification of facilitating or inhibiting factors bearing on the effectiveness with which the system could function in the program.
>
> Incentives--The incentives which exist or which could be made available to motivate delivery system participation; incentives which delivery systems could utilize to motivate youth participation.
>
> Materials--The types of materials which can be used by direct contact systems; the type of material development/dissemination assistance which can be provided by supporting systems.

The analysis was based on two source documents (McKnight and Simone, 1978; McKnight and McPherson, 1981), materials produced by the various delivery systems, and project staff familiarity with the delivery systems.

The characteristics of delivery systems thought to have the greatest potential for the supplemental program are summarized in Figure 7.

FIGURE 7

CHARACTERISTICS OF POTENTIAL DELIVERY SYSTEMS

DELIVERY SYSTEMS	AUDIENCE	ACTIVITY	EFFECTIVENESS	INCENTIVES	MATERIALS
Direct Contact 1. Youth Traffic Safety Clubs	K-12 Students	1. Various efforts to increase awareness of traffic safety	1. May have difficulty recruiting participants at senior high age 2. Actively seeking programs for senior high age	1. Organizational purpose is to bring safety information to young people	No limitations
2. Safety Councils	All drivers	1. Driver improvement 2. Defensive driving course instruction	1. May not be able to reach significant number of young drivers	1. Desire to implement new programs	No limitations
3. Licensing Agencies	All drivers A. Beginning B. Renewal	1. Licensing 2. Testing 3. Driver Manual 4. Driver Improvement	1. Reaches all new drivers 2. Can pass on information	1. Licensing incentives for young drivers 2. Seeks better safety programs	Limitations within various activities
4. Local Police	Secondary Schools	1. Traffic safety lectures 2. Public schools	1. Reach most high school students 2. Credible source 3. Access to local accident statistics	1. New material available for incorporation to programs	No limitations
5. AAA	Club members (some young drivers)	1. Various efforts to increase awareness of traffic safety among young drivers	1. Access to large membership 2. Relationship with localities 3. Local clubs	1. Desire for new programs	No limitations
6. Service Groups	Members (children of members	1. Local community activities	1. Credible status 2. May not have access to participants 3. May not have interest in program	1. Provide a service to communities, young people	Limitations due to funds and time available
7. National Assn. for Women Highway Safety Leaders	Members	1. Promotion of highway safety activities	1. May not have access to population 2. May be able to administer program	1. Participation in highway safety programs	No limitations
Supporting 1. Vendors of Educational Material	Schools	1. Supply schools with educational materials	1. Reach all secondary schools and curriculum supervisors	1. Need to promote new products 2. Financial gain	No limitations
2. State Supervisors of Driver Education	Individual Driver Education Programs	1. Promote and provide support for state driver education programs	1. Contact with all driver education instructors 2. Contact and influence with school superintendents	1. Desire to implement better driver education courses 2. Need to upgrade driver education	No developmental support/ no limitations on dissemination
3. ADTSEA	Driver Education Professionals	1. Improving and extending traffic safety education	1. Contact with most driver education professionals	1. Need to assist in the improvement of driver education	Limited to advertisement of material through existing publications
4. HUFSAM	Traffic Safety Community	1. Development and dissemination of traffic safety materials	1. Local community group contacts 2. Little contact with youth	1. Desire to reduce traffic accidents	No limitations
5. League of Women Voters	Local Community Groups, Employers, etc.	1. Participation in political and social issues	1. Little contact with youth 2. Politically oriented	1. Desire to improve community	Limitations due to level of commitment

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Delivery System Contact

The potential delivery systems listed in the chart were contacted to determine or confirm their potential for delivering supplemental instruction. Representatives of these organizations were contacted by either phone or mail and were asked a series of questions summarized below. These questions were intended to elicit opinions on the feasibility of administering supplemental driver education.

1. Does your organization currently participate in any driver education programs for young licensed drivers?

2. Could your organization participate in either a support or direct contact role?

IF YES: DIRECT CONTACT	IF YES: SUPPORT
3. What limitations are there to activities your organization can engage in?	3. What type of support could your organization offer?
4. What types of programs (e.g., lectures, film, demonstration) would your organization be most comfortable with?	4. What direct contact organization could your organization encourage to participate?
5. Can your organization recruit participants? How many? How?	5. What is the potential of these direct contact organizations?
	6. What material development assistance could your organization offer?

The results of this investigation indicate that while potential direct contact and support organizations do exist for delivering educational programs to young licensed drivers, numerous problems also exist. These problems must be resolved before delivery systems could participate. The identification of these problems or issues occurred during contacts with delivery system representatives and driver education experts.

The most frequently raised issues include those dealing with:

- Audience incentives
- System incentives
- Level of effort
- Resource availability
- Program

Figure 8 shows where these concerns become evident in the investigation.

FIGURE 8

ISSUES IN DELIVERING SUPPLEMENTAL DRIVER EDUCATION

	ISSUES				
	AUDIENCE INCENTIVE	SYSTEM INCENTIVE	RESOURCE AVAILABILITY	LEVEL OF EFFORT	PROGRAM IDENTITY
DIRECT CONTACT					
YOUTH TRAFFIC SAFETY CLUBS	X		X		
SAFETY COUNCILS	X	X			X
LICENSING AGENCIES	X				
POLICE PROGRAMS	X		X	X	
AAA	X	X			X
SERVICE GROUPS		X	X	X	
WOMEN LEADERS IN HIGHWAY SAFETY			X		
SUPPORTING					
VENDORS	X	X		X	X
STATE SUPERVISORS OF DRIVER ED.	X				
ADTSEA	X	X			
HUFSAM	X	X			
DRIVER EDUCATION LEADERS	X	X	X	X	X

Audience Incentives

The most pervasive concern expressed by all contacted was that even if a program were made available, recruiting participants would be problematic. Participants in basic driver education are motivated by the desire to qualify for a license and the added attraction of insurance premium reductions. These incentives do not apply once the driver is licensed. There is, therefore, little to motivate individuals to enroll in supplemental training.

This concern was often cited as the reason organizations might not be able to deliver programs. Organizations which are self-sustaining (e.g., Safety Councils) could not invest in a program for which an audience is not available. Organizations which seek to serve their members or the community will often have other programs available which generate more interest.

System Incentive

Both support and direct contact delivery systems need an incentive to participate. Often, this is satisfied by the knowledge that a large audience will be reached with important and desired information. In the absence of this, systems may require a financial reward or some other tangible benefit. Organizations which cited this concern linked the absence of a large market with the absence of a system incentive (financial or otherwise).

Some organizations would be willing to participate even with the knowledge that the audience would be small and the rewards few. These organizations are highway safety-oriented and thus have a responsibility to promote highway safety programs. Such organizations are few in number and many of these would decline to participate when opportunities arise to reach larger audiences.

Several experts expressed the feeling that legislative action would be required to guarantee participants and thus create an incentive for delivery systems. Such legislation might redefine an original license as a probationary license with graduation to a full license dependent upon meeting certain requirements such as graduation from a supplemental driver education course.

Level of Effort

Two concerns relating to the level of effort required for program delivery were cited by those contacted.

1. Delivery systems may not be willing or able to make a continuous long-range commitment.

2. Delivery systems may not be able to devote much time to program implementation even when they can make a long-range commitment.

Program Effort

Many potential delivery systems would be unable to spend a great deal of time in program implementation. Delivery of a program would be, for all organizations, an added responsibility taxing limited financial and personnel resources. The amount of time organizations could devote to a program would vary; however, it is likely that some would only implement portions of the program at sporadic intervals.

Most of those who expressed a willingness to become actively involved stated that efforts would have to be limited to what could be integrated with other activities.

Resource Availability

Tied closely to the problem of "level of effort" is the problem of resource availability. Few, if any, organizations are so flexible that they could easily take on added responsibility with little prospect of financial reward.

Local police traditionally visit high schools and lecture students in traffic safety. Usually, three or four officers are responsible for an entire county and have very little, extra time to devote to other efforts. It would be difficult to obtain additional personnel time on a volunteer basis.

A worthwhile program such as a supplemental driver education module would have to compete with other worthwhile programs for limited funds. A number of experts noted that many delivery systems would have to charge participants to cover the cost of the program. This would further reduce the prospects of recruiting participants.

Program Identity

Many potential delivery systems must be identified as the sponsor of a program before they will participate. Some organization representatives indicated that they would be unable to sponsor a supplemental driver education program unless it meets specific organizational objectives. A nationally oriented program may not be specifically suited to local delivery system objectives.

Many profit-seeking organizations such as the AAA or local Safety Councils may take the program and sell it as their own. While this would not be undesirable in itself, such organizations might adapt as well as adopt a program--a situation that could threaten the program's educational integrity.

Conclusions

It is evident that continuous, productive, and long-term delivery system participation in supplemental driver education may be available. However, the problems and considerations described herein suggest that such participation will be difficult to obtain. In fact, unless certain problems are resolved, widespread supplemental driver education delivered outside the basic driver education course would appear to be generally unfeasible.

The issue of audience incentive is the central issue to supplemental driver education. All other issues hinge on the resolution of that issue. If there is a way to motivate audience participation (aside from offering economically prohibitive rewards), system incentives will also exist. If the program has a large audience, then funds may be made available or organizations may be able to charge participants. Organizations are also more likely to make lasting commitments to a program that reaches a large audience and can be financially rewarding.

DEVELOPMENT OF MODULES

The identification of young driver deficiencies pinpointed shortcomings in the knowledges, attitudes, skills, and day-to-day driving practices of young drivers that need to be overcome through better training. The analysis of delivery systems provided insights as to the form of training needed. The next step was to develop, in each of the five content areas, training modules capable of overcoming the deficiencies identified and being handled through existing delivery systems. Print materials developed as part of this project are contained in Volume II of this report.*

General Approach

Each of the five content areas discussed has been extensively treated in traditional driver education. A great wealth of material has been developed to support this instruction. In order to succeed in improving behavior, where previous programs have failed, something other than the commonly employed instructional methods had to be used. The general approach taken was to place greater emphasis upon providing students with experience in the behavior to be sought, and placing less reliance upon the delivery of information to the students.

This emphasis upon experience is appropriate for two important reasons. First, a wealth of learning research has established the value of experience in facilitating learning. Experience is necessary in the development of skill and is also capable of having a powerful influence upon attitudes. Secondly, it is experience, or the lack of it, that primarily distinguishes young drivers from their older counterparts. One of the ways in which older drivers become better drivers is by behaving incorrectly, or observing others doing so, and then observing the consequences.

While experience may not be "the best" teacher, its acknowledged value as an instructional method made it a promising route to the correction of young driver deficiencies revealed by the analyses that have been described.

* Print materials used in the Energy-Efficient Driving module are presented in Vol. II of the NEEDS Final Report (McKnight, et al., 1981) and are not included in the second volume of this report. Similarly, the attitude and behavioral instruments used in conjunction with the Alcohol module are those presented in McKnight, et al. (1979). They also are not included in the second volume of this report.

The rationales underlying the development of modules and the descriptions of the modules and materials employed in field testing are described, content area by content area, in the remaining paragraphs of this section of the report.

Alcohol Modules

Research studies show that young people generally have a fairly good idea of how alcohol can affect a drinker. Despite having their opportunities to directly observe how alcohol affects drinkers and despite the knowledge (however it may have been obtained) of how alcohol does affect people, young people still tend to believe that they are not subject to the detrimental effects of alcohol. Indeed, some believe they drive better after a few drinks. Since the first faculty affected by alcohol is judgment, it is understandable that young people who drive after drinking often believe they are driving well or even better than normal.

Simply informing young drivers that they are not immune to alcohol and that, because of their vulnerability, drinking engenders great personal risk for them, is not enough to induce a change in their drinking/driving behavior. An 8-hour program prepared for NHTSA (McPherson, et al., 1976) did emphasize the risks engendered by drinking and the consequences--both short- and long-term--that may arise out of irresponsible drinking and driving. The experimental evaluation of this program showed that this program produced a significant and substantial knowledge gain among young drivers, but no significant change in attitude or self-reported drinking/driving behavior (McKnight, et al., 1979).

Approach to Alcohol Modules

The instructional needs identified through the analysis of young driver deficiencies could be categorized in terms of the behavior involved--self-directed behavior and peer-directed behavior. While both categories of behavior had been previously treated by the NHTSA program just referred to, it seemed desirable to make them the objectives of two different modules (1) to be able to devote more instructional time to each category of behavior, and (2) to permit instruction relating to each category of behavior to be evaluated separately.

Self-Directed Behavior

While the deficiency testing revealed the need to inform young people of the risks and consequences of drinking and driving, it appeared that the only way to break through the alcohol-induced misconception of personal immunity to alcohol's effects was to give young drivers an opportunity to see how alcohol affects them. If people who drink and drive could observe their impaired performance while sober, they would be in a position to make a rational judgment of their own ability and performance. If that experience could be arranged, it would seem likely that their perception of personal risk would increase.

One program that would permit young people to assess their own performance under the influence of alcohol would be a carefully controlled "drink--in." In this activity, individuals consume alcohol and, at given intervals during the consumption period, perform various tasks related to driving. A visual record is made of their performance so that they can later witness the degradation in performance level that occurs as blood alcohol concentrations increase. A visual record of performance would seem a most promising means of convincing participants that they are, indeed, affected by alcohol.

While project staff wished to cast a drink-in module, investigation into the feasibility of such an activity indicated that liability insurance would be a formidable obstacle. Potential sponsors would not conduct a program unless insurance were provided, and the costs of such insurance are extremely high. While the costs have not prevented the staging of drink-ins for demonstration purposes, they made use of this approach totally infeasible as an everyday instructional technique. An additional obstacle to implementation of drinking programs among the intended audience (16- to 18-year olds) are the drinking age laws in most States.

An alternative approach was to provide a vicarious experience--one in which selected individuals participate in a drink-in and others observe. Obviously, if this drink-in exercise were filmed, the size of the audience able to observe and assess would be enormously expanded. While the vicarious experience of watching someone else show the effects of alcohol is clearly different from observing its effect on oneself, it was thought that the experience might be sufficient to alter observers' view of themselves and their capabilities in their capacity as drinking drivers. In providing a vicarious experience, a critical consideration would be to select individuals with whom the audience could identify. In keeping with this consideration, project staff sought a film of a drink-in activity involving young people.

Peer-Directed Behavior

The evaluation of the NHTSA program mentioned earlier also pointed the way to an additional possibility. When McKnight, et al. (1979) divided self-reported behaviors into (1) one's own drinking/driving, and (2) attempts to intervene in the drinking/driving of others, the latter category showed a small but significant improvement. Surveys generally indicate that young people are more willing than older people to take measures to help protect their friends in drinking/driving situations. From these reports, it appears that, even though young people may not recognize their own vulnerability to alcohol, they are able to observe how alcohol affects their friends and to perceive when their friends are unable to drive safely because of having had too much to drink. According to a study done for NHTSA in 1979, those who are most likely to intervene to help others in drinking/driving situations are under 25 and have a high perception of risk.

From these studies, it appeared that even though an individual may not believe himself to be vulnerable to alcohol, he will be able and willing to intervene to help others so long as he (1) knows that they are at risk, (2) recognizes when they are impaired and (3) knows what to do to keep the affected individual from driving after drinking. Some alcohol safety programs give limited treatment to the subject of intervention, describing both the need for intervention and the techniques for intervening successfully. However, people are typically reluctant to intervene in the behavior of others, particularly when the individual to be intervened with is irrational, as is someone who has had too much to drink. One way to overcome this somewhat natural reluctance to intervene would be to provide young drivers with an opportunity to experience their first intervention in the protective atmosphere of the classroom. Through role-playing exercises, students would have an opportunity to gain both the skill required to intervene successfully and the confidence that they could do so.

Description of Alcohol Modules

Three modules--information, self-image, and peer intervention--were developed to meet the three categories of requirements just discussed. This section will describe each of the modules.

Alcohol Information Module

Both of the areas of alcohol instruction identified as having a possible salutary effect on drinking/driving behavior shared the same core of requisite content (e.g., communication of how alcohol affects people, how alcohol affects driving performance, how alcohol increases risks). A program consisting of this instructional base material would serve as a "core" informational module to both of the more "experience" oriented modules just described. Moreover, a group of young drivers given this informational module could serve as a control group to allow the effects produced solely by information to be compared with those produced by the vicarious drink-in experience and with those produced by the peer intervention role-playing experience.

The informational module presented the key content items identified by the deficiency testing as being necessary to communicate to young drivers. Critical knowledges to be communicated included the effects of alcohol, the relationship between alcohol consumption and risk, means of controlling the amount of alcohol consumed, and means of avoiding driving after drinking. The component also covered how to help others out in drinking/driving situations. Supporting materials include an Instructor's Guide, transparencies, and a Student Manual. The Instructor's Guide for the information module provides an introduction and a statement of goal and objectives. It provides a content outline for use in the instructor's presentation of information. To supplement the instructor lecture and to emphasize the major points being communicated, 14 transparencies were employed. Some presented simple picture charts; others merely contained words summarizing the ideas.

A Student Manual entitled "Drinking and Driving--Whose Problem Is It?" was prepared to augment the instructor's presentation of information. It was written conversationally to appeal to a youthful audience. Similarly, it presents ideas in contexts with which young people can readily identify. Contents emphasize that no one is immune to the effects of alcohol and that everyone needs to understand what those effects are, whether the individual drinks or not. The Manual explains:

- how alcohol works and how it affects the ability to drive
- the serious risks of drinking and driving and the relationship between drinking and driving and accidents

o ways to separate drinking from driving

o methods for controlling drinking.

The Manual concludes by summarizing the reasons for becoming involved rather than ignoring a drinking and driving situation. It also contains a brief description of a hypothetical situation involving a group of young people, one of whom has become too drunk to drive. The readers are asked to consider the circumstances and to decide what they would do if they were involved. The Alcohol Information Module was designed to require one class period for presentation.

Self-Image Module

A program designed to alter students' own drinking and driving behavior was labeled, for want of a better term, the "Self-Image" Program, in reference to its immediate objective--altering the image that students have of their own performance after drinking. The Self-Image Program requires about two class periods: the first to be used to present the information presented in the information program; the second to be used to present the filmed drink-in (vicarious experience) and conduct a class discussion concerning that film. The film complements the information component of the program and vividly demonstrates the effects of alcohol upon driving skills. Supporting materials used in the self-image module were an Instructor's Guide, the film ("Five Drinking Drivers"), and the Student Manual and transparencies used in the Information Module.

Instructor's Guide--The Instructor's Guide for the Self-Image Module contains an introduction and a statement of goal and objectives specific to this module. In addition to a content outline to guide the presentation of the information component, the Guide contains a brief summary of the film which instructors were to use as an introduction, guidelines for conducting the post-film discussion by students, and questions to start the discussion and to help instructors follow up on responses in a way that would draw out key ideas.

Film--"Five Drinking Drivers" was produced by Vermont's Project CRASH. In this film, five young people volunteer to take part in a drink-in while a stockcar race crowd watches. Each participant is interveiwed before the drink-in takes place, establishing the personal characteristics of the participants which was deemed necessary to promote audience identification with the participants. The film then shows events on the day after, when the five volunteers express their feelings of the experience, view news films that show their driving while impaired, and reexamine their attitudes about drinking and driving.

Peer Intervention Module

Like the Self-Image Module, the Peer Intervention Module begins with the delivery of basic information as per the Information Module. Following this, the program provides instruction in techniques for intervention in drinking/driving situations. During the program, students participate in role-playing activities designed to show them that it is possible to intervene and to feel comfortable doing so. Students first act out prepared scenarios and roles. Later they devise their own scenarios for role playing. Student discussion is used throughout, to help clarify information and to reinforce important ideas. The program required nine hours: one hour of the information presentaton, and eight hours of role-playing.

Supporting materials included an Instructor's Guide, prepared scenarios, and guidelines for student-prepared role-playing. The same transparencies and Student Manual used in support of the other modules were also used in support of this module.

> Instructor's Guide--The Instructor's Guide for peer intervention begins with the same introduction, statement of goal and objectives, and content outline for instructor presentation provided with the other modules. The Guide then explains how to conduct the program role playing in which students use the first scenario for practice to become familiar with this form of instruction. The Guide discusses how to make role assignments and how to monitor the role playing. In the final activity, students must play out roles and scenes they themselves have devised. The Instructor's Guide explains the purpose of this activity and outlines the student preparation that is necessary. Instructions are included for the instructor-led discussion to be held after each student-prepared skit.

> Prepared Scenarios--Each of the six prepared scenarios consists of a one-page description of events leading to a drinking/driving situation involving eight young people. Eight role descriptions are included with each scenario. The one-page scene provides general information for all of the role players. The individual role descriptions contain more specific information on perceptions and motivations to help each player in handling his or her role realistically. Players read only their own roles. In this way, dramatic tension can be created, and behaviors and reactions are likely to be more natural than if all players had read all roles.

> Guidelines for Student-Prepared Role Playing--The guidelines are a brief set of instructions to be followed by students in creating their own scenes and roles. The guidelines suggest that students draw upon their own experience or things they have heard about to create situations that are likely to occur or have, in fact, already occured. Students are asked to devise realistic characters and to reveal conflict about drinking and driving among these characters. The students are also directed to show what would happen or should happen to resolve the conflicts created.

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Speed Module

The most appropriate experiences to provide in attempting to combat excessive speed would be those that expose drivers to the consequences of high speed, including:

- Less time and space to respond to emergencies
- Greater crash forces during collisions
- Traffic citations and their consequences (fines, insurance costs, loss of license)
- Greater fuel consumption.

Approach to Speed Module

The approach taken was to provide students exposure to the consequences of excess speed through films and the printed word. While such exposure is certainly less vivid than that engaged through experiencing the consequences, it is certainly safer and more practical. It also differs somewhat from most treatments of the subject given driver education curricula and text, which tend to focus upon physical and man-made laws relating to the speed of vehicles. The approach taken also involved a group discussion in which students could share personal experiences involving the consequences of excessive speed, experienced as drivers, passengers, or witnesses.

Module Overview

The goal of the speeding instructional module was to reduce the frequency of speeding and speeding violations among young drivers. Content covers how speed limits are set (the rationale behind speed limits), the risks of speeding, the seriousness of the consequences attached to speeding violations and speeding accidents, and the benefits of good speed management. This content is presented by means of instructor presentation, a student manual, and a film. Presentation requires about one class period. The module concludes with an instructor-led discussion of the "reasons" for speeding, to show that they are not valid and to reinforce the facts and ideas presented earlier. The discussion requires about one class period, bringing the total time needed to conduct the module to two hours. Supporting materials for the speeding module include an Instructor's Guide, a Student Manual ("Speeding...Why Not?"), and a film, ("Why 55?").

Instructor's Guide

The Instructor's Guide begins with a brief introduction to the problem of speeding and its role in fatal accidents involving young drivers. The Guide lists the goals and objectives for the program and presents instructions for conducting each program activity. All program activities are then outlined.

The Guide is designed for use with any class size. The detailed content outline for instructor presentation parallels the content of the Student Manual. The Guide provides suggestions for shortening the presentation, if necessary (for example, if time is very limited). If students have read the manual prior to class and their responses to statements and questions by the instructor indicate they have retained the key ideas and facts, the instructor may cover the introductory material quickly and place emphasis only on the most important topics, which are marked by asterisks in the outline. The content outline includes statements to be used in introducing the film, "Why 55?," as well as questions to ask the students after they have seen the film. The activity that follows information presentation is a discussion of reasons for speeding. The Instructor's Guide provides some statements to use for beginning the discussion and a brief summary of counter-arguments for commonly used excuses for speeding.

Student Manual

The student manual is a short booklet entitled "Speeding...Why Not?" In it, ideas and facts are presented conversationally and are set in contexts that are appropriate for the student reader. The booklet discusses how speed limits are set, defines safe limits, and explains how drivers can manage their speed to stay within safe limits. The factors that determine stopping distance and the conditions that increase stopping distance are presented in detail.

The booklet lists the benefits of lower speeds and the serious risks of speeding, explaining benefits and risks in a youthful context to maximize their impact. The safety results and other benefits of the 55 mph speed law are touched upon. The booklet concludes with a discussion of some of the commonly used reasons and excuses for speeding, along with explanations of why these reasons and excuses are not valid. Manual content parallels and complements the content of the instructor presentation.

Film

"Why 55?" is a 20-minute film produced by Matrix International. While its title implies that it deals solely with the reasons for the 55 mph speed limit, in fact the film deals as well with the risks of speeding in general. It explains the relationship between speed and accident risk and accident severity and discusses the fuel savings achieved with lower speeds. Throughout the film, a number of drivers express their opinions (both positive and negative) about the 55 mph law. The film is narrated by James MacArthur and includes an appearance by Indianapolis 500 winner Rick Mears, who strongly endorses the 55 mph limit.

Safety Restraint Use Modules

From deficiency testing conducted in this project, it appears that young drivers have a relatively low perception of personal risk, i.e., the need to protect themselves with safety restraints (even though they know that restraint use can provide them with protection). It would appear that the low usage rate among young people is due in large part to the fact that they do not appreciate the magnitude of forces involved in a collision and the potential effect of those forces. Additionally, there may be a fundamental belief that the likelihood of an accident is low in general and virtually non-existent for each individual personally. And, finally, there is the matter of myths inhibiting the use of restraints which appear to be held by many young people.

Approach to Restraint Module

In an effort to employ an experiential approach to instruction in restraint use, three forms of experience were examined:

- o Accident experience
- o Impact experience
- o Vehicle control exerience

Accident Experience

The experience of being in an accident, while a potential influencer of restraint use, is not one that can be readily incorporated into training. However, exposure to someone who has been involved in an accident and thus had an opportunity to experience the consequences of belt use certainly seems feasible. Such a "testimonial" by an accident victim could involve either:

- o Someone who has avoided the consequences by restraint use.
- o Someone who has experienced the consequences through failure to use a restraint.

Of the two, the latter seems more likely to encourage restraint use, particularly if the individual manifested visible effects of the consequences in the form of a crippling or disfiguring injury.

A testimonial by someone who has been severely injured borders on the "scare tactics" that have been shown to be ineffective as a means of modifying behavior. However, the ineffectiveness of scare tactics can be traced to two factors that would not apply to the testimonial. First, they generally involve situations that are so unpleasant (e.g., blood and gore), as to cause the audience to "tune out" the presentation. The accident effects visible on the individual supplying the testimonial would certainly not be this extreme. Secondly, scare tactics have seldom been applied to specific behavior, such as fastening a restraint. In fact, it is rarely possible to identify what specific behavior they are attempting to "extinguish." These differences were believed sufficient to warrant at least an experimental assessment of a testimonial approach.

Impact Experience

Few drivers realize the magnitude of impact in even a low-speed collision. The results of the deficiency testing, along with other data, indicated an unwarranted confidence in the ability of an unrestrained occupant to withstand impacts at city driving speeds (e.g., 25 mph) without the aid of restraints. One approach that has been taken to counter this impression of invulnerability at low speeds has been use of a safety belt "convincer." This device allows individuals to safely experience impacts at speeds of 5-10 mph. Finding these impacts to be much greater than anticipated is expected to convince those who experience them of the need to use restraints even at low speed.

Vehicle Control Experience

The value of restraints lies not only in protection in impacts, but in the ability to maintain control of a vehicle during violent maneuvers. By keeping drivers behind the wheel, restraints help them to maintain control of the vehicle in an evasive maneuver, or following an initial impact.

One way to help young drivers appreciate the value of safety belts in controlling a vehicle is to let them experience violent vehicle maneuvers, both restrained and unrestrained by safety belts. These experiences can be gained quite safely and economically by operating vehicles through evasive maneuvers at relatively low speeds (e.g., 10-25 mph).

Description of Safety Restraint Modules

Modules were prepared to support each of the experiential approaches just described. The modules have been labeled:

- o Testimonial module
- o Convincer module
- o Vehicle module

In addition, an "Information Module" was developed to communicate the core information that would be required in an education program employing any of the experiential modules.

Information Module

This module requires approximately one class period for information presentation. The module consists of a relatively brief review of what happens in a collision, and explains the second or "human" collision. The odds of being in an accident and the benefits of safety restraints are also covered rapidly. Most of the information is presented by the film, which illustrates the consequences of various kinds of vehicle collisions and provides graphic demonstrations of the protection belts provide. The film also acknowledges and counters common myths concerning restraints. Supporting materials used in the information module and all other modules in the safety restraint area consisted of an Instructor's Guide, a film, and a Student Manual.

Instructor's Guide--The Guide provides a brief introductory statement of goal and objectives. A content outline is then presented, and followed by an introduction for the film. Guidelines to help the instructor conduct a post-film discussion are included as well.

Film--The film used was "Dice in a Box," a half-hour production from Canada that is set in Ontario. In the film, a young newspaper reporter interviews the local coroner who takes her to a wrecking yard, pointing out wrecked cars and talking about the role of safety belts. The coroner uses the cars and the accidents which brought them to the wrecking yard to illustrate his points. Throughout the film, the reporter questions the doctor on common myths about safety belts. He dispels these by explaining the facts, again illustrating his statements using the wrecked cars and drawing on his own experience. The film provides many statistics that support belt use, some from Ontario where the use of safety belts is mandatory.

Student Manual--The Student Manual, "Safety Belts--What Do You Think?" was used in this and all other restraints modules. The manual is conversational in tone, and much of the content is devoted to dispelling myths surrounding the use of safety belts. The booklet explains exactly what happens to occupants in an accident, and what is meant by the "human collision." Also explained is why and how belts protect drivers and their passengers. Statistics are presented throughout to support the facts about safety belts.

Testimonial Module

In this module, students viewed a "testimonial," presented by means of a slide/tape program. The module required one class period for delivery. The module is suited for delivery at student assemblies.

Instructor's Guide--The Instructor's Guide used in connection with the testimonial module contains introductory information useful in preparing students to view the testimonial. Discussion guidelines for use following the program also are included.

Side/Tape Program--The slide/tape program, "Stayin' Alive," was prepared by Peers Aiming Toward Highway Safety in cooperation with the Wisconsin Governor's Office on Highway Safety. The half-hour program tells the story of a young accident victim who sustained serious, permanently disabling injuries when he was thrown through the windshield of his car in a crash. The victim, Gary Erickson,

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was 17 at the time of the crash (1967). At first, he was not expected to live, and he remained in a coma for eight months. When he regained consciousness, extensive rehabilitation began. Erickson can now speak, but his words--heard throughout the program--are halting and slurred. In the slide/tape show, Erickson urges the audience to avoid his mistakes: drinking and driving and failure to wear safety belts. In addition to the dramatic impact of Erickson's voice, the program uses contemporary music and arresting photographs for added effect.

In-Vehicle Module

The information presentation segment is used to prepare students to ride as passengers in an instructor-driven vehicle. The car is driven over a prescribed course, where students ride restrained.

The module requires two class periods for delivery, assuming a class of about 25. With larger groups, the in-vehicle activity would require more time unless more than one car were used and additional support personnel could be made available.

Facility and equipment requirements for the in-vehicle segment of instruction are: an off-street area, a car, and traffic cones for marking the driving course. All materials are the same as those used with the information module except that the Instructor's Guide includes detailed guidelines for conducting the in-vehicle exercise, including safety precautions. A sample course layout also is provided at the end of the Guide.

Convincer Module

In this module, all students ride on a Seat Belt Convincer which simulates a low-speed crash and demonstrates the impact forces and the protection afforded by safety belts. Significantly, before this activity begins, students receive key information to set the stage for learning from this experience.

The program requires about two class periods, based upon a class of approximately 25. Larger groups again require additional time to complete the Convincer activity, unless additional sleds and instructors are available.

In addition to the usual materials, the module requires a Seat Belt Convincer sled and an open area in which to locate the sled. The Instructor's Guide lists the procedures to be followed in conducting the Convincer Ride activity and outlines an introduction for use in explaining this activity to students.

Hazard Perception Module

The analysis of young driver deficiencies evidenced substantial shortcomings in the ability to identify the hazards presented by bicyclists, motorcyclists, and pedestrians. Development of a module capable of overcoming these deficiencies was launched.

Module Approach

Through the years, special interest groups have attempted to create an awareness on the part of automobile drivers of individual categories of the road users (e.g., bicyclists, motorcyclists). Motorists have been asked to "look out for" a particular type of road user, but the messages rarely have been accompanied by instructions for specific action. Drivers cannot be expected to devote their total attention to seeking out pedestrians and cyclists (the hazards under consideration in this project). Young drivers must be given some way of recognizing those situations in which hazards from the presence of pedestrians and cyclists are most likely to arise. For example, the prospect of encountering a pedestrian/cyclist hazard is certainly greater and much more worth being concerned about in the vicinity of bicycle paths and hiking trails than along expressways or most open highways.

Even when proper search patterns are employed, there can be no guarantee that a hazard detected through this pattern will be perceived as a hazard. Even when found, the great majority of pedestrians and cyclists pose no true hazard to road users. They stay where they are supposed to be and do what they are supposed to do. Young drivers need to learn the characteristics and behaviors of pedestrians and cyclists that present the greatest risk.

The objective of the hazard perception program described here was to acquaint drivers with the highway traffic situations, the pedestrian and cyclist characteristics, and the behaviors that are most likely to result in accidents.

These situations, characteristics, and behaviors form cues to hazard recognition that can be taught to young drivers. Obviously, it would not be possible to provide a direct experience to communicate these cues and their importance to young drivers with a modicum of safety. Therefore, the hazard perception module attempted to involve students indirectly in hazard perception through the use of a film medium and subsequent discussion of the reactions stimulated by the visuals. The module and module materials selected for use in field testing are described in the following paragraphs.

Module Description

The goal of the hazard perception program is to reduce the frequency of accidents involving young drivers and motorcylcists, mopeds, bicycles, and pedestrians. The program explains to students why accidents involving these categories of hazards are a serious problem and provides information on key hazard detection principles, tying search activities to specific driving environments and to the activities and characteristics of other road users.

Information is presented by means of a slide/tape presentation and a problem-solving activity during which students view slides depicting examples of pedestrian/cyclist hazard clues and are asked to identify the clues and explain what might happen in each situation. Information content covers clues provided by the environment and by characteristics and activities of pedestrians and riders. The proper responses to perceived clues are explained.

The program requires about an hour to administer. Students first view the slide/tape presentation (15-20 minutes) and then participate in the problem-solving activity (20-25 minutes). Materials consist of an Instructor's Guide, a slide/tape presentation, and six problem-solving slides.

Instructor's Guide

The Instructor's Guide begins with a brief background description and then sets forth program goal and objectives. The two learning activities are described next. The Guide provides step-by-step instructions for conducting the two activities and lists required materials. A copy of the script for the slide/tape presentation is included in the Guide for instructor reference and use as necessary. Guidelines for discussion during the problem-solving activity are also provided.

Slide/Tape Presentation

The slide/tape presentation, "Hazard Clues You Can Use," is a series of 95 slides with synchronized narration. It explains that clues to hazards are found in three things: situations in which other road users are found, characteristics of the road users themselves, and the activities in which the road users are engaged. Examples of the three types of clues for each category of road user--pedestrian, bicyclist, moped rider, and motorcycle rider--are then presented and discussed. The presentation emphasizes that these road users often fail to look out for themselves and that for everyone's safety, automobile drivers must look for cues or clues to hazards so they can anticipate and prevent conflicts.

Problem-Solving Slides

The problem-solving slides are intended to reinforce and generalize recognition of the clues introduced in the slide/tape presentation. Each depicts a scene involving a pedestrian, a bicycle, a motorcycle, or a moped in which there are several hazard clues. The problem-solving activity and slides give students an opportunity to apply what they have learned and to discuss the transition from hazard recognition to proper response.

Fuel-Efficient Driving Module

Recent research has focused attention on the fuel-saving potential of specific driving behaviors by suggesting that certain changes in travel habits and driving techniques, together with the use of more fuel-efficient vehicles, could effectively reduce individual fuel consumption.

Since the oil embargo of 1974, more and more high schools have incorporated energy-efficient driving into their driver education programs. Several States prepare driver education curricula to guide the efforts of the schools, and publishers and media houses have developed materials to support the programs. Yet, although a number of claims have been made for the success of these programs, conclusive evidence of effectiveness has not been reported.

The results of the young driver deficiency testing evidenced marked shortcomings in knowledge, attitude, skills, and day-to-day driving practices related to fuel-efficient driving.

Research in Fuel-Efficient Driving

In arriving at an approach to alleviate young driver deficiencies, the project staff was fortunate to have available a recently completed NHTSA evaluation of various approaches to teaching fuel-efficient driving (McKnight, Goldsmith and Shinar, 1981). This research established that substantial gains in knowledge and changes toward more favorable attitudes could be obtained through the incorporation of fuel efficiency into high school driver education. However, none of the methods evaluated was effective in improving skills or driving practices, as reflected in measures of performance.

The techniques evaluated included several forms of in-vehicle instruction as well as the use of in-car feedback devices (vacuum gauges). The failure to improve performance was attributed to lack of "readiness" on the part of students. Novices whose ability to control the vehicle is marginal simply do not have the spare capacity to be able to attend to the needs of fuel-efficient driving.

The study concluded that there was little to be gained by the inclusion of fuel-efficient driving in behind-the-wheel instruction. The time devoted to such instruction fails to affect performance and takes away from the meager time currently available to develop basic vehicle handling skills.

The assessment of performance was confined to vehicle operation. There was no way to assess performance in vehicle selection, maintenance, or use, where opportunities to perform would not arise until long after the program had been completed.

Approach to Fuel Efficiency Module

In vehicle operation, an experiential approach to learning required finding a way of providing students an opportunity to encounter situations requiring fuel-efficient behavior without having to operate an automobile at the same time. The best way of confronting drivers with such situations would be through the use of motion picture film, which could be used to simulate a variety of situations calling for application of fuel-efficiency procedures. A driver "simulator" would allow actual vehicle control responses to be simulated. However, use of simulation would have restricted instruction to formal driver education, and only those schools having simulator equipment.

Fortunately, the vehicle control responses involved in fuel efficient driving are quite simple. What needed to be learned was an association between those responses and circumstances calling for them, e.g., changing lanes to circumvent stalled traffic ahead and maintain momentum. It seemed likely that the required associations could be established more firmly if the situations were presented pictorially, as they would appear in actual driving, than if they were simply described verbally. Instruction then required development of a motion picture film that would present situations critical to fuel efficiency as they would be seen by the driver of an automobile.

Vehicle operation was the only aspect of fuel-efficient driving that was susceptible to an experiential treatment. Students cannot be provided "experience" in selecting vehicles, carrying out maintenance, or altering patterns of daily vehicle use. However, it was possible to generate classroom exercises that would allow students to carry out many of the decision processes involved in these activities.

Module Description

Using the approach described, a fuel-efficient driving module was prepared. The module consists of the following segments:

- Operating techniques
- Trip planning
- Vehicle selection and maintenance.

The segments are designed in a way that allows them to be either combined to form a separate energy-efficient program or integrated into an existing driver education course. All segments are confined to classroom instruction. No in-car instruction is given. This permitted a test of the program's ability to lead to energy-efficient driving without what had appeared to be the unjustifiable expense of in-car instruction. Approximately three hours are required to administer the entire module.

Operating Techniques

The segment on operating techniques provides both a general introduction to energy-efficient driving and a detailed presentation of operating techniques. The introduction included a discussion of the importance of fuel conservation, and an overview of vehicle operation, use, maintenance, and selection.

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As noted previously, because students lack the vehicle handling skills to permit operating techniques to be effectively practiced during training, it seemed necessary to implant the techniques in students' minds in a way that would foster their retention for application at a later date. This was done by associating each operating technique very strongly with the situation to which it applies. For example, the technique of timing one's approach to an intersection so that a left turn may be made across traffic without stopping was tied to the visual perception of an intersection.

To help make the appropriate mental connections, a film encompassing the full range of energy-efficient operating techniques was prepared. For each procedure, the film displays the driving situation and the appropriate response to it. Scenes are presented from the driver's point of view so that students see each situation as they would from behind the wheel of a car. The final portion of the film introduces the subjects of trip planning, vehicle selection, and vehicle maintenance. The segment concludes with an instructor-moderated discussion of operating procedures.

This section also includes an in-car checklist that may be used by instructors and student observers to guide application of operating techniques in the highway traffic environment. The instruction may be integrated into regular in-car instruction or provided separately. This portion of the segment was not used in the field test of the module because of the lack of evidence from prior research that it contributed anything to fuel-efficient driving.

Trip Planning

In the trip-planning segment, students view a slide/tape presentation on trip planning and then participate in a classroom exercise in which they figure out how to attain a set of travel objectives with the fewest trips.

Vehicle Selection and Maintenance

This segment consists of an activity during which students choose a fuel-efficient vehicle for each of three fictitious families.

Program Materials

Supporting materials for this three-hour module consist of an Instructor's Guide, student reading materials, a film, a slide/tape presentation, and four transparencies.

> Instructor's Guide--The Guide provides brief background and sets forth the goals and objectives. It next presents a summary of the program content in outline form and explains how the content can be reinforced and emphasized throughout the regular driver education curriculum. The Guide contains instructions for conducting each of the learning activities and lists and describes the required materials.

Student Reading Materials--One handout is a basic student reference covering driving skills, vehicle maintenance, trip planning techniques, and vehicle selection. It contains information to prepare the student for classroom instruction. Other materials include a checklist of points covered in the fuel economy content areas, and handouts supporting the in-class exercise in which students are asked to select new fuel-efficient vehicles for three fictitious families.

Film--The film used for the module is entitled "S.A.F.E. Driver." It presents information on fuel-efficient operating techniques and shows proper and improper techniques from a behind-the-wheel perspective. Fuel-efficient behaviors in the three other fuel economy content areas are also touched upon in the film.[1]

Slide/Tape Presentation--"Short Trip Penalty" is a 10-minute slide/tape presentation that supports the trip planning learning activity. It illustrates the fuel penalties involved in short trips around town.

Transparencies--Four transparencies are used for the student trip-planning exercise. The transparencies include a "neighborhood map" and a sequence of errands that must be planned in a fuel-efficient manner.

1 Development of the film was funded by the Maryland State Police and followed guidelines established by the project staff.

PHASE II--PILOT TESTING OF EXPERIMENTAL MODULES

The experimental modules were evaluated for their potential to improve critical knowledges, attitudes, and behaviors among 16-18 year olds. Pilot tests occurred in high schools.

In three of the content areas (Drinking/Driving, Hazard Perception, and Energy-Efficient Driving) the modules were delivered during driver education classes. The Speeding and Restraints modules were delivered to licensed students who regularly drove to and from school.

The remainder of this section describes the methodology used in pilot testing and presents the results obtained.

ALCOHOL MODULES

The Self-Image and the Peer Intervention modules were tested to determine their effectiveness in developing knowledge, changing attitudes, and modifying behavior. These same criteria were applied to the Information module which was assessed twice--once at each of the locations where the other modules were being implemented. As mentioned in the earlier section of this report, the information-only module was used primarily as a means of measuring the relative effectiveness of the other two alcohol modules. There was no great expectation that an information-only approach would be effective in changing attitudes or modifying behavior. Since somewhat different procedures were used in pilot testing the Self-Image module and the Peer Intervention module, the test methodologies employed will be described separately.

Self-Image Module

The Self-Image module was tested in July 1981 during the Summer School Session at Friendly Senior High School, Oxon Hill, Maryland.

Test Design

A "before and after" design was used. Results of the Self-Image module were compared with results of the Information module. Measures of knowledge, attitude, and behavior were administered prior to and following program delivery.

Test Population

The test population consisted of six driver education classes randomly divided into treatment and comparison groups of three classes each. The treatment group had 76 students. The comparison group had 73. Both groups included males and females.

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Administration

The group receiving the Self-Image module was designated as the "Treatment" group. They received this module over two consecutive days. Delivery took two full class periods. The comparison group received the information module, which was delivered during one and one-half class periods over two consecutive days. Both modules were conducted by a member of the project staff who is a qualified, certified instructor, experienced at teaching high school students.

Peer Intervention Module

The Peer Intervention module was tested at Bowie High School in Bowie, Maryland, in March and April 1981.

Test Design

Again, a "before-and-after" design was used. As results of the Peer Intervention module were to be compared with results of the Information module, measures of knowledge, attitude and behavior were administered prior to program delivery to establish the prior equivalence of the "Treatment" group (those receiving peer intervention instruction, and the comparison group).

Test Population

The test population consisted of six classes of driver education students randomly divided into treatment and comparison groups of three classes each. The treatment group totaled 69 students. The comparison group totaled 58 students.

Delivery

The modules were delivered during the school day. The Peer Intervention module was delivered during nine class periods on nine consecutive school days. The Information module was delivered to the comparison group during their regular driver education class period in one day (approximately one hour). The instructors for both groups were experienced driver education teachers on the Bowie High School staff.

Measuring Instruments

Measures of knowledge, attitude, and behavior were employed to assess the effects of the alcohol modules. All three types of measures were drawn from the Youth Alcohol Criterion Measure developed through a previous NHTSA project (McKnight, et al., 1979).

Knowledge Instrument

Data on knowledge were collected by means of a paper-and-pencil test. The knowledge test consisted of 20 multiple-choice questions. Two forms were used to allow students to receive alternate forms on the pre-test and post-test administration. Norms furnished with the knowledge test were employed to eliminate differences in test difficulty from the pre-post comparisons.

Attitude

Attitude measures also were of a paper-pencil format. Three different measures were used: one obvious and two subtle.

> Obvious--This type permits direct assessment of attitudes underlying drinking driving behavior. Two forms were used. Each contained 21 multiple-choice questions. Students were asked to select the answers that corresponded most closely to their opinions. Norms furnished with the measure were used to eliminate differences between the two forms from the pre-post comparison.
>
> Subtle--Two subtle attitude measures were used: projective and pseudo-knowledge. The projective measure contained 20 photographs that students were asked to interpret by selecting an answer from 20 associated multiple-choice questions. Students were expected to "project" their attitudes into their interpretation of the pictures. The pseudo-knowledge measure was an opinion scale disguised as 18 multiple-choice questions. The answers selected reveal attitudes. Only one form of each of the two subtle measures was used.

The obvious measure is designed to assess specific beliefs concerning alcohol and is the appropriate measure of assessing educational outcomes. The subtle measures are more sensitive to general feelings about alcohol and designed primarily to corroborate the results of the obvious measure. If the subtle and obvious results do not correlate with one another, one may be suspicious as to the honesty reflected in the results of the obvious measure.

Behavior

Data on behavior were collected by means of a self-report containing 37 multiple-choice questions, including questions about the frequency of behavior and the intensity of behavior. For purposes of the present study, questions were divided into the following three categories:

> Drinking/Driving Behavior--Questions relating to the individual's own drinking and driving.
>
> Host Behavior--Questions about the individual's behavior as a host to parties involving drinking/driving.

Intervention Behavior--Questions concerning the individual's behavior in intervening with the drinking and/or driving of others.

Administration of Measures

The measures were administered to students in the two schools according to the following schedule:

Pre-test--Immediately prior to administration of the module.

Post-test--Immediately following administration of the module.

Followup Test--Six months following completion of the module.

The knowledge and attitude measures were administered at all three points in the schedule. Where alternate forms were employed (knowledge, obvious attitude), half the students took each form on each administration, just to prevent any possible unnormalized differences from affecting the comparison. One group received forms in sequence A-B-A, while the others had the sequence B-A-B. The behavior measure was not administered as a post-test since it takes several months to experience enough exposure to drinking/driving situations to provide meaningful reports of behavior.

Data Analysis

Data were analyzed for those students receiving all administrations of a measure (that is, any student who missed one or more administrations of the measure was dropped from the sample). This was necessary to keep the sample the same across pre, post, and follow-up administrations and thus assure that any differences were due to differences in the characteristics of the students and not differences in the composition of the sample.

Mean scores for students on all administrations of all measures were obtained. The significance of pre-post and pre-followup differences in means were assessed by t-tests of correlated measures.

Results

Because the Peer Intervention module and the Self-Image module differed in their objectives, they cannot be compared directly. Each is, therefore, discussed separately here.

Self-Image Module

Results will be presented and discussed separately for attitude, knowledge, and behavior measures.

Attitude

Results obtained from the obvious measure of attitudes appear in Table 17. Both groups of students, those receiving the Information module and those receiving the Self-Image module, evidenced a significant shift toward an attitude that was more favorable to responsible drinking and driving. There were no significant differences between the Self-Image and Information modules at any of the three administrations.

The magnitude of the shift--3-4 points--is small, equivalent to a change of one response category on each of three items. However, the change may not be quite as small as it looks, since the standard deviation of the attitude measure was only 8 points, meaning approximately two-thirds of the students fell in a range of (2 x 8 =) 16 points. Also, the students had a somewhat favorable attitude to begin with, scoring approximately 3 points higher than students elsewhere (McKnight et al., 1979). There may not have been a great deal of room for improvement.

Students receiving the Information module appeared to show an improvement in attitude from post- to followup-test. This could reflect the effect of experiences following completion of the module or could be a chance result. Since the difference between post-test and followup-test was not significant, the latter explanation is the more acceptable.

TABLE 17

**SELF-IMAGE MODULE:
MEAN ATTITUDE SCORES**

Module	N	Pre	Post	Pre/Post Difference	Followup	Pre/Followup Difference
Self-Image	54	48.4	52.3	+3.9*	51.6	+3.2*
Information	51	47.8	51.0	+3 2*	52.3	+4.5*

* $p < .01$

The attitude measure samples opinions dealing with all aspects of drinking and driving. Those items dealing specifically with one's own drinking and driving behavior were analyzed separately from other items (general attitude items and items dealing with the drinking and driving behavior of others). No significant difference was obtained between the two types of items; both showed equivalent attitude change.

The correlations between the obvious and subtle measures of attitude ranged generally between .3 and .5, in keeping with previous findings. One exception was the followup administration to the group receiving the Self-Image module, where the correlations disappeared (r=.09). With a relatively small sample (N=54) this could be a chance finding. On the other hand, it may mean that some of the students were, for one reason or another, falsifying their responses to the obvious measure. This may help account for the fact that the scores of the Self-Image group on the followup administration fell below those of the Information group after being slightly higher on the previous two administrations.

In summary, the informational component of the Drinking/Driving modules produced a small but significant shift of attitude in the desired direction. The addition of the film designed to alter students' image of themselves when they drink did not have any additional effect upon attitude, either attitudes toward drinking and driving generally, or those concerned with one's own drinking and driving.

Knowledge

Results obtained from administration of the knowledge test appear in Table 18. Both modules, Self-Image and Information, produced substantial and statistically significant knowledge gains. The gains appear fairly sizable in comparison with the standard deviation of approximately .3 for pretest scores.

TABLE 18

SELF-IMAGE MODULE: MEAN KNOWLEDGE SCORES

Program	N	Pre	Post	Pre/Post Difference	Followup	Pre/Followup Difference
Self-Image	71	11.5	15.2	+3.7*	14.8	3.3*
Information	61	10.5	14.8	+4.3*	14.6	4.1*

* $p < .01$

There were no significant differences between the two groups in any of the three administrations. The fact that the Information group evidenced a larger gain may be attributable to the fact that it had a lower score to begin with and therefore had somewhat more room for improvement.

Behavior

Neither the Self-Image nor the Information modules produced significant changes in behavior from pre-test to followup-test on any of the three categories of behavior: drinking-driving, host, and intervention. The inability to influence the student's own drinking and driving behavior is consistent with the findings of the evaluation of the NHTSA program described earlier. Evidently, the vicarious experience of watching somebody else under the influence of alcohol did not achieve the desired goal of influencing the image that students had of their own drinking-driving behavior--at least not to the degree necessary to alter their behavior.

The NHTSA program, as previously noted, produced a small but significant change in intervention behavior. However, that curriculum was 8-1/2 hours long and devoted considerable attention to intervention. Within the one-hour information component of the Self-Image module, the treatment of intervention behavior was proportionally smaller. Apparently there was insufficient instruction to yield a change in behavior.

Discussion

Overall the results obtained from the Self-Image module parallel those of earlier efforts. There is a significant gain in knowledge and attitude unaccompanied by any change in behavior. If the filmed drink-in was successful in altering the student's image of their own drinking and driving behavior, it was not reflected in their behavior.

It cannot be concluded that the drinking and driving behavior is incapable of being influenced by instructional programs. There could conceivably be changes in behavior that were not reflected in the behavior measure. Finding changes in measured knowledge and attitude are encouraging. However, the failure of any difference to materialize between the Self-Image and the Information group on any of the measures suggests that the filmed drink-in is not really accomplishing anything.

Peer Intervention Module

The results of the Peer Intervention module, like those of the Self-Image module, indicate changes in attitude and knowledge. They also indicate a change in behavior.

Attitude

The results obtained from administration of the attitude measures appear in Table 19. The Peer Intervention module showed an attitude shift similar to that obtained from both the Self-Image and Information groups (Table 17). The Information module, on the other hand, produced a somewhat smaller change to begin with and a drift back to the point of non-significance on the follow-up test.

Those attitude items concerned primarily with peer intervention were separated from other items (general items and those concerned with self-image). Both categories gave similar results; the Peer Intervention group showed a larger attitude shift in both categories than the Information group. Correlations between the obvious and subtle attitude measures ranged between .3 and .5, indicating that students were generally truthful in responding to the obvious measure.

TABLE 19

PEER INTERVENTION MODULE:
MEAN ATTITUDE SCORES

Program	N	Pre	Post	Pre/Post Difference	Followup	Pre/Follup Difference
Peer Inter-vention	42	44.9	47.4	+2.5*	47.6	2.7*
Information	50	45.0	46.9	+1.9	46.0	1.0

* $p < .05$

It is somewhat surprising that the same Information module that produced a large change within the school in which the Self-Image module was studied (Table 17) produced only a small change in this case. The difference may have to do with the characteristics of the students in the two schools. The differences between the pre-test scores shown in Tables 17 and 19 suggest that the two samples of students were different from one another.

Knowledge

Knowledge test results appear in Table 20. Both modules produced a significant knowledge gain. There was a slight loss from post- to followup-test. However, the residual gain was still significant. The Peer Intervention module yielded a higher gain than the Information module, although the difference is not statistically significant.

The magnitude of the knowledge gain is not as great as that found in the school in which the Self-Image module was studied, although the differences are not statistically significant. If there is a true difference in magnitude, it is probably attributable to characteristics of the students rather than the modules, since the Information module was identical in both schools.

TABLE 20

PEER INTERVENTION MODULE: MEAN KNOWLEDGE SCORES

Module	N	Pre	Post	Pre/Post Difference	Followup	Pre/Followup Difference
Peer Intervention	42	11.5	14.3	+2.8*	13.8	2.29*
Information	52	11.5	14.0	+2.5*	13.3	1.75*

* p < .01

Behavior

Results obtained from administration of the behavior measure will be discussed separately for each category of behavior: self-directed, host, intervention.

Self-Directed--Results obtained in the portion of the behavior measure dealing with self-directed behavior appear in Table 21.

TABLE 21

MEAN BEHAVIOR SCORES: SELF-DIRECTED BEHAVIOR

Module	N	Pre	Followup	Difference
Peer Intervention	49	3.93	3.63	-.30
Information	53	3.87	3.55	-.33

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In obtaining the values in the table, the scores obtained by each individual were divided by the number of items answered to obtain the average item score. Use of average item scores was necessary to allow for the fact that different students answered different numbers of questions, depending upon their exposure to drinking/driving situations. The mean of the average item scores was then obtained for students in each module.

The higher the average item score, the safer the behavior. The results in Table 21 show a significant tendency toward less responsible drinking/driving behavior on the part of students in both groups. At first glance, it would appear as though both modules backfired. However, it is important to bear in mind that the number of students who drove increased markedly from the pre-test to the followup test. The increased exposure to drinking-driving situations would not in and of itself affect the results since use of average item scores adjusted for such changes. However, the increased exposure meant exposure to new situations, situations that could produce marked differences in average scores. It is easier to attribute the decrease in mean scores to differences in situations than to any effect of the modules themselves.

The value of the special activities making up the Peer Intervention module can best be seen by comparing the followup scores of the two groups. The difference is small and statistically non-significant ($p>.05$). From this, we can conclude that the practice in intervention did not have any effect upon the individual's own drinking-driving behavior--nor would it be expected to.

Host Behavior--Table 21 shows the results obtained from that portion of the behavior measure dealing with host behavior.

TABLE 22

MEAN BEHAVIOR SCORES: HOST BEHAVIOR

Module	N	Pre	Followup	Difference
Peer Intervention	13	2.30	2.90	.61*
Information	21	2.85	2.70	-.15

*$p<.01$

It is evident from the small N: that only a small portion of either sample reported hosting parties at which alcohol was served. Despite the small sample, however, the group participating in the peer intervention activity exhibited a statistically significant change toward more responsible host behavior (p<.01). The group receiving the Information module failed to show any improvement.

A comparison between followup results from the two modules is somewhat clouded by the fact that the information group reported more responsible host behavior to begin with (2.85 vs 2.30). While the difference fell somewhat short of statistical significance (p = .14), it was large enough to keep the differences in followup scores (2.90 vs 2.70) from being statistically significant. One might make the point that the information group, having a higher score to begin with, had less room for improvement. Nevertheless, there should have been some improvement if the module had been effective.

It would appear from the results that the Peer Intervention module was successful in leading to more responsible host behavior while the Information module was not.

Intervention Behavior--The results obtained from that portion of behavior measure concerned with intervention behavior are shown in Table 23.

TABLE 23

MEAN BEHAVIOR SCORES: INTERVENTION BEHAVIOR

Module	N	Pre	Followup	Difference
Peer Intervention	38	2.50	2.85	.35*
Information	37	2.66	2.75	.09

*p<.01

The results for intervention behavior are similar to those for host behavior. Those receiving the Peer Intervention module showed significant shifts toward more intervention, while those receiving the Information module did not. The differences between the Peer Intervention and the Information group on pre-tests and followup tests were almost identical to those recorded for host behavior. It would appear that the lower pre-test scores prevented the Peer Intervention group from exhibiting superiority over the Information group on the followup test.

Discussion

The Peer Intervention and Information modules seem to be equally effective in communicating drinking and driving information. This is not surprising since the information component of both modules was the same. The information component also seems to have been successful in creating attitudes more favorable to responsible drinking and driving. However, the additional activities making up the Peer Intervention module seem to have increased both the magnitude of the attitude change and the extent to which it is sustained over time.

The difference between the Peer Intervention and Information modules is most noticeable when it comes to the effect upon actual drinking-driving behavior. The Peer Intervention module produced a significant change toward greater intervention in the drinking-driving of others. The Information module had no effect on behavior whatever; nor did the Peer Intervention module have any effect on the students' own drinking-driving behavior. Pre-program differences in the groups complicate comparisons between the two modules. However, it appears as though the Peer Intervention module did achieve its goal of getting students to intervene in the drinking-driving behavior of their peers, both as hosts of and participants in activities involving drinking.

Over all, the results support earlier research showing that it is easier to get young people to intervene in the drinking-driving of others than it is to induce change in their own drinking-driving behavior. The present study goes one step further, showing that allowing young people to experience intervention through role-playing activities is effective in leading to intervention. Just what is responsible for the effectiveness of the Peer Intervention module cannot be determined from the data. The hypothesis upon which the Peer Intervention module was established is that providing people with an opportunity to intervene successfully within the psychologically protective atmosphere of a classroom situation helps to overcome the anxiety that tends to discourage intervention with actual drinking-driving behavior.

SPEED MODULE

The speeding module was pilot tested in February and March 1981 at A&M Consolidated High School of College Station, Texas. Evaluating this module required measuring speeds driven by students. This measurement had to take place where the population would be concentrated, in proximity to the school. The school selected as the test site was approached by only two roads. This had the advantage of limiting not only the number of places where speed had to be monitored, but also the number of non-students who would be using the road. The speed limits on the two roads were 30 mph and 45 mph.

Test Methodology

The methodology employed in pilot testing the Speeding module is described according to the test design, the populations who were the subject of the test, the instructors used in delivering the program, and the means in which the program was delivered.

Test Design

A "before-and-after" design was used in which measures of speed were collected before and after delivery of the module. "After" measures were taken both immediately after the module and two months later as a follow-up collection. Use of a control or comparison group was prevented by the inability to distinguish one group from another as students approached and left school.

Test Population

The test population consisted of approximately 260 licensed drivers from the high school student body. These 260 students constituted the entire population of students who drove to and from school. A subsample of 44 students was selected for knowledge and attitude testing. The group included males and females.

Instructors

The module was delivered by personnel from the Texas A & M University Education Program, with assistance from members of the project staff. All instructors were qualified, certified teachers experienced in providing instruction at the high school level.

Delivery

The module was delivered on March 2, 1981. The students received the information component of the program in an auditorium. This required one class period (approximately one hour). Immediately following this, the students were divided into discussion groups of approximately 35 each, plus an instructor. The groups met individually to complete the last activity of the module (discussion of reasons for speeding). This also required one class period.

Data Collection

Pre, post, and follow-up data were collected in the three areas of knowledge, attitude, and behavior.

Knowledge and Attitude

Knowledge and attitude measures consisted of paper-and-pencil tests. The knowledge test consisted of 20 multiple-choice questions. Two forms of the knowledge test were used. Students received alternate forms at each administration. The attitude instrument presented 16 multiple-choice questions on each of two forms.

Pretests were administered on the Friday prior to module delivery to the subsample of 44 students. Post tests were administered immediately following the program. Follow-up data were collected two months after the post tests.

Behavior

Data on behavior were collected by the Human Factors Division of Texas Transportation Institute (TTI) using direct observation. During each of the three collection periods (pre, post, and followup), data were collected on three consecutive days. TTI staff used stationary radar positioned at two locations, one on each of the two roads approaching the school. Each location was characterized by a high volume of student traffic and presented an opportunity for drivers to speed. In addition, both permitted radar to be located unobtrusively.

During the data collection, the radar was on continuously and recorded the speeds of all passing cars. Observers were instructed to look for cars with school stickers and for drivers whose appearance indicated they were students. The speeds of drivers who were clearly not students were not noted.

Pre-module data were collected on the three consecutive school days immediately prior to program delivery. Post-module data were collected on the afternoon immediately following program delivery, and for the next three days. Followup data were collected on three consecutive days, 10 weeks after the post-data collection period.

Results

Results from the study of the Speeding Module include results of analysis of speed, compliance, and knowledge and attitude measures.

Speed

Mean speeds observed on both roads during the three periods of data collection appear in Table 24. Statistically significant differences between pre-module and post-module speeds were found for both roads.

The significance of difference was assessed through a one-tail test. Substantial and significant differences in mean speed were found across the six sets of daily measures within each of the three periods of observation. In testing significance, it was necessary to compare differences between periods with the day-to-day differences. To do so, T-tests were performed using as measures the six mean speeds rather than speeds of individual vehicles.

The post-module speed reduction was higher on the 30 mph road than on the 45 mph road. This interaction between module effect and posted speed was probably caused by characteristics of the specific roads involved, rather than the speed limits themselves and, therefore, may not be of any practical significance.

Speed reductions endured through the follow-up period, although about half the effect was lost on the 30 mph road.

TABLE 24

SPEED INSTRUCTIONAL MODULE:
MEAN SPEED
(mph)

Limit	Pre	Post	Pre/Post Difference	Follow-up	Pre/Follow-Up Difference
30 mph	31.8	29.8	-2.0*	30.4	-1.4*
45 mph	46.2	45.5	-0.7*	45.5	-0.7*

* $p < .01$

Compliance

The objective of the speed module was not so much to reduce speed as it was to seek compliance with the speed limits. Reduction in speed would be expected only among those drivers exceeding the speed limit. Table 25 shows the effect of the module upon the percentage of drivers exceeding the speed limit. Statistical significance was again tested through a one-tail T-test, using the daily percentages as observations.

Significant decreases in the percentages of drivers exceeding the speed limit occurred between the pre-module and post-module phases over both roads. The differences between the two roads parallel those observed for mean speed. What is of particular interest is the extent to which small differences in mean speed produced rather large changes in compliance with the speed limit.

The effect upon compliance endured through the followup period just as it did for mean speed. Moreover, while the 30 mph road showed the same shrinkage found for mean speed, the 45 mph road appeared to show further improvement. It would be unwise, however, to make too much of these differences. Because of the differences in the distribution of speeds over the two roads, the same reduction in mean speed would be expected to produce somewhat different levels of compliance.

TABLE 25

SPEED INSTRUCTIONAL MODULE:
PERCENTAGE EXCEEDING SPEED LIMIT

Limit	Pre	Post	Pre/Post Difference	Follow-Up	Pre/Follow-up Difference
30 mph	55.1	30.6	-24.5**	39.3	-15.9*
45 mph	61.6	53.4	-8.2*	49.0	-12.6**

* $p < .05$
** $p < .01$

Knowledge and Attitude Measures

The results obtained from administration of the knowledge and attitude measures appear in Table 26. A small but significant knowledge gain occurred from pre- to post-module administration. The gain appears to have endured over the followup period. (The apparent increase in knowledge from postprogram to followup periods probably resulted from chance fluctuations since there was no source of information to add to the knowledge gain.)

The attitude measure failed to evidence a significant change either immediately after the program or after the followup period. The post-module gain approaches significance ($p = .07$) but would be of little value even if it represented real changes since it obviously did not endure for the followup period.

It is quite possible, if not likely, that failure of the module to register changes in the attitude measure is the fault of the measure rather than the module. Behaviors that are as sensitive to motivational factors as are speeding and compliance with speed limits are not likely to evidence change without a concomitant change in attitude.

Development of attitude measures is nowhere near as straightforward as that of knowledge measures. The lack of an available measure forced development of that used in evalution of the Speeding module. It does not appear that effort was very successful.

TABLE 26

SPEED INSTRUCTIONAL MODULE:
MEAN KNOWLEDGE AND ATTITUDE SCORES
(N = 44)

Measure	Pre	Post	Pre/Post Difference	Follow-Up	Pre/Follow-Up Difference
Knowledge	8.4	9.6	+1.2*	10.0	+1.6*
Attitude	8.1	9.4	+1.3	7.6	-0.5

* $p < .05$

Discussion

The Speeding module appears to have been successful both in reducing the average speeds and in increasing compliance with speed limits on the two roads leading to the school in which it was tested. Moreover, the effects appear to have lasted throughout the followup period.

An evaluation performed at one school on two roads is not sufficient to prove the effectiveness of the module. Nevertheless, the results are certainly promising enough to warrant further implementation at a number of sites and an assessment of its effect upon speed and compliance. The fact that knowledge gains were rather modest and attitude changes nonexistent should not reflect adversely upon the program. Rather, results from the use of those measures should be viewed as evidence of the need to improve the measures themselves.

RESTRAINT USE MODULES

The four restraints modules were pilot tested at four separate sites because the modules were to be evaluated through measures of actual restraint usage. If more than one module had been given at a single sight, it would have been impossible to isolate the effects of any one module, since there would have been no way to distinguish students receiving one program from those receiving another. All four modules were delivered in April of 1981 at schools in St. Louis, Missouri. Instruction in all cases was delivered by a qualified, certified teacher from the project staff with the exception of the Convincer module. In that instance, the project staff member served as the instructor for the information component of the program only. A member of the teaching staff of the School of Public Service, Safety Department, at Central Missouri State University served as the instructor during the Convincer Ride portion of the module.

A "before-and-after" design was employed in each of the four pilot tests. Measures of knowledge, attitude, and actual restraint use were taken before and immediately after the modules were delivered. There was no intent to make comparisons across modules, since the primary objective was to determine whether any of the modules were effective, not which were most effective. The reason for this was that the modules were designed for administration outside of driver education, and it would be possible to administer several effective modules to students at different times during their high school careers. In contrast, modules intended specifically for incorporation into a driver education course ought to be the most effective program available, since students invariably receive driver education instruction only once.

Test Methodology

While the design of the pilot testing was uniform across all four experimental modules, the test site, population, and delivery differed from module to module. These are described by module in the following paragraphs.

Information Module

The module was pilot tested at Riverview Gardens High School in St. Louis. The test population consisted of 65 vocational education students (from six small classes) and comprised all students who drove to and from school. The group included males and females. The information module was delivered in one class period. Students were assembled in one large classroom and received the module as a group.

Peer Testimonial Module

The Peer Testimonial module was delivered at Pattonville High School in St. Louis. The test population consisted of 94 vocational education students. The group comprised all students who drove to and from school. While both males and females were represented, the vast majority were males. Three vocational education classes comprised the group. The information component of the Peer Testimonial module was delivered during one class period in place of the students' regularly scheduled classes. On the following day, the testimonial portion of the module (slide/tape presentation) was shown to the students, again during the regular classes. This required about half of a class period.

In-Vehicle Module

The module was pilot tested at Hazelwood West High School of St. Louis. The test population consisted of 108 vocational education students, which represented all students driving to and from the school. Both males and females were among this group. The information component of the module was delivered in a large group assembly in place of students' regular classes. Following this segment, the in-vehicle activity was administered on a class-by-class basis.

Convincer Module

The module was pilot tested at Hazelwood Central High School. The test population consisted of 177 vocational education students--all of whom drove to and from school. The group of 177 represented six classes, both males and females. Delivery occurred on two consecutive days. On the first day, all students received the information in a large group assembly in place of their regular class. Convincer rides required an additional class period and were handled on a class-by-class basis.

Data Collection

Collection of data on knowledge, attitude, and behavior was handled in the same way for each of the restraints modules. Pre and post data were collected immediately prior to and after module delivery. Followup data were collected approximately one month after delivery at the sites where the In-Vehicle and Convincer Ride modules were delivered. Followup behavioral data were not collected in the pilot tests of the Testimonial and the Information Modules because the school schedules did not permit this to be done within the time frame required.

Knowledge and Attitude

Knowledge and attitude measures consisted of paper-and-pencil tests. The knowledge test consisted of 20 multiple-choice questions. Two forms were used, and students received alternate forms at each administration. The attitude test consisted of 11 multiple-choice questions. Only one form was used.

Behavior

Data on behavior were collected using direct observation. Members of the National Honor Society were positioned at the point of entry and exit of the school's designated student parking lot, where all members of the treatment group parked. The observers generally worked in pairs. No effort ws made to disguise or to announce the observation activity. Observers were stationed as unobtrusively as possible, consistent with the need to maintain a good vantage point. At all sites, Honor Society members traditionally enjoy a free range of the campus. Perhaps for this reason, there were no reported instances of students questioning observers as to why they were at the parking lots and what they were doing.

Observations were made twice daily (from approximately 7:45 to 8:00 am and from 11:45 to noon) on three consecutive days during each collection period. The number of cars and the number of drivers using safety belts were recorded. Observers were told to look at each car entering or exiting the lot and to observe whether the driver was wearing a safety belt by examining the position of the shoulder harness.

Results

Results from the study of the restraints modules will be discussed in terms of (1) actual use of restraints, (2) knowledge about restraints, and (3) attitudes toward restraints.

Use of Restraints

Results obtained from monitoring use of restraints are shown in Table 27. It is evident that wide pre- and post-module differences existed among the students receiving the four modules. However, such variation is unimportant, as the pilot test was not intended to provide for cross-group comparisons. Rather, pilot testing was designed to determine whether or not any program induced behavioral change.

Each of the four modules produced a gain in usage. Gains for the Information, Testimonial, and In-Vehicle modules were statistically significant ($p < .05$). Significance was assessed through a one-tail test in which the gains in mean percentage of use were compared with day-to-day percentages. The small gain for the Convincer group was well within day-to-day chance variation ($p = .26$).

As noted earlier, followup comparisons could be made only for the In-Vehicle and Convincer modules. The In-Vehicle group maintained the substantial gain obtained earlier. The gain for the Convincer group continued to be small and nonsignificant.

TABLE 27

RESTRAINTS MODULES:
PERCENTAGE USING RESTRAINTS

Module	Pre	Post	Pre/Post Difference	Followup	Pre/Followup Difference
Information	3.3	8.5	+5.2*	-	-
Testimonial	4.1	6.7	+2.6*	-	-
Vehicle	13.5	26.7	+13.2*	27.7	+14.2*
Convincer	9.0	13.2	+4.2	11.8	+2.8

*$p < .05$

Knowledge

Results obtained from the administration of knowledge tests appear in Table 28. Although students in all four modules were given the same information presentation, the Information and Testimonial groups showed the largest gain, 42 percent and 32 percent, respectively. Significance was tested by means of t-tests for correlated measures. Both gains were highly significant. The knowledge gain for the In-Vehicle group, although statistically significant, was considerably smaller. The Convincer group failed to show a significant information gain.

While the information component of all four modules was the same, the conditions under which it was delivered differed among the groups. For the Information and Testimonial modules, it was presented in a classroom situation, with opportunity for interaction. The information presentations for the In-Vehicle and Convincer modules were, on the other hand, given to all students collectively in an assembly hall. There was no interaction, and no way of making sure students were paying attention. These conditions may explain the small amount of gain.

The follow-up knowledge administration evidenced a somewhat lower but still statistically significant gain for the In-Vehicle module. Results for the Convincer module were the same as they were immediately after the program.

The failure of the Convincer group to show a significant knowledge gain may help explain the lack of a significant gain in a restraint use. It appears that what little gain in restraint use occurred for the Convincer group came as a result of the experience in the Convincer and not the information that was presented.

TABLE 28

RESTRAINT MODULE:
MEAN KNOWLEDGE SCORES

Module	N.	Pre	Post	Pre/Post Difference	Followup	Pre/Followup Difference
Information	65	8.5	12.1	+3.6*	-	-
Testimonial	94	9.5	12.5	+3.0*	-	-
In-Vehicle	108	9.8	11.2	+1.4*	10.8	+1.0*
Convincer	177	9.8	10.3	+0.5	10.2	+0.4

*$p < .05$

Attitudes

Results obtained from administration of the attitude measures to students in the four modules appear in Table 29. All groups evidenced statistically significant pre/post gains. Attitude gains for the Information and Testimonial groups paralleled the knowledge gains. This is not surprising considering the relationship between knowledge and attitudes. The attitude gains for the In-Vehicle and Convincer groups surpassed knowledge gains and seem to indicate that experiences in the vehicle or Convincer also influenced attitudes. The results of followup measures suggest that the attitude changes experienced by students in the In-Vehicle and Convincer modules tend to endure.

TABLE 29

RESTRAINT MODULES:
MEAN ATTITUDE SCORES

Module	N	Pre	Post	Difference	Followup	Pre/Followup Difference
Information	65	12.2	16.5	+4.3*	-	-
Testimonial	94	13.1	16.7	+3.6*	-	-
In-Vehicle	108	11.9	15.3	+3.4*	15.2	+3.3*
Convincer	177	12.4	14.1	+1.7*	14.5	+2.1*

*$p < .05$

Discussion

The overall results indicate that all four of the modules are capable of having a beneficial effect on use of restraints. The Information and Testimonial modules produced significant gains in knowledge about, attitudes toward, and use of restraints. How long these gains were sustained could not be determined, but the fact that gains realized through the other two programs appeared to endure is encouraging.

The In-Vehicle module produced substantial and enduring gains in restraint use. While they appear to be greater than those realized through the Information and Testimonial modules, it would be dangerous to make comparisons. The fact that the pre-module use rate was highest among students receiving the In-Vehicle module may be an indication that they were a more responsive group than those receiving the other modules. What is most encouraging is the fact that gains in use occurred despite rather little gain in knowledge.

The effectiveness of the Convincer module is difficult to evaluate. The failure to obtain any significant gains in use is certainly discouraging. However, this failure is accounted for at least in part by (1) failure of the information component of the module to communicate effectively, and (2) large day-to-day variation in prevailing restraint use.

HAZARD PERCEPTION MODULE.

The Hazard Perception module was pilot tested in June 1981 at Baltimore Polytechnic Institute, in Baltimore, Maryland. The methodology used, the data collection procedures, and the results are presented in the following paragraphs.

Test Methodology

The effectiveness of the Hazard Perception module was evaluated through a comparison group design in which the performances of students receiving the Hazard Perception module were compared with those of a group not receiving the program. The comparison group comprised those students from Baltimore Polytechnic Institute who received the instruction of the Fuel-Efficient Driving module. (The "treatment" group for the hazard perception module served as the "comparison" group for the Fuel-Efficient Driving module.) This process of having the "treatment" group in one experiment serve as the comparison for another not only made maximum use of available student subjects but also equalized the two groups for any effects stemming merely from participation in a program--i.e., the "Hawthorne Effect." A pre-post design could not be used owing to the fact that the test subjects--driver education students--could not legally drive prior to receiving the module, thus preventing pre-module performance measures from being collected.

The test population consisted of two classes of driver education students. The treatment group for hazard perception consisted of 32 students, and 32 others made up the comparison group (which received the energy-efficient driving module). Each group contained both males and females.

The program was delivered in a single class period by an experienced driver education teacher from the high school staff.

Data Collection

Measures of behavior behind the wheel and performance in a simulator were used to assess the effectiveness of the hazard perception module. The measures were identical to those administered to students in the pilot test of the Fuel-Efficient Driving module. In fact, since the group receiving the Hazard Perception module served as a comparison group for the pilot test of the Fuel-Efficient Driving module, and vice versa, the measures were administered to students in both groups at the same time.

Behind-the-Wheel

Following completion of training, students operated vehicles over a test route approximately five miles in length. Driving time averaged from 15 to 20 minutes. The route was designed primarily to assess fuel-efficient performance and was administered to students participating in both the hazard perception and fuel efficiency programs under the test methodology already described. Because of the number of subjects involved, it was not possible to "stage" hazards in the way that was done during the deficiency testing. However, through the use of videtape, it was possible to record students' response to those hazards that materialized along the test route. The taped image as recorded through the windshield revealed any two-wheeled vehicles or pedestrians whose direction and position rendered them a hazard. By reviewing the tape several times, a set of objective criteria for what constituted a "hazard" was established. The response of students to those situations identified as hazardous was then scored. A change in speed and/or position, evidencing awareness of the hazard, was scored as a correct response. Those doing the scoring had no knowledge of whether a particular student had received the Hazard Perception module or the Fuel-Efficient Driving module.

Simulation

The risk in trying to compare groups against a criterion as unstandardized as responses to the chance occurrence of hazards along the road was recognized. Simulation was used to provide a criterion having somewhat greater reliability, if less validity, than the "targets of opportunity" used to assess performance in the test route.

For the simulation test, a motion picture film was prepared in a manner similar to those used for simulator training in driver education courses. The film presented a "through-the-windshield" display of a driving scene. Six hazardous situations were staged and filmed. The six hazards were as follows:

Crosswalk--Crosswalks located at major intersections, approached at a speed that required a speed reduction.

Delivery Truck--A step van is double-parked, forcing overtaking vehicles to pass close by the driver's door.

Motorcycle--A motorcycle coming up between two lines of traffic, was visible in the rear-view mirror.

Bicycle--Bicycle approaching a parked car ahead at a rate that would cause it to swerve into the street just as the simulated vehicle was about to pass it.

Disabled Vehicle--A vehicle by the side of the road with the rear end jacked up, and the driver pulling a tire out of the trunk.

Children Running--Children running along the sidewalk on a residential street.

Student recognition of a hazard was assessed through the position of the accelerator, as recorded by the simulator's automatic response recording system. If the accelerator was released at any point during a prescribed interval after appearance of the hazard, it was assumed the hazard had been recognized and a correct response was entered. Failure to release the accelerator during the prescribed period was scored as a failure.

The hazard situations were interspersed with situations calling for fuel-efficient driving, as well as other situations that were totally unscored, in order to keep drivers from becoming sensitized to the hazards. Accelerator position was monitored at points where no response was required. Students whose accelerator was released unnecessarily were assumed not to have been using the accelerator, and their data were discarded.

Knowledge

No assessment was made of the effect of the hazard perception module upon knowledge. During early developmental testing of materials, it became evident that students, once acquainted with what was deemed to be a "hazard" would almost universally score 100% on the test given during the deficiency testing. Once attention was called to a potential hazard through a written test item, students had no difficulty in identifying it as a hazard. There seemed no point in administering a test to establish what was patently obvious through casual observation. Therefore, the assessment focused upon the more difficult task of detecting hazards without prompts provided by written test questions.

Results

Results of the Hazard Perception module include analysis of behavior behind the wheel and performance in the simulator.

Behind-the-Wheel Behavior

No significant differences emerged between the two groups of students in responses to hazardous situations encountered during the road test. The only difference of any magnitude involved responses to pedestrian hazards, in which students receiving the Hazard Perception module responded correctly twice as often as those not receiving the program (40.5% compared to 21.7%). However, the variation in rate of correct response among students within each group was so great as to make the apparent differences easily attributable to chance.

Simulator Behavior

The results obtained by students in response to the six hazardous situations portrayed in the simulator film appear in Table 30.

TABLE 30

HAZARD PERCEPTION MODULE: SIMULATION TEST SCORES (Percentage Correct)

Hazard	Treatment	Comparison	Difference
Crosswalk	34.5	37.9	- 3.4
Delivery truck	8.3	6.1	+ 2.2*
Motorcycle	30.0	43.8	- 13.8
Bicycle	10.3	15.2	- 4.9
Disabled vehicle	13.8	6.5	+ 7.3*
Children running	36.4	13.3	+ 23.1*
Overall Average	22.2	20.5	+1.7
N	32	32	

* $p < .05$

There was no overall difference between the two groups of students in response to hazards. However, individual hazards showed sizable differences, some in favor of the treatment group and some in favor of the comparison group. Curiously, all of the differences favoring the treatment group were statistically significant while those favoring the comparison group were not. There are two possible explanations:

1. The module had a significant impact upon perception of certain categories of hazards, but not of other hazards.

2. The module had no impact, the differences within individual types of hazards being in reality chance fluctuations, the largest favoring the treatment group.

There is no way of knowing which of these hypotheses is correct. However, given the negative results obtained from the behind-the-wheel test and the lack of any good explanation to account for differences in type of hazard, the second seems the more tenable. In any case, it would be unwise to interpret the results in Table 30 as demonstrating the effectiveness of the Hazard Perception module in any particular category of hazard.

Discussion

The Hazard Perception module failed to improve the responsiveness of driver education students to pedestrian and cyclist hazards in either the highway traffic environment or the simulator. This does not mean that the students who received the Hazard Perception module failed to improve their recognition of hazards; there could have been real effects that the measures employed failed to detect. A simulator is not the real thing, and even the real thing--a road test--offered limited exposure to hazards from pedestrians and cyclists. Nevertheless, a module that has any hope of influencing long-term perception of hazards should have evidenced some effects even in relatively insensitive measures.

FUEL-EFFICIENT DRIVING MODULE

As indicated in the previous section, the Fuel-Efficient Driving module was field tested at Baltimore Polytechnic Institute. A comparison group design, in which a group of driver education students receiving the module was compared with a group not receiving the module, was employed. As previously noted, the students not receiving the Fuel-Efficient Driving module were given the Hazard Perception module.

Test Methodology

The test methodology used was similar to that used in connection with the Hazard Perception module. The Treatment group was limited to one class (32 students) primarily by the need to administer road tests to all subjects in connection with this module. The module and the road test were administered by an experienced driver education teacher from the high school staff. The Fuel-Efficient Driving module was delivered to the treatment group over the course of three consecutive days in three classroom periods.

Data Collection

Data on knowledge, attitude, and behavior were collected. Pre-data were collected for attitude and knowledge only. Post- data were collected in all three areas.

Knowledge and Attitude

Knowledge and attitude measures consisted of paper-and-pencil tests. The knowledge test contained 24 multiple-choice questions that sampled representatively from the three module segments. Two forms were needed so that prior exposure to test questions would not result in inflated estimates of postcourse knowledge. The tests had been previously equated for both content and degree of difficulty. As an added precaution, each form was given both as a pre-test and post-test (i.e., administered alternatively with half the sample receiving Form B as the pre-test and Form A as the post-test). This balancing of forms prevented any small differences between the forms from biasing the pre-post comparison.

The attitude test consisted of 17 multiple-choice questions. Each item presented an issue and allowed three alternative responses representing three levels of attitude toward energy-efficient driving. Only one form of the attitude test was used. Pre-data were collected on the first day of instruction at the beginning of class. Post-data were collected the week following administration of the module.

Behavior

Data on behavior were collected over six days using two methods: Behind-the-Wheel and Simulation. As previously noted, data on behavior were collected simultaneously for the Fuel-Efficient Driving and Hazard Perception modules.

Behind-the-Wheel

In this method, a driver education instructor rode in the front passenger seat, directing the student driver along a fixed route. The test vehicle was fitted with a fuel-trip monitor (developed under the NEEDS) project that measures fuel consumption to the nearest thousandth of a gallon and with an accelerometer that measures both longitudinal and lateral acceleration. A member of the project staff rode in the rear seat of the vehicle, recording data at designated route checkpoints. A videotape camera inside the vehicle also was used to record the route conditions encountered by a subsample of students during their test runs. The test was administered alternately to treatment and comparison group subjects to prevent differences in traffic conditions from affecting the comparison of the two groups.

The route required 15 to 20 minutes of driving time. The route was selected to include hills, stop signs and lights, turns, and congested traffic, and for proximity to the school. The route was circular for convenience.

Fuel usage was examined in two ways. (1) The route was divided into nine segments. Fuel consumption on each segment, as well as total fuel consumption, was measured. (2) At ten designated checkpoints on the route, acceleration was measured to determine whether the student was accelerating or slowing down as appropriate. Gradual braking, maintaining of momentum, and steady acceleration were the ideal fuel-efficient behaviors.

Fuel consumption records could not be obtained on 10 of the 64 students owing to a combination of malfunctions in the fuel monitoring equipment and scheduling problems that prevented some students from taking the road tests. Acceptable videotape records were not obtained on 19 subjects due to a combination of camera problems, tape loss, and visual obstructions.

Simulation

In this method, staff used a Super-8-mm film containing four driving situations to which the student could make a fuel-efficient or fuel-inefficient response. All responses were capable of being measured by the simulator controls. Responses included lifting the foot off the accelerator to indicate intention to slow down and signaling to indicate intention to change lanes.

Results

Results of the Fuel-Efficient Driving module are discussed in terms of performance, attitude, and knowledge.

Performance

Energy-efficient driving performance was measured in three ways:

Consumption--fuel consumed over the test route.

In-Car Behavior--the behavior of driver in response to situations encountered during the road test.

Simulator Behavior--responses to simulated situations as measured through simulator response recording equipment.

Consumption

There were no significant differences in the amount of fuel consumed over the test route. The Treatment group averaged 1.04 gallons compared with .88 gallons on the part of the Comparison group. However, there was considerable variation from one student to another owing to differences in the amount of traffic and waiting time to stop lights. The standard deviation was over .3 gallons.

To allow the relationship between fuel consumption and route characteristics to be assessed, separate measures of consumption had been taken over each of nine route segments. None of the individual segments evidenced a significant difference.

In-Car Behavior

Analysis of videotape records revealed ten energy critical situations occurring along the test route with sufficient regularity to serve as a basis for group comparison. The situations included approaching red lights, accelerating from stops, left turns across traffic, and negotiating a hill. In responding to these situations, both groups obtained identical results; each responded correctly 53 percent of the time. While differences appeared between the two groups in responding to various individual situations, the differences were not significant and can be viewed as random fluctuations around a true difference of zero.

Simulator Behavior

The simulator test was used to provide a measure of the students' ability to respond to traffic situations in an energy-efficient way under conditions in which the ability to respond is not degraded by having to control the vehicle at the same time. Results of the simulator test appear in Table 31.

TABLE 31

FUEL-EFFICIENT DRIVING MODULE: SIMULATION TEST SCORES (Percent Correct)

Behavior	Treatment	Comparison	Difference
Maintaining Following Distance	0	3.2	- 3.2
Changing Lanes for Construction	12.1	25.0	-12.9*
Coasting to Red Light	6.1	15.4	- 9.3*
Timing Left Turn	12.1	16.7	- 4.6
Overall Average	7.6	15.0	- 7.6

*$p < .05$

While there were no significant differences between the two groups in overall performance, the Treatment group was outperformed by the Comparison group in two situations, changing lanes in response to road work ahead and coasting up to a red light. More surprising than the differences between the two groups is the extremely poor performance of both groups. The percentage of situations responded to correctly is much lower than that achieved by the same students during the road test, when they had to control a car as well as employ energy-efficient driving practices. Results cast considerable doubt upon the validity of the simulator as a measure of energy-efficient driving, and suggest that the significant differences between the two groups may be the result of outside factors.

Attitude

Results obtained from administration of the attitude measure to the Treatment and Comparison groups appear in Table 32. The effectiveness of the Fuel-Efficient Driving module in leading to attitude change is represented by the post-module difference between the two groups (rather than by pre-post differences). This difference was 2.4 points. Since there were no significant pre-module differences (if anything, the Treatment group was worse), the post-module differences can be attributed to the effect of the Fuel-Efficient Driving module.

While a difference of 2.4 points looks rather small in comparison with mean total scores, the variability of group performance is quite low, a standard deviation of approximately 3 being found in both groups. If attitudes as measured by the attitude survey are capable of influencing fuel-efficient driving, then the changes brought about the program should be sufficient to produce some behavior change.

TABLE 32

FUEL-EFFICIENT DRIVING MODULE: MEAN ATTITUDE SCORES

Group	Pre	Post
Treatment	31.9	34.5
Comparison	32.9	32.1
Difference	-1.0	2.4*

*$p < .05$

Knowledge

Results obtained from administration of the knowledge test appear in Table 33. Again, the effect of the Fuel-Efficient Driving module appears in the difference between the Treatment and Comparison groups on the post test. The difference of 6.6 is highly significant and, in the absence of any significant preprogram differences, may be attributed to the effects of the module. The difference of 6.6 represents a 60 percent increase over the score of the Comparison group and is over twice the standard deviation for the knowledge test. The fact that knowledge levels prior to administration of the program were rather low (approximately 40 percent of items answered correctly) means there was a lot of room for improvement.

TABLE 33

FUEL-EFFICIENT DRIVING MODULE:
MEAN KNOWLEDGE SCORES

Group	Pre	Post
Treatment	10.1	17.5
Comparison	9.6	10.9
Difference	0.5	6.6*

*$p < .05$

Discussion

The results obtained from the field test of the Fuel-Efficient Driving module are a discouraging replay of the results obtained from the earlier research--significant improvements in knowledge and attitude unaccompanied by any change in behavior. The hypothesis advanced to explain earlier results--insufficient vehicle handling skill to permit energy-efficient behavior--may also apply here. Use of the simulator should have overcome this problem. However, the type of simulator employed is really a training device and does not faithfully reproduce the driving task. What was responsible for the similarity and differences between the two groups may be confined to the simulator itself and have nothing to do with actual driving.

A program based upon the module pilot-tested as part of this project was administered to a group of experienced drivers in Michigan under another project. When administered to this group, large and significant gains ($p < .01$) were obtained both in terms of observed performances and in mileage-per-gallon measurements. Specifically, the frequency of fuel-conserving behaviors increased more than 200% (from an average of 9.9 to 30.4 per trip) after instruction. The instances of wasteful behavior declined 83% (from 16.8 per trip before instruction to an average of 2.8 after instruction. In terms of actual fuel consumption, the group showed an improvement from 20.0 mpg to 25.5 mpg--a gain of 27.5%. The Michigan experience lends further credence to the hypothesis that the problem lies not in the program content, methods, or materials, but in the characteristics of the student population.

The measures of behavior assessed only one of the three module segments --Operating Techniques. It was not possible to contrive a performance measure to assess the other two modules, Trip Planning and Vehicle Selection and Maintenance. It could be many months before students had sufficient use of a vehicle to put into practice the trip planning principles taught in the course. It could be a matter of years before appreciable numbers of the students had an opportunity to participate in vehicle selection. These two segments were, of course, evaluated through the knowledge and attitude measures, and the favorable results obtained offer some hope that they will ultimately have an impact.

PHASE III--EVALUATION OF RESTRAINT USE MODULES

The pilot testing described in the previous section of this report indicated that substantial improvement in knowledge and attitude could be obtained in the areas of drinking and driving, restraint use, speeding, and energy efficiency by the use of modules developed specifically to alleviate deficiencies revealed through a program of deficiency testing. Certain of the modules developed in the areas of drinking-driving, restraint use, and speeding also led to significant improvements in behavior.

Drinking-driving and restraint use are areas of particularly high potential impact. Alcohol is involved in approximately 50% of automobile fatalities, while it has been estimated that universal use of safety restraints would reduce the likelihood of a fatality in an accident by about 50%. No other behaviors would have anywhere near the effect upon fatalities as would the simple fastening of a safety belt or refraining from driving when impaired by alcohol.

Because of the their potential impact upon fatal accidents, drinking-driving and restraint use are high priority areas within the National Highway Safety Program. While the pilot tests of drinking-driving and restraint use modules was highly encouraging, the high priority given these areas warranted replication of the evaluation under conditions that would strengthen the findings and conclusions. These conditions included the following:

> Larger Sample--The sample employed in the pilot test was somewhat limited by available funds for data collection. Larger samples might (1) reveal significant improvement where it was not found previously, and (2) permit more precise estimation of the magnitude of improvement.
>
> More Schools--Only one school was involved in the testing of each module. Results might have, to some extent, been influenced by characteristics of the specific schools. More schools were needed to permit greater generalization.
>
> Use of Control Groups--Because of funding limitations, the collection of data in the pilot test was largely a cooperative effort; school staffs collected data in return for having the program taught at their schools. This did not permit the use of control groups (no one would participate in return for having no program). While control groups were not considered a necessity, their use would permit control of any outside factors that just happened to coincide with introduction of the modules.

Evaluation of the alcohol module was undertaken outside of the present project and is described in a separate report (McKnight and Mason, in process). This section of the report will describe the expanded evaluation of the restraint use modules.

INSTRUCTIONAL MODULES

In all, a total of six modules pertaining to safety restraint use were selected for examination in the demonstration testing. Four of these were more "refined" versions of the four experimental safety belt modules examined in Phase II--Information, Testimonial, Convincer, and Vehicle. The fifth module was a modified version of the Peer Testimonial Module. As noted previously, the heart of the Peer Testimonial Module was a slide/cassette program entitled "Stayin' Alive," developed outside of the project. During the field test, this module, like the others, included the Information Module. However, because the program has been so widely used by itself, an evaluation of its effectiveness without the aid of an information module was desired.

The sixth module consisted of a film dealing with the dynamics of crashes and an instructor's guide. The film had been field-tested in another project (Contract No. DTNH22-81-C-05235) which determined that it had a potential for increasing student knowledge concerning restraint use, improving attitudes toward restraint use, and increasing the self-reported usage rate among students.

Brief descriptions of each of the six modules evaluated in this third and final stage of the project are presented in the following paragraphs. Fuller descriptions of the modules developed within this project are provided in the preceding section of this report. A full description of the film which was used in the "crash dynamics" module is contained in a report by Cushman and McPherson (1982).

Information Module

This module is designed to present drivers with basic factual information regarding the protection provided by restraints in various types of vehicle collisions. Instructional content was supported by a film ("Dice in a Box") depicting various restraint "statistics" and by a student manual ("Safety Belts...What Do You Think?").

Vehicle Module

In this module, the information module described above is followed with a controlled demonstration of the extent to which restraints can keep vehicle occupants in place during sudden vehicle movements. Students ride as passengers over a prescribed course, both belted and unbelted. The course is designed to provide participants with an opportunity to experience directly (at relatively low speeds) the various forces acting upon occupants in abrupt maneuvers. An off-street range or parking lot and a demonstration vehicle is required for this demonstration.

Convincer Module

Students ride a "convincer sled" as a laboratory exercise following the information module previously described. This exercise allows students to experience forces which simulate those generated in a crash.

Testimonial Module

This module combines the informational module previously described with the multi-media presentation "Stayin' Alive," which depicts the history of a young accident victim who sustained permanently disabling injuries. The intent of this module is to pair informational content describing the value of restraints in a collision with a personalized and somewhat emotional presentation of the human consequences of failing to wear restraints.

Testimonial-Only Module

This module consists solely of the multi-media program entitled, "Stayin' Alive." The appeal of the module is largely emotional. It intends to communicate at a personal level--through the use of a peer model--the value of restraints in an accident. Essentially, it allows students to experience vicariously the devastating consequences which may be attached to not using belts.

Crash Dynamics Module

In this module, students view a series of brief film presentations which depict the dynamics of vehicle crashes, particularly the human collisions which result from these crashes. Some of the materials also demonstrate the different effects of crashes on restrained versus unrestrained occupants or objects. The film is informative, as the narration presents salient facts and figures concerning the effectiveness of belt use. Beyond the film, no informational material is presented to students. Rather, the audio-visuals are used as "trigger" films to get students to discuss and discover for themselves the pertinent facts concerning belt use. Instructor participation is limited to presenting the films and posing discussion questions.

EVALUATION METHODOLOGY

The evaluation criterion used was the effect of the instructional treatments on restraint usage rates by young drivers. For each treatment, a measure of effect was determined by analyzing the differences in restraint use rates among pre-, post-, and followup observation periods. A control group was established to permit a determination of the extent to which the observational methods used to gather data affected restraint use rates.

Test Sites

The assessment of potential alternative delivery systems indicated that, if supplementary modules were to be delivered to young drivers, the most likely delivery agent would be high schools. As the intent of the evaluation was to determine the effectiveness of the modules in circumstances most closely approximating those most likely to prevail in a "real world" situation, it was determined that the modules would be presented within high schools. Candidate test site locations were selected from those jurisdictions where school officials volunteered to participate in the project.

Solicitation of Schools

The project staff contacted representatives of individual schools and state school systems who had demonstrated an interest in traffic safety in the past. Most of these initial contacts were made by phone with individuals who were in a position to at least tentatively commit their schools to the evaluation effort. In general, these contacts were devoted to explaining the objectives of the evaluation, the nature of the instructional treatments, and the participation requirements.

In general, the volunteer rate was relatively low. Stumbling blocks to a higher volunteer rate were numerous, including:

- Disruption of instruction--Many administrators were unwilling to disrupt ongoing instructional activities to accommodate a supplemental instructional program on a "one-shot" basis.
- Research support--A number of administrators perceived little or no value in supporting "research," especially considering the frequency with which such outside requests were made.
- Apathy--Many of the administrators were simply not interested in traffic safety in general, viewing it as an issue which need not be addressed by the public school system. Other officials were reluctant to support an instructional program linked with driver education for fear that participation in the project might imply a continuing commitment to a program which was, locally, "under the gun."

Some schools responded positively to the initial solicitation contact, but were unable to provide the time required for module instruction.

It should be noted that high schools are beseiged with requests to make time available for introduction of various instructional programs for operational or research purposes. It was extremely difficult to obtain participation of a number of schools to perform a rigorous evaluation. The necessary participation was obtained only through the dedicated efforts of teachers and administrators in various jurisdictions.

Site Selection

From the pool of schools volunteering to participate in the project, a total of 20 were selected as potential evaluation sites. The main criterion governing selection was that the school campuses provide a reasonable opportunity to observe safety belt use among students. Consequently, all schools selected met the following conditions:

Limited parking--On-site parking facilities had to be available for the use of students.

Limited entrances--Student parking facilities had to have only a limited number of entrances so that the campus would not be "overrun" by observers.

Number of students driving to school--As the desire was to observe as many young drivers as possible, schools meeting the other criteria for selection were given top consideration according to the number of students driving to school.

Of the 20 schools meeting these criteria, 17 from six different states were selected for participation in the evaluation study. These schools are listed in Appendix B.

Assignment of Modules

Modules were assigned to schools such that each of the six modules was taught at a minimum of two schools, thus obtaining necessary replication. The no-treatment control group consisted of four schools selected for geographic dispersion. The one remaining school was held aside in the case of a last-minute defection by one of the participating schools. When it was apparent that all assigned schools would participate, the remaining school was arbitrarily assigned to the Information module.

The assignment of individual schools to modules was based, to the extent possible, on the following four criteria:

Initial Usage Rate--Schools were assigned to modules such that the average pre-program usage rate for each pair of schools was approximately the same. This meant that schools having unusually low initial usage rates were always paired with schools having very high initial usage rates.

Geographical Dispersion--The maximum geographical dispersion within each pair of schools was sought (and within the four control schools, as previously mentioned). No two schools from the same state were assigned the same module.

Expressed Interest--It was necessary to accommodate expressed interest of administrators, some of whom would accept only certain programs. Fortunately, interests were broad enough to permit all modules to be taught.

Constraints--The schools had to have the administrative and physical ability to administer various modules. For example, a school administering the Vehicle module had to have an off-street area suitable for instruction.

Experimental Sample

The sample consisted of all licensed drivers among the student body of participating schools. This is not to say that other students did not receive the treatments at some of the evaluation sites. At schools where modules were presented during an assembly (i.e., the Testimonial module and the Testimonial-Only module) the entire student body received the treatment. However, where students were selected for instruction, only those who drove to school received the treatments. The experimental sample, however, was determined not by the students receiving treatment, but by the students for which use data were collected.

Data Collection

Measures of the module impact were taken through covert observations of restraint use over three ten-day (two school weeks) periods. Pre-measurements were taken during ten consecutive school days immediately prior to the start of instructional activities. Post-data were collected during the ten consecutive school days immediately following the completion of instructional activities. Followup data were collected on the ten consecutive school days which began 30 days after the last day of post- observations.

Treatments and all observations were conducted simultaneously across all treatment and control sites to minimize any differences in observations which might result from climatic differences and to insure that all evaluation activities were completed within a single (fall) school semester. Also, if the study were to extend beyond a single semester, many untreated subjects might be introduced into the sample, as many students enrolled in driver education during the fall semester might become licensed and swell the ranks of those driving to school.

The primary reason for limiting data collection to observed usage was to minimize the possibility that students would become aware that their use of restraints was being monitored. Administration of paper-pencil measures following exposure to the instructional program could have tipped off students to the fact that their response to the program was being evaluated. Their subsequent use of restraints might have been affected more by the evaluation than by the module. Since the results of the pilot testing had rather well established the impact of the informational and experiential elements upon knowledge and attitude, there was no need for further administration of the paper-pencil measures. Minimizing contamination of use criteria by not administering them seemed to outweigh any possible benefit from giving them.

Method of Observation

Restraint use was covertly observed at all schools by observers trained in data collection techniques by project staff. Observers were provided with a "cover story," disseminated by school officials who described their activities as conducting a traffic survey. Students were told that the survey was being conducted to analyze traffic flow patterns in school zones and that they might expect to see these observers off and on throughout the semester. Pilot tests of this cover story demonstrated that students found it to be believable initially and continued to believe it throughout a long period of observation. The cover story provided a number of unique advantages:

- It did not require observers to disguise either their presence or the general nature of their activities. Students assumed they were tallying car "count" rather than belt use.

- It allowed observers to observe and record restraint use openly, therefore facilitating accurate data collection.

- It permitted observers to be placed close to the flow of student traffic.

All observers were provided with a clipboard which held their data collection forms. On the back of these clipboards, visible to drivers entering the parking lots, were the words "traffic flow survey." Observers also were dressed in orange fluorescent vests, providing an extra measure of credence to the cover story as well as safety for the observers.

Timing of Observation

Observations of restraint use were confined to morning arrival traffic. Departing afternoon traffic was not observed for reasons of efficiency. The majority of students arrive at school within a short period of time (less than one hour). An analysis of arrival rates at selected Howard County, Maryland, schools indicated that 70% of the total number of students observed throughout the school day were observed during a 45-minute time period in the morning. However, because students leave at different times of day, approximately 2-1/2 hours of afternoon observational time would be required to produce samples of restraint use equivalent to those obtained during the 45-minute morning observation period.

Observation Procedures

Observations of restraint use were limited to only those passenger vehicles (including vans and light trucks) which were (1) equipped with single-unit 3-point restraint systems and (2) occupied only by young people. Vehicles in which adults were seated either as drivers or as passengers were recorded as having entered the parking facility, however, use data were not collected for any occupants of these vehicles. For vehicles meeting the observation criteria specified, use or non-use was recorded for front seat occupants (driver and, if present, passenger) only.

Individual observations of restraint use were recorded on standardized data forms. The form permitted observers to record:

- Presence of adults in vehicle (if adult present, no other data were recorded)

- Presence of 3-point restraint equipment (if such equipment was absent, no other data were recorded)

- Restraint use by front-seat occupants (by seating position).

Location of Observers

Observers were located at the entrance or entrances of student parking facilities at each evaluation site. Prior to the start of the evaluation, project staff visited each site to determine the best location at each entrance for observers and the traffic volume passing through each entry point. The number of observers assigned to each site was determined by the number of major entrances to the parking facilities and by volume. At least one observer was located at each major entry point. Where traffic volume was so high as to threaten the accuracy with which an individual observer could observe and record use data, a second "observer" was added. Where such two-person teams were used, one observed belt use and verbally communicated his or her observations by entry code while the other recorded these observations. This allowed data to be recorded quickly, and eliminated the possibility of duplication of data collected that would have existed had two people been recording data independently at the same entry point.

IMPLEMENTATION

To assure that the experimental design was implemented and executed properly, the project staff engaged in three major activities: preparation of instructional materials, preparation of instructors and observers, and monitoring of data collection.

Materials Preparation

In preparation for the demonstration test, prototype materials developed as a result of deficiency testing were upgraded to match the production quality of materials commonly used in schools. The student manual, "Safety Belts...What Do You Think?," was edited to assure technical accuracy and to achieve a somewhat lower reading level that would be more accessible by students. This manual was then typeset and produced in a textbook format.

The instructor guides also were edited to eliminate problems in communication identified through the pilot tests. Additionally, a supplement to the teacher's guide was developed. This supplement was drawn from "A Guide to More Effective High School Safety Belt Instruction" (Cushman and McPherson, 1982) and was provided to instructors as a means of providing them with more extensive background material concerning how safety belts work and the importance and effectiveness of safety restraint use. Instructors and moderators for all treatment groups received this supplement.

Individual instructors received all instructor guides for those modules which they might be called upon to teach. In many instances, instructors did not know which module they would be delivering to students until after they had received preparatory training in several treatments. The student manual was delivered to instructors in those schools where this manual was part of the instructional packet. Manuals were not sent to schools offering the Testimonial-Only or the Crash Dynamics modules.

Personnel Selection

Project staff selected personnel from the evaluation sites to serve as instructors, observers, or supervising observers.

Instructors

Instructors were selected from the ranks of student government leaders or school administrators at sites where assembly-delivered modules were to be employed and from the ranks of driver education teachers or state highway safety officials at those locations where classroom instruction was to be provided. These types of individuals would be called upon to fulfill these roles if and when schools decided to provide supplemental training as a regular part of its academic offerings at a later date. From among the pool of people of the type identified, instructors were selected on the basis of their:

- Motivation to participate in the program
- Interest and knowledge in important instructional content areas
- General instructional experience.

Observers

Observers were selected from the communities in which the studies were conducted. Candidate observers were drawn from the ranks of:

- University students concentrating in highway safety or behavioral disciplines
- Police agencies (off-duty officers)
- Members of local traffic safety organizations.

Individual observers were selected on the basis of their motivation to participate in the project, their interest in the project, and any prior experience in behavioral studies or traffic safety surveys. Beyond this, it was requisite that none of the observers be known to members of the student body. It had to be plausible that each observer actually was working as part of a traffic flow survey team.

Supervising Observers

During training periods, supervising observers were appointed. The primary responsibilities of these supervisory personnel were to:

- Assist in observations when other observers were absent.
- Oversee the quality and sufficiency of observations.

- Coordinate observation activity with school administrative personnel.
- Review and correct observational data forms.
- Indicate the progress of observational activities to project staff.
- Forward validated forms to project staff for data processing.

Personnel Training

Training programs for observers and instructors were conducted by project staff early in September of 1982. Training was conducted on a state-by-state basis.

Instructor Training

Instructor training consisted largely of an orientation to the evaluation project, an explanation of experimental procedures and individual responsibilities, and a structured "trial run" in which instructors presented the modules which they might be called upon to deliver in the schools. These trials continued until project staff determined that instructors had met all pre-established performance levels. These performance requirements were:

- Completion of instructional activities within specified time
- Delivery of instructional content with clarity and accuracy
- Delivery of instructional content without continued reference to instructional materials
- Error-free operation of audio-visual equipment or other teaching aids.

As schools had not, at the time instructor training was given, received their treatment assignments, all instructors from a given state were trained in the delivery of all modules which might possibly be delivered in at least one participating school within that state. This provided instructors with a greater insight into the similarities and differences of the various modules being examined.

Observer Training

Observers were oriented to the experimental design and their responsibilities in following that design. Following an orientation to the data collection form and procedures, observers conducted a two-day "trial run" at the experimental sites under the eye of project staff. Project staff monitored these trial performances to verify that observers could:

- Complete header information on data forms accurately and without assistance.

- Properly execute the recommended procedures to be followed under adverse conditions such as:

  --detection of "true" purpose of activities by public
  --inquiries as to the nature of activities
  --interruption of observation by weather, traffic, etc.

- Complete 100 restraint observations independently and without error.

"Substitute" observers were trained along with the core observer staff. This assured that qualified observers would be "on call" within each jurisdiction in case the regulars fell ill or were unable to man an observation post during any of the three data collection periods.

Monitoring of Data Collection

Because the instructional treatments were delivered simultaneously at various locations through six states, on-site monitoring of instructors or observers by project staff was not possible. Consequently, project staff monitored presentational and observational activities through frequent, regular telephone contacts with field personnel, and review of data collection forms. Project staff remained in close contact with field staff throughout the experimental period. Telephone calls were used to verify the sufficiency and timeliness of instructional and observational activities. Potential and real problems were corrected immediately. In addition to periodic conversations with observers, project staff reviewed the data forms which were submitted to NPSRI every Friday during the observation periods. Letters were sent to observers prior to the start of each observational period, reminding them of the approach of a new round of observations.

To safeguard against data collection errors resulting from "rustiness" that might have set in during the intervals between collection periods, observers were instructed to assume their positions and collect data during the school day immediately preceding the start of the official post- and follow-up observation periods. Data collected during these one-day trial runs were not used in the analysis. Forms were reviewed to verify that observers were following proper coding procedures (e.g., were individual observations inherently self-contradictory?) and that they were recording data for all cars entering the site (e.g., was the total number of observations recorded about what had been expected on the basis of prior site inspections?).

Pre-data were collected in the latter half of September. Post-data were collected in the latter half of October, and follow-up data were collected during the first half of December 1982.

Data Analysis

Data were analyzed through a factorial analysis of variance performed on daily use rates within each school.

First, the percent of drivers in each school was obtained for each day by dividing the number of restrained drivers by the total number of drivers whose use of restraints could be reliably observed (i.e., restrained plus unrestrained drivers). This daily use rate became the observation subject to analysis.

For each module, a two-factor analysis of variance was performed. One factor was the period of observation, pre-program, post-program, followup. Variance in this factor represented the effect of the module (i.e., treatment effect).

The second factor was the schools receiving the treatment. Stratifying the sample by schools permitted variance associated with differences between schools to be controlled, thus allowing a more powerful test of significance. It also permitted a test of interaction of the module effect with schools. The error term in each analysis was the variance among the 10 observations within each school within each period.

RESULTS

Results will be discussed on a module-by-module basis, followed by a synthesis of results for the entire restraint use program.

Information Module

Results obtained from the Information module appear in Table 34 below.

TABLE 34

**INFORMATION MODULE:
MEAN RESTRAINT USE RATES BY PERIOD AND SCHOOL**

SCHOOL	PERIOD		
	Pre	Post	Followup
1	5.7	14.8*	15.0*
2	6.3	7.8	7.3
3	2.3	5.7	10.2*
TOTAL	4.8	9.5	10.8

The table shows an increase in restraint usage across the three periods, increasing from 4.8 to 10.8% use. There are also sizeable differences across the three schools. Both differences are significant (p < .0001). There was also a significant (p < .003) interaction between schools and periods, meaning that the effect of the information-only program varied significantly from one school to another. This significant interaction precludes any discussion of an overall "main effect." If the effect differs from one school to another, then its overall magnitude will always be a function of what schools happen to be included in the sample. Fortunately, despite the interaction, a gain in safety belt use was apparent in all schools. This means that, while the effect of the program might vary from one school to another, the effect always appears to be positive.

Effects of the program upon individual schools was assessed by use of the Duncan Multiple Range Test. This test is a somewhat conservative test of differences in that it takes into account the effect of multiple comparisons upon probabilities. An asterisk next to an entry in the "Post" or "Followup" column means that the mean percentage given is significantly different from that in the "Pre" column. The results show that Post-Program and Followup means were significantly higher than Pre-Program means in school 1, while the Followup mean is significantly higher than the Pre-Program mean in school 3. Not indicated in the table was the fact that there was a significant gain from Post to Followup in School 3.

Testimonial-Only Module

The results from the Testimonial-Only module are presented in Table 35.

TABLE 35

TESTIMONIAL-ONLY MODULE: MEAN RESTRAINT USE RATES BY PERIOD AND SCHOOL

SCHOOL	PERIOD		
	Pre	Post	Followup
1	1.0	1.0	3.0
2	17.1	26.0*	27.7*
TOTAL	9.1	13.5	15.4

The results for the Testimonial-Only module are quite similar to those previously discussed for the Information module. There is improvement across the three periods and sizeable differences between the two schools (p < .0001). It is also evident that the increases in restraint use over the three periods is much greater in one school than in another. This shows up in a highly significant interaction between schools and period (p < .0003). As shown in the table, only the gains from school 2 are statistically significant by the Duncan test. What gain there was in school 1 didn't occur until the follow up period. While it was small in absolute magnitude, it is large relative to the pre-program level.

As with the previous comparison, it appears that the overall effect of the module is beneficial, with the magnitude of apparent benefit varying from one school to another.

Testimonial Module

The results obtained from the Testimonial module appear in Table 36. The difference between the Testimonial module and that discussed in the previous section is that the Testimonial module included the Information module as well.

TABLE 36

TESTIMONIAL MODULE
MEAN RESTRAINT USE RATES BY PERIOD AND SCHOOL

SCHOOL	PERIOD		
	Pre	Post	Followup
1	4.4	7.1	9.7*
2	10.5	11.0	20.8*
TOTAL	7.5	9.1	15.3

The results for the Testimonial module are very similar to those discussed previously, with significant differences across periods and schools ($p < .0001$) and a significant interaction between the two factors ($p < .04$). As with the previous comparisons, gains are observed at each of the schools, with Pre-Followup differences being significant. While the results for the two schools parallel one another more closely than in previous comparisons, the conclusion remains the same--the Testimonial module appears to have a generally beneficial effect, with the magnitude of benefit depending upon the school in which it is administered.

One difference between this and the previous comparisons is the relatively larger gain from Post to Followup period. This was primarily due to the second school, in which the percentage gain almost doubled and was statistically significant.

Vehicle Module

Results obtained from the vehicle module (including the information module) appear in Table 37.

TABLE 37

Vehicle Module:
Mean Restraint Use Rates by Period and School

SCHOOL	PERIOD		
	Pre	Post	Followup
1	7.1	8.9	6.1
2	8.2	13.3*	10.9*
TOTAL	7.7	11.1	8.5

The table again shows substantial and significant differences across period ($p < .006$) and schools ($p < .0003$). However, the pattern of differences across schools is quite dissimilar from that of previous comparisons, evidencing a gain from the Pre to the Post period, and a decline from Post to Followup. Looking at individual schools, there is a significant gain from Pre to Post in one school. During the Followup period, however, use rate fell in that school, but still remained significantly above Pre-Program levels. Despite the difference between the two schools during the Followup period, the pattern was sufficiently similar to result in a non-significant interaction between schools and periods ($p > .18$). This difference in pattern will be discussed more fully in the synthesis of results provided in a moment.

Convincer Module

Results obtained from use of the Convincer module (combined with information) appear in Table 38.

TABLE 38

Convincer Module:
Mean Restraint Use Rates by Period and School

SCHOOL	PERIOD		
	Pre	Post	Followup
1	2.4	4.1	3.8
2	10.7	31.6*	37.1*
TOTAL	6.6	17.8	20.4

The results presented in the table resemble those obtained from the Information, Testimonial Only, and Testimonial Program. There are substantial and significant gains across periods and schools, as well as a significant interaction between periods and schools ($p < .0001$). The biggest difference between these results and those presented previously is the extremely large gain in use from Pre to Post Periods. It is by far the largest gain found in evaluating any of the modules. The irony is that the Convincer module was the only one of the restraint use modules failing to show a significant improvement in usage during the pilot test (for reasons that were described earlier). Changes from Post to Followup were minor and nonsignificant. There was additional gain in one school and a slight decline in the other. Overall, they represent what might be considered a "leveling off" after the substantial gain from Pre to Post.

Again, it may be concluded that the convincer program has a beneficial effect, with the magnitude of the apparent benefit depending upon the school in which it is administered.

Crash Dynamics

The results obtained from the Crash Dynamics module appear in Table 39 below.

TABLE 39

CRASH DYNAMICS MODULE:
MEAN RESTRAINT USE RATES BY PERIOD AND SCHOOL

SCHOOL	PERIOD		
	Pre	Post	Followup
1	0.1	4.0*	2.9*
2	14.5	9.5*	6.6*
TOTAL	6.8	6.7	4.8

The results shown in the table are in marked contrast with those presented previously. While there are substantial differences between schools, differences across periods are relatively small and are characterized by a decline rather than an increase in use. While the differences across periods are statistically significant ($p < .05$), largely due to the decline from Post to Followup Period, it is overridden by an extremely large interaction ($p < .0001$). This interaction involved an increase in use at one school and a decrease at the other. Because of the nature of this interaction, it is not possible to conclude whether the Crash Dynamics module has a beneficial effect or not. The existence of any benefit would appear to depend totally upon where the program is implemented.

Control Group

The usage rates obtained from schools not receiving any restraint module (the control group) appear in Table 40.

TABLE 40

CONTROL GROUPS:
MEAN RESTRAINT USE RATES BY PERIOD AND SCHOOL

SCHOOL	PERIOD		
	Pre	Post	Followup
1	0.3	0.0	0.0
2	4.4	3.9	3.0
3	12.8	8.1*	10.8
4	4.1	5.2	7.8*
TOTAL	5.4	4.3	5.4

Again, there are sizeable and significant differences across schools ($p < .0001$). However, the differences across periods follow no logical pattern. Nor do the differences for individual schools.

While the pattern of differences across schools is not an easily interpreted one, it is marginally significant ($p = .05$). There is also a highly significant interaction between periods and schools ($p < .0001$). Taken together, the results seem to indicate that the various schools are subject to widely differing patterns of use across the three periods. School 4 evidenced a general increase, school 2 a general decline, school 1 no change, and school 3 a decline and then increase.

Since the control schools received no programs, the differences across periods in each school reflect the influence of prevailing factors that introduce significant period-to-period differences. Just what these factors are is not known. They could have to do with weather, school activities, or other events that could affect either safety belt usage by those who drive to school or the composition of the population that does drive to school from one period to the next.

Presumably, the factors that cause significant variation in use rate from one period of time to another affected the schools receiving the various restraint use modules as well as the control schools. The fact that these influences vary from one school to another helps explain the significant interactions observed in each of the comparisons previously discussed.

DISCUSSION OF RESULTS

The results of the evaluation, while not totally conclusive, are certainly encouraging. Of the six modules evaluated, five evidenced some degree of improved restraint use in each of the schools in which it was evaluated. The lone exception was the Crash Dynamics module, administration of which was accompanied by a marked increase in use at one school and a marked decline in the other. In the four schools where no program was administered, there was no consistent change in use over time. In the case of the Information, Vehicle and Testimonial modules, the results confirmed those obtained during the earlier pilot testing. Results for the Convincer module are much more encouraging than those of the pilot test and suggest that the failure of the Convincer to yield a significant behavioral change during the pilot test was due to factors associated with the school in which it was implemented rather than the module itself.

Outside Factors

Confounding the effects of the various modules are significant variations in restraint use over time, resulting from unknown, outside factors. There is no means by which these variations can be separated from module effects with certainty. The results obtained from the control group reveal no consistent pattern in these variations during the time observations were being made. It is unlikely that these small, haphazard variations could account for the consistent, and frequently large changes in use from one period to the next among groups receiving the modules.

Each of the module comparisons evidenced highly significant interactions between the effect of the module, as indicated by variation over periods, and the school in which the module was administered. These interactions precluded any estimate of the magnitude of module effect. There is no way of knowing just what caused the interactions to occur. These causes can be divided into two categories:

> Module-Related--Characteristics of modules that actually interact with schools to vary their true effect upon restraint use.
>
> School-Related--Characteristics of schools that have nothing to do with the effects of the modules, but rather influence restraint usage directly.

Of the two potential causes, the school-related factors are the more likely to be responsible for the interaction between schools and variation over periods. There are no elements within the modules whose effect could be logically expected to vary from one school to another. On the other hand, the period-to-period variation observed within the control groups reveals the existence of factors capable of causing significant variation in use over time, factors that obviously vary from one school to another.

The explanation most consistent with observed results is that the Information, Testimonial, Testimonial-Only, Vehicle and Convincer modules all have a significant and relatively uniform effect upon the tendency to use restraints. However, other factors, which vary over time and from one school to another, also affect the same tendency. As a result, changes in use following administration of the modules varies from school to school.

Variation in external factors also seems to offer the most plausible explanation for the interaction between schools and periods noted in connection with the Crash Dynamics film. It is hard to imagine any characteristic of a film that would actually depress restraint usage among one group of students, while increasing it among another group. While the period-to-period changes among the students seeing the Crash Dynamics film exceeded those found among schools making up the Control group, the hypothesis that they result from changes in external factors is still more acceptable than any alternative hypothesis identified.

The fact that the Crash Dynamics film did not evidence a favorable overall effect does not mean that the film was without benefit. It only means that what benefit it may have had failed to reveal itself under the conditions in which the evaluation was conducted. A more extensive evaluation, involving a larger number of schools to provide more stable estimates of use within each period would be necessary before a conclusion of "no effect" could be justified.

Comparison of Modules

As previously explained, the significant interaction between module effects and school precludes any general conclusions as to the magnitude of module effects. This in turn rules out any comparison among modules for magnitude of effect. However, some comparison can be made in the patterns of change, particularly pre-post changes relative to post-followup changes.

It is noteworthy that the two modules involving Testimonials showed the largest relative gain from Post to Followup. The Post-Followup gain for the Testimonial Only module was half again the Pre-Post gain, while the Post-Followup gain for the Testimonial (with information) module was almost four times that of the Pre-Post gain. These differences could be solely the function of changes in outside factors. However, it could be the result of a "the more you think about it..." effect.

The remaining modules--Vehicle, Convincer, Information--evidenced a lesser increase and, in the case of the Vehicle module, a slight decline. Again, the changes from Post to Followup may be the result of outside factors. On the other hand, it may mean that whatever effects the modules have are immediate. (Neither the Convincer nor Vehicle module evidenced a noticeable gain from Post to Followup in the pilot test.) Approaches that are largely cognitive and physical might well have effects that are different from those of a program as emotionally laden as the Testimonial.

The comments just made are highly speculative and offered merely as possible explanations for the observed differences in patterns of change. There is no evidence to offer in support of them. Indeed, there is no assurance that the same patterns would appear in another group of schools.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

From the assessments of the alcohol, speed, restraint use, hazard perception and fuel efficiency modules, the conclusions in the following paragraphs are warranted.

Alcohol

From the results of the pilot test, the following conclusions may be reached concerning the effectiveness of the alcohol modules:

1. The Information, Self-Image and Peer Intervention modules are capable of producing significant gains in knowledge concerning responsible use of alcohol.

2. The Self-Image and Peer Intervention modules are capable of producing more favorable attitudes toward responsible use of alcohol. The ability of the Information module to produce attitude changes is uncertain.

3. The Peer Intervention module is capable of leading to increased incidence of intervention in the drinking and, driving behavior of others. It is not capable of altering one's own use of alcohol. Neither the Self-Image nor the Information module appears capable of altering behavior in the use of alcohol.

Speed

The following conclusions may be reached concerning the effectiveness of the Speed module:

1. The Speed module appears capable of increasing knowledge concerning speed, improving compliance with the speed limits, and reducing mean speed.

2. No conclusions concerning the effect of the speed module upon attitudes is warranted owing to the uncertain validity of the attitude measure.

Restraint Use

From the results of the evaluation, and the pilot test that preceded it, the following conclusions may be reached concerning the effect of the modules upon restraint use:

1. The Information, Vehicle, Convincer, Testimonial, and Testimonial-Only modules appear to be capable of having a significant impact upon knowledge, attitude, and restraint use.

2. Outside factors produce a significant variation in restraint use across periods of time. These factors vary significantly across schools, producing a significant interaction between schools and periods of time with respect to use rate.

3. Changes in observed use rate following introduction of modules vary significantly from one school to another, precluding any meaningful estimate of the magnitude of effect in absolute or relative terms. These differences in change may be due to characteristics of the modules themselves or to the effect of outside factors.

4. No conclusions concerning the effectiveness of the Crash Dynamics module may be offered on the basis of this evaluation.

Hazard Perception

From the results of the pilot test, the following conclusions concerning hazard perception are offered:

1. The Hazard Perception module does not appear to have had a signficant effect upon the perception of motorcycle, bicycle, or pedestrian hazards by driver education students.

2. The limited vehicle handling skill of driver education students probably limits their ability to evidence hazard perception skill in actual traffic, while the simulator measure is of questionable validity.

Fuel-Efficient Driving

1. The Fuel-Efficient Driving module is capable of improving knowledge about, and creating more favorable attitudes toward, fuel-efficient driving.

2. There is no evidence that the module is capable of leading toward more fuel efficient behavior in the operation, maintenance, selection, or use of vehicles.

3. The lack of vehicle handling skill on the part of driver education students makes it difficult to develop fuel efficient operating skills or to assess the skill level.

4. It is not possible to assess the effect of instruction on actual vehicle selection, maintenance, or use without extremely long term followup.

RECOMMENDATIONS

Based upon the conclusions reached, the following recommendations are made concerning distribution of materials, implementation of modules, and additional research.

Distribution of Materials

It is recommended that NHTSA publish all printed materials in a form suitable for general distribution and make the materials available to the public in the following ways:

1. Sale of materials through the Government Printing Office.

2. Providing reproducible copies to state and local agencies, including state highway safety offices, state departments of education, and (where requested) local school districts.

3. Authorizing and encouraging marketing through the private sector, e.g., American Automobile Association and National Safety Council.

Printed materials include those prepared for all alcohol and restraint modules as well as the speed and fuel efficiency modules. Each of these modules was shown to be effective in improving knowledge and/or attitude. Not all were effective in modifying behavior, and this fact should be made known. However, lack of proven effectiveness in modifying behavior--a shortcoming shared by most educational materials--does not mean the material is truly ineffective. Making it available will allow interested organizations to undertake evaluations that may establish an impact upon behavior.

The Hazard Perception module consisted primarily of projected visuals rather than printed materials. The expense of preparing such materials for widespread distribution is not justified by the results of the evaluation, which failed to show any effect at all.

Implementation

It is recommended that NHTSA actively foster implementation of the Peer Intervention (alcohol) module as well as the Information, Testimonial, Testimonial-Only, Vehicle, and Convincer (restraint) modules. The established effectiveness of these modules in modifying behavior, coupled with the high potential impact of improved behavior upon highway injury and fatality, warrants intensive efforts to obtain widespread implementation. Steps that may be taken by NHTSA to foster implementation include the following:

1. Working through its established network of organizations including youth groups (e.g., 4-H), teacher organizations (e.g., ADTSEA), safety interest groups (HUFSAM), and other types of organizations involved in the delivery of safety information, as identified earlier in the report (Figure 7).

2. Authorize the use of 402 funds to purchase the additional materials required in support of the modules (audio-visuals, convincers) where they can be shared by many jurisdictions within a state.

3. Provide Federal funds to help support large scale evaluations of modules designed to estimate the magnitude of effect upon behavior as well as the significance of any impact upon injuries.

Research

The research leading to the various modules only scratches the surface of several highly critical behavior areas. Distribution of materials and implementation of modules should not preclude additional study aimed at improving the state of the art in these areas. Research could profitably be devoted to the following:

1. Improve Modules--Some of the modules that failed to evidence an effect upon behavior might do better with some improvement. For example, the Self-Image module might be improved with a form of experience that provides a more convincing demonstration of the effect of alcohol upon oneself than a film that shows its effect upon others. The Crash Dynamics (restraint) module might show a consistent beneficial effect if accompanied by the informational materials that were found to be effective by themselves and in combination with other modules.

2. Study Combined Effects--While modules were assessed individually, they may not be implemented on that basis. This is particularly true of restraint modules, which might be presented in series in order to obtain an enduring impact. Alternative strategies for combining modules is necessary in order to get the most beneficial additive and interactive effect.

3. Investigate New Approaches--The experiential methods employed in the present study certainly do not exhaust the potentially effective approaches to modification of behavior in the five areas addressed. Other approaches--experiential and otherwise--certainly warrant study. The ability of the modules to bring about behavior change in the areas of alcohol, restraint use, and speed is sufficiently encouraging to provide impetus to the study of other approaches.

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APPENDIX A:

DATA COLLECTION AGENCIES FOR DEFICIENCY TESTING

1. Mesa Public Schools (3) - Mesa, AZ
2. Central Missouri State University (3) - Warrensburg, MO
3. Kansas State Department of Education (2) - Topeka, KS
4. Western Dubuque Community School District (2) - Farley, IA
5. Owensville High School - Owensville, MO
6. Rhode Island Department of Education (3) - Providence, RI
7. Nebraska Department of Education (2) - Lincoln, NE
8. Clinton High School - Clinton, IA
9. Kelso High School - Kelso, WA
10. Michigan State University (2) - East Lansing, MI
11. Menomonie High School - Menomonie, WI
12. Blue Springs High School - Blue Springs, MO
13. James Robinson High School - Fairfax, VA
14. Columbia Public Schools (2) - Columbia, MO

APPENDIX B:

SCHOOLS PARTICIPATING IN PHASE III EVALUATION

SCHOOL	LOCATION
Blue Springs	Blue Springs, MO
Clearview Regional	Clearview, NJ
East Lansing	East Lansing, MI
Essex Junction	Essex Junction, VT
Excelsior Springs	Excelsior Springs, MO
Franklin Institute	Joplin, MO
Glassboro*	Glassboro, NJ
Handley	Winchester, VA
Hartford	Whiteriver Junction, VT
Haslett	Haslett, MI
Hempstead	Dubuque, IA
L & M	Letts, IA
Mason City	Mason City, IA
Middlebury	Middlebury, VT
Mt. Abraham	Bristol, VT
North Country*	Newport, VT
Quakertown*	Quakertown, PA
Rice Memorial	South Burlington, VT
Stonewall	Manassas, VA
West Deptford	West Deptford, NJ

* Participation was limited to pre-data collection.