DRIVER EDUCATION FOR MOTORCYCLE OPERATION

FINAL REPORT

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ABSTRACT

This report deals with the planning, implementation and evaluation of a pilot effort in which motorcycle rider education was provided to young drivers in North Carolina. The project effort covered a three-year period in which three groups of volunteer classes of young students were given 15 hours of classroom instruction and 10 hours of off-road, on-bike instruction. The curriculum used was the Motorcycle Rider Course developed by the Motorcycle Safety Foundation. The driving records of the students trained in either of the first two years were subsequently followed for a 12-month period along with the driving records of a randomly assigned control group which was identified from the volunteer pool at each class site.

Because of the low number of volunteers and subsequent very low number of motorcycle riders, the evaluation phase was forced to deal with administrative procedures and secondary driver history measures rather than changes in motorcycle crash rates. The principal implementation-related findings concerned the facts that the number of students volunteering to take the training and the subsequent motorcycle acquisition rates were both lower than had been anticipated.

In terms of driver histories, because of the very low amount of motorcycle exposure which was subsequently accumulated, only nine motorcycle related crashes involved either an experimental or control student in the monitored period. Supplemental analyses involving driving histories of the experimental and control groups in other vehicles (primarily passenger cars) were carried out to examine the hypothesis that the additional training might affect driving in these other vehicles. While no significant differences were found between the driving records of trained and untrained students, it is again noted that no conclusions can be drawn concerning the efficacy of motorcycle training in reducing motorcycle crashes--the variable of primary interest. An analysis of the North Carolina program costs (approximately $55.00 per student) indicated that the training would need to reduce between 24 and 60 percent of the expected crashes to break even economically.

Major recommendations based on the administrative and effectiveness findings concern the need to continue the implementation and evaluation of such pilot efforts in the driver education area, the need to closely monitor the results of other ongoing motorcycle education programs to determine whether or not a 20-30 percent effectiveness level is indicated, and the need to maximize the probability of trained students acquiring and riding motorcycles by carefully choosing students in future programs.

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INTRODUCTION

The North Carolina Department of Public Instruction is the state agency with the primary responsibility for educating North Carolina's beginning drivers in safe driving techniques. There currently exists in North Carolina a very comprehensive program in automobile driver education. However, at present, there are no state programs in driver education for motorcycle operators. The only training that exists is that which is given by some motorcycle dealers when a motorcycle is sold.

Coupled with this lack of a training program is a tremendous growth in motorcycle registrations and motorcycle crashes. Between 1972 and 1974 motorcycle registration increased from 59,631 to 117,014, a rise of 96 percent. Since 1974 the number of motorcycle registrations has remained high. In 1976 and 1977 there were 105,144 and 103,699 motorcycles registered, respectively. The growth in North Carolina motorcycle registrations has resulted in a large increase in motorcycle crashes. As shown below, the number of crashes has increased by 133 percent between 1970 and 1977.

Motorcycle accidents by year of occurrence.

	All Accidents	Fatal Accidents	Injury Accidents
1970	1476	49	1221
1971	1891	48	1552
1972	2263	67	1954
1973	2869	91	2493
1974	3123	79	2743
1975	2892	74	2510
1976	2973	79	2542
1977	3292	75	2841

Because of this growth in motorcycle usage, the possibility of the development of a statewide motorcycle operators driver education program is being considered. Two additional factors which have contributed to this interest are even more timely. First, in connection with the state's driver education teacher certification program, some high school driver education instructors have partially met their certification requirements by taking courses in motorcycle driver education taught at two universities in the state.

Second, there is a current move toward a system of classified driver licensing in North Carolina. Such a system would require that in order to be licensed to drive a certain type of vehicle, an operator would have to be tested in that vehicle. The first step toward a classified licensing system was taken by the 1977 General Assembly, which passed a law requiring written and on-bike testing for certain motorcyclists. As passed, the law requires that a N.C. driver who wishes to operate a motorcycle must obtain a motorcycle license unless the rider can certify that he or she has had two years experience prior to January 1, 1978, or that he or she will only be riding motorcycles whose engines are rated at 190 cc's or less. Any original licensee or renewal applicant obtaining a license after January 1, 1978 will be subject to these provisions.

With the passage of such a law, pressure may increase for making available some form of motorcycle training. Thus, there is an apparent need to develop factual information concerning what type of motorcycle operating training could be given and what effect such training would have in terms of accident reduction. In an attempt to obtain this information, a limited motorcycle driver education pilot program was funded by the Governor's Highway Safety Program under the direction of the Department of Public Instruction (DPI), and evaluated by the University of North Carolina Highway Safety Research Center (HSRC). DPI moved into this area on a pilot rather than a statewide basis in order to evaluate the programs in terms of both administration (i.e., concerning implementation problems) and effectiveness (i.e., knowledge gained and potential accidents reduced). DPI felt that there was a special need to examine the motorcycle education area because, with a motorcycle licensing law already passed, it may be that the next requirement placed by the legislature will be a requirement for motorcycle education. Thus, the program was looked at in a fairly low cost pilot effort in order to determine whether statewide implementation is feasible and necessary.

The pilot program involved off-road motorcycle training for beginning drivers. It was recommended by Council, et al. (1975), that the current driving range usage program should include new, innovative training procedures such as motorcycle training. This was attempted through a pilot program conducted at several of the state's driving ranges and counties. The first year of the program involved approximately 422 students from five locations. The second year involved seven sites and approximately 364 students. A detailed description of the teaching program, evaluation methodology, and progress and problems for the first two years is provided by Council, et al. (1976), and Desper et al. (1977).

The statewide pilot program evolved into a three-year effort (see Figure 1). Four sites and 164 students participated the third year. Subsequent driving histories for students and comparable control groups in the first two years were monitored for at least one year following completion of training.

This report covers all three years of the program, including details of the teaching program, evaluation methodology, problems encountered in the implementation and evaluation, and the results of the evaluation.

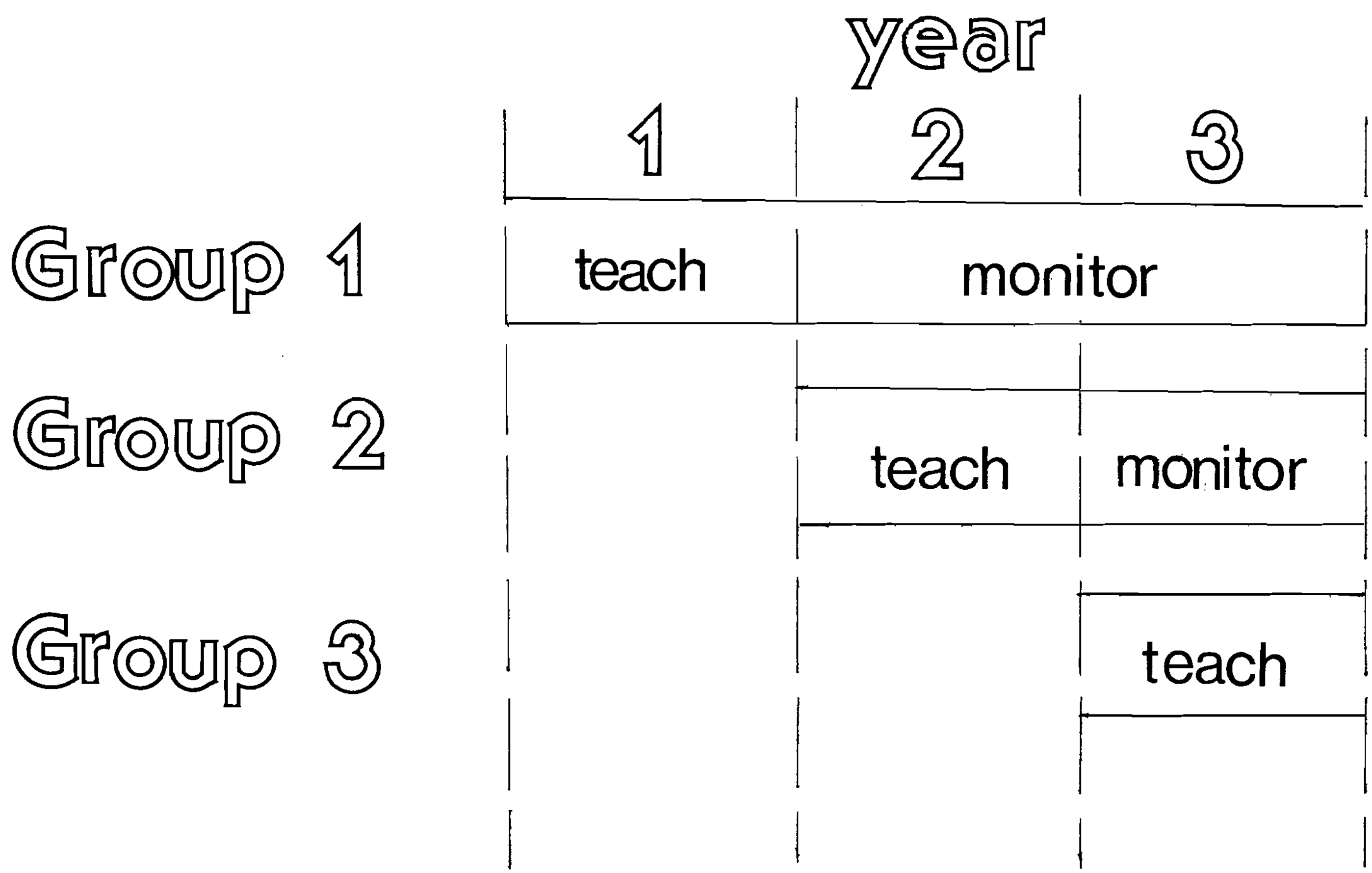

year
1
2
3
Group 1
teach
monitor
Group 2
teach
monitor
Group 3
teach

Figure 1.

PROGRAM DEVELOPMENT AND IMPLEMENTATION

Curriculum Materials

The Motorcycle Safety Foundation's Beginning Rider Course was chosen as the teaching program for the first year of the pilot study. This package included the Beginning Rider Course Textbook, Beginning Rider Course Workbook, and Beginning Rider Course Instructor's Materials. These curriculum materials, the best package available in terms of content and method of presentation, were the logical choice for the pilot program since they had been used in the university training received by the driver education teachers.

The Motorcycle Safety Founcation's new curriculum Motorcycle Rider Course was chosen as the teaching program for the second and third years of the pilot study. This package includes the Motorcycle Rider Course textbook, instructor's guide, four 16 mm. films, and three audio/cassette film strips. Representatives from the Motorcycle Safety Foundation presented a one-day refresher course to the driver education teachers involved in the second year of the pilot program. The purpose of the course was to familiarize the teachers with the new Motorcycle Rider Course curriculum. Teachers from this same trained pool were used in the third year efforts.

Site and Instructor Selection

The Department of Public Instruction sent letters to the superintendents of all the 17 counties which have driving range facilities asking them to volunteer to participate in the first year of the motorcycle education program. The only qualifications to be met were that there be a driving range located in the county and that one or more of the county's driver education teachers had previously completed the motorcycle course. Six sites were chosen from the volunteers, with east-west location being taken into account. The six sites chosen for the first year were Cabarrus County, Charlotte/Mecklenburg, Craven

County, Gaston County, Halifax County, and Wake County. The sites were to teach a total of 240 students; there was also a control group of equal size.

The first year of the pilot program generated a great deal of interest around the state among driver education instructors. Thus, for the second year there was an attempt to expand the program from five range sites to thirteen sites, including approximately 380 students at both range and non-range sites. The Department of Public Instruction contacted the superintendents of the counties that had previously expressed interest in participating in the motorcycle driver education program and asked them to volunteer to participate in the second year's program. The qualifications were the same as those of the first year except that the driving range qualification was dropped. Any county that had a driving range or parking lot suitable for motorcycle instruction was eligible. Thirteen sites volunteered and were chosen to participate in the program. Charlotte/Mecklenburg, Craven County, Gaston County, Halifax County, and Wake County were continued over from the first year. Additional sites for the second year were Bertie County, Cleveland County, Edenton-Chowan, Edgecombe County, Greensboro City, Kinston City, Pitt County, and Vance County.

The Department of Public Instruction obtained volunteers for the third year of the pilot program by contacting the superintendents of the counties that had been previously involved in the motorcycle driver education program. Eight sites (16 classes) were planned to include a total of 320 students. The seven sites that volunteered for the third year were Bertie County, Cleveland County, Edenton-Chowan, Gaston County, Halifax County, Kinston City, and Wake County. Figure 2 shows the counties selected for each year.

As noted earlier, the teachers were chosen from the group of high school driver education instructors who had already received training in motorcycle

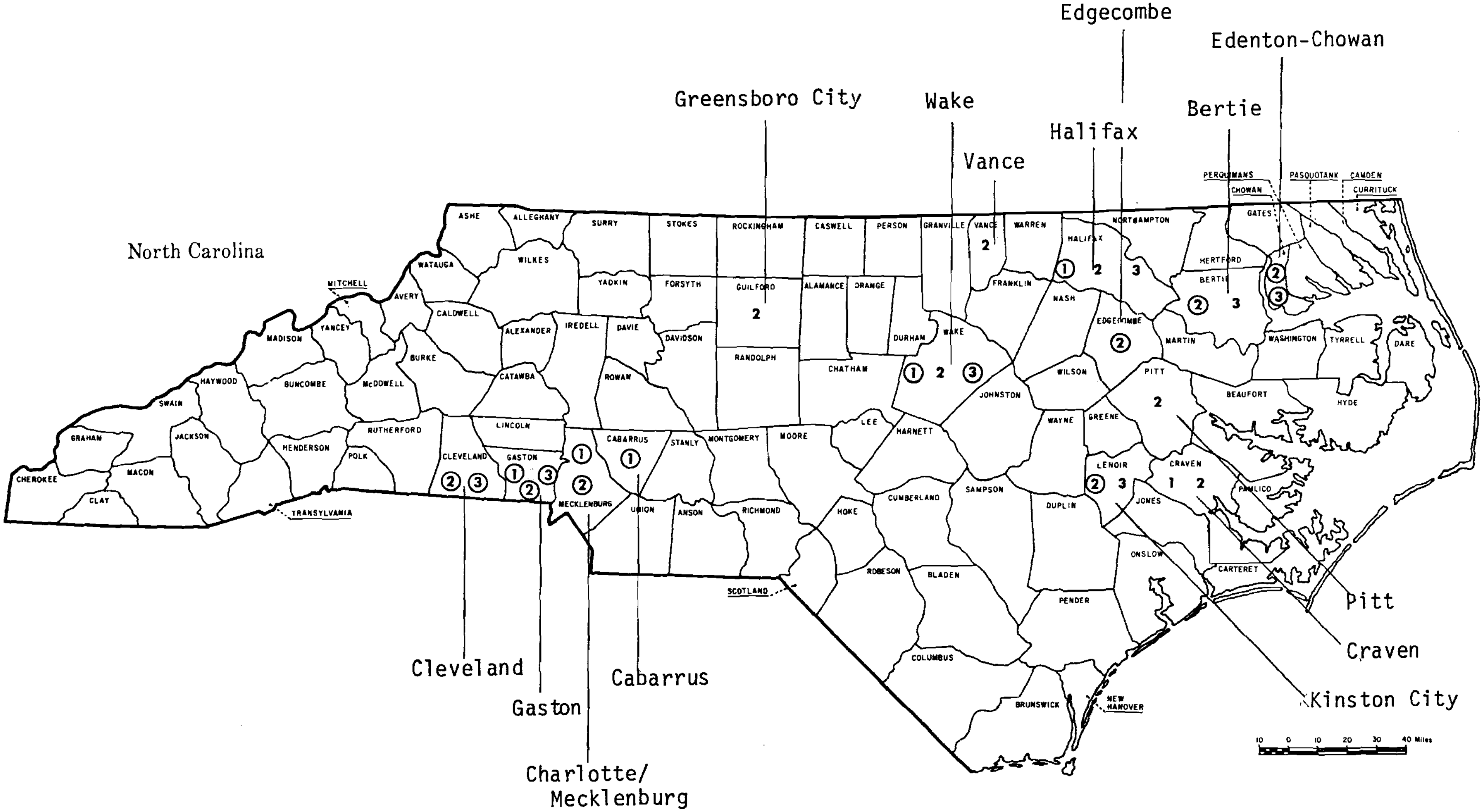


Figure 2. Sites for Motorcycle Driver Education

Numbers shown indicate years each site was chosen.

Circled numbers indicate years each site actually participated in the program.

operator education. Each of the sites supplied one or two teachers for the pilot program.

When the sites were informed of their acceptance into the program, they received a time schedule which provided specific dates for the completion of the various parts of the program (i.e., acquisition of insurance, acquisition of motorcycles, obtain student volunteers, etc.).

Each site submitted a proposed budget for the first year, which included such costs as insurance, gas, maintenance, as well as necessary range modifications. Taking these requests into account, DPI and HSRC drew up a budget to be used as guideline for spending for each site. The first year's budget and actual spending was used as a basis for the suggested budget for the next two years.

Each site obtained at least ten motorcycles on loan from local motorcycle dealers. Insurance for the motorcycles was also acquired through motorcycle dealers. Each site made arrangements for medical payment insurance through their regular driver education insurance company or another insurance company.

Student Selection

Each site was to obtain 45-50 student volunteers for each class to be taught. This was more than twice the number which would ultimately be taught. The volunteer group was to consist of inexperienced riders who expected to purchase and operate motorcycles shortly after the training period. The volunteers were to to be licensed North Carolina drivers whenever possible. The student selection process is explained in more detail in the following section.

Evaluation Methodology

The evaluation methodology used involved the comparison of the subsequent driving records of trained and untrained subjects (i.e., experimental versus control groups). The basic evaluation design chosen was a modified version of the classic before/after design with control group. Obviously for such an evaluation to be meaningful, the two groups must be assumed to be equal on all relevant factors other than training. Because there is no way to identify or control for all other relevant factors ahead of time, a random assignment technique was employed under the assumption that such assignment would balance the experimental and control groups on these other factors.

Random assignment techniques could be employed basically because of the monetary restraints of available funding. Since the number of students to be taught could be predicted based on the amount of available funds, the number of students needed for a comparable sized control group could also be projected. The control group and treatment groups were obtained as follows: each teacher at a participating school was required to obtain a list of twice as many volunteers as he would ultimately be teaching (i.e., if his class size was ultimately going to be 20 students, he was asked to obtain a list of 40 volunteers). This list was then sent to HSRC, where the students were randomly assigned into either the treatment or the control sample; then the list was returned to the teacher. Some students out of the control sample were assigned to be alternates.

Thus, each site was assigned an experimental group composed of approximately 20 students per class and a control group of equal size. As indicated earlier, the desired sample size was 480 for the first year, 380 for the second year, and 320 for the third year.

It should be noted that by choosing both the experimental (trained) and control (untrained) groups from the same list of volunteers, the "volunteer biases" often noted in past driver education studies were eliminated. Because both groups were volunteers, it was not necessary to compare a group of volunteers (with their attitudes, driving habits, etc.) with a group of non-volunteers who might well differ on factors other than just training. It is also noted that DPI did not unfairly discriminate against the control group since the funding constraints dictated the number of students which could be taught, and the students to be trained were selected essentially by flipping a coin. Thus, by including evaluation planning in the advanced project planning, DPI and HSRC were able to fairly select both an experimental and a control group which should be comparable. The point being stressed here is that the limitations on funding of highway safety projects can often be used as an ally in establishing a sound evaluation design, but only if total project planning includes evaluation planning.

In order to investigate the assumption of comparable groups (trained and untrained), information on biographic variables was collected. Address, birth date, race, and sex data for each student (experimental and control) were supplied by the teachers. Past riding experience (minibikes, motorcycles, etc.) was obtained through a questionnaire given to each student at the outset of the course (see Figure 3, page 23). The questionnaire included questions about each student's past riding experience, training and ownership of motorcycles, mopeds, and minibikes. Driver license number and date of issuance were obtained from the questionnaire and through Department of Motor Vehicles' records.

As noted above, each site conducted one or two classes of 20 students per class. Each student received approximately 15 hours of classroom training and 10 hours of range instruction on the motorcycle. According to the Motorcycle Rider Course, the curriculum is designed to help the student "acquire the knowledge necessary for cycle riding," "gain experience in the basic safe riding procedures and routines," and "make sound riding decisions."

A knowledge pre-test containing both motorcycle questions and general driving questions was administered to both experimental and control groups at most of the sites. A follow-up test was given at the conclusion of the course.

At the conclusion of each course, all students in both the experimental and control groups for the first two years were sent a mailing which included a postcard to be completed and returned to HSRC. The postcard solicited information from each student as to whether or not he had yet obtained a motorcycle. If so, the student was to indicate whether the motorcycle was new or used, and the current mileage on the motorcycle. During the first year, if the student indicated on the questionnaire or one of the postcards that he had access to a motorcycle he was sent an additional mailing asking him to indicate how many miles he drove a motorcycle to school, work, and for pleasure each day for a week. For the second year this information was included on the original postcard sent to each student. Each student was sent three such exposure postcards at three-month intervals.

The three basic criteria for the evaluation were the accidents and violations of the students, the written test scores and exposure data. An auxiliary evaluation was conducted through a teacher questionnaire in which each teacher and driver education coordinator involved in the three-year program was sent a detailed questionnaire soliciting his comments and suggestions on every phase of the pilot program. The questionnaire responses were used to prepare recommendations for future programs.

Program Implementation Problems

Over the course of the three-year pilot program, several problems emerged which interfered with and, in some cases altered, program implementation. The overwhelming problem which occurred all three years was the low sample sizes of students who were ultimately trained. While part of this problem in the initial year stemmed from a necessary reduction in the proposed budget and thus less training funds), the major problem was the difficulty experienced in obtaining student volunteers. The teachers had expected strong interest in motorcycle training, but such was not always the case. One main reason for this problem was scheduling. An after-school motorcycle course interfered with such activities as sporting events and practices, and after-school jobs. During the first two years some students may have felt that the training was not necessary because no special license was needed to drive a motorcycle. Another reason for the volunteer problem may have been the way the program was advertised at each school. Some teachers had more access to the students through such means as announcements, classroom visits, etc. than others.

It is also noted that this problem resulted to some degree from the shift in the start of the federal fiscal year (and thus the project year) to an October 1 date. Because funds were not available (nor final decisions possible) until a final contract had been signed, no implementation could begin until approximately one to two months after the school year began. Thus, in most cases, the search for volunteers for the motorcycle riding instruction could not begin with the initial standard driver education sessions but had to be delayed until November, effectively eliminating the fall semester as a potential training period. While this discussion is certainly not intended as a criticism of the NHTSA funding procedures, it does point out the need to note possible conflicts between contract year and school year in future efforts involving education programs for young drivers.

One result of the problem of getting student volunteers was the decision to drop the N.C. drivers license requirement in some cases. In order to obtain greater numbers of volunteers, it was necessary to allow driver education students close to the age of sixteen to volunteer for the program. Using the younger students shortened the potential driver record monitoring period of these students.

Lack of student volunteers also caused several sites each year to withdraw from the program. Most of these sites made an intensive effort to get the volunteers but the interest was not there.

During the first year, most of the sites got volunteers during fall semester, but did not begin teaching until spring semester. Many of the students who volunteered in the spring were no longer interested or were unable to take the course in the spring. This often necessitated soliciting more volunteers. This problem was solved in the second and third years by asking the teachers to get volunteers approximately two weeks before teaching was to begin.

Another problem encountered by several of the sites was in obtaining medical payment insurance. Each site had to add additional coverage to their regular driver education insurance or seek insurance from another source, causing major delays at some of the sites.

Generally, there were no problems in obtaining motorcycles or other equipment. One or two sites had difficulty finding a motorcycle dealer in their area willing to provide the motorcycles, but with the assistance of DPI, HSRC, and the Motorcycle Safety Foundation, all sites were able to get the motorcycles they needed.

A detailed description of the specific problems of each site for the first two years is provided by Council, et al., (1976) for the first year and Desper, et al., (1977) for the second year. The counties that participated in the program and the number of students taught can be found in Figure 2 (page 7) and Tables 1-3.

Table 1. Student Participants for the First Year.

	Experimental	Control
Charlotte/Mecklenburg		
South Mecklenburg High	18	36
West Charlotte High	14	37
Gaston		
Ashbrook High	15	42
Hunter Huss High	20	39
Halifax (2 classes)	32	58
Wake	11	38
Cabarrus (2 classes)	17	45
Total	127	295
Participants originally anticipated	240	240

Table 2. Student Participants for the Second Year.

	Experimental	Control
Bertie	20	31
Cleveland		
Crest Senior High	8	15
Burns Senior High	8	18
Edenton-Chowan	14	35
Edgecombe	19	27
Gaston		
Ashbrook High	16	23
Hunter Huss High	16	25
Charlotte/Mecklenburg	7	17
Kinston (2 classes)	15	50
Total	123	241
Participants Originally Anticipated	190	190

Table 3. Student Participants for the Third Year.

	Experimental	Control
Gaston		
Ashbrook High	19	22
Hunter Huss High	17	22
Cleveland		
Burns Senior High	10	19
Edenton-Chowan	9	10
Wake	4	32
Total	59	105
Participants Originally Anticipated	160	160

Generally, the participants in the third year of the pilot program encountered the same problems as those faced in the first two years. Kinston City and Bertie County were forced to drop out of the program because of lack of student interest. Lack of student interest as well as inclement weather caused Halifax County to withdraw from the program. Cleveland County, Edenton-Chowan, and Wake County were each able to teach only one small class because of a shortage of student volunteers. Only Gaston County was able to solicit and teach the desired number of student volunteers. Because all four sites had participated in the program before, none encountered any difficulty obtaining insurance or motorcycles and equipment.

In summary, the most persistent problem affecting program implementation involved obtaining student volunteers. Most other problems were related to the volunteer problem. The other important administrative problem was arranging for medical payment insurance.

Evaluation Problems

The program implementation problems and other unforeseen problems encountered over the course of the three year program resulted in several evaluation problems. The basic problem was sample size. In the original planning process, funding was requested for sample sizes twice as large as those finally used. Because of other funding obligations, these large sample sizes were not possible. Thus, the sample size ultimately planned for was small. It was hoped that over the three-year period a respectable sample size would be accumulated. As indicated in the previous section, there were problems in obtaining the desired number of students in each of the three years. During the first year, 127 students were trained; 295 students were in the control group. The original plan for the first year had been for 240 students in both the experimental and the control groups. In the second year, training was provided for 123 of the 190 students planned for. Again, the control group was larger with 241 students. The plans for the third year involved 160 students in both the experimental and control groups. Fifty-nine students received the training and 105 students made up the control group. As shown in Table 4, 309 students were trained during the three years. The original plan was to teach 590 students and have an equal number of students in the control group. Thus, the sample size was much smaller than planned.

Another major evaluation problem was that fewer students than expected ultimately owned or had family members who own motorcycles. As was noted earlier, in the initial planning stages of the program at each school, volunteers were solicited who "were planning to buy a motorcycle." While it was known at that time that student response would probably be more truthfully based on the desire to ride a motorcycle rather than future purchasing plans, it was hoped that a representative sample of the experimental and control students would ultimately obtain motorcycles. (Indeed, some critics of motorcycle education programs contend that such training is primarily designed to increase future sales.) Unfortunately, two problems were encountered -- low usage of motorcycles after training and inconsistent reporting of usage/ownership by the subjects. Approximately 204 of the 444 experimental and control students from the first two years indicated that they own or have a family member who owns a motorcycle on the "past riding experience" questionnaire. However, some of these same students indicated different status on the exposure postcards. Of the 661 responses to the exposure postcards, there were only 124 responses of ownership or family ownership of motorcycles. Of the students who indicated ownership or access to a motorcycle, even fewer actually indicated that they subsequently rode the motorcycles.

Table 4. Planned and final sample sizes.

	Experimental		Control		Total	
	Planned	Final Count	Planned	Final Count	Planned	Final Count
Year 1	240	127	240	295	480	422
Year 2	190	123	190	241	380	364
Year 3	160	59	160	105	320	164
Total	590	309	590	641	1180	950

Because of this low number of motorcycle riders in the treatment and control samples, very little motorcycle crash data were anticipated (or found). While this problem eliminated the desired motorcycle crash data analyses, an alternative set of analyses were generated to examine a companion hypothesis -- that the additional 10 hours of on-range/on-vehicle training and the additional 5 hours of classroom training might have some effect on the driving experience of these subjects even while in other types of vehicles. It is noted that this additional training represents a 170 percent increase in driving experience over the six hours provided in the standard North Carolina driver education program. It is certainly admitted that this analysis is by no means as scientifically sound as an analysis of motorcycle crashes would be, and thus meaningful conclusions will be difficult to draw.

In order to monitor the driver history of the experimental and control students, it was necessary to obtain each student's N.C. drivers license number so that each one could be matched with the appropriate computerized driver history. Each teacher was asked to supply the license numbers when he submitted a list of volunteers. However, some students did not have a N.C. drivers license at the time of the course. Thus, alternative matching schemes had to be implemented. These usually involved repeated attempts at matching names, birth dates, and other information against the computerized file. Several problems were encountered. There were 29 students in the first year and 13 in the second year that could not be matched with a license number even after repeated tries. The probable reasons for this are name changes because of marriage, address changes, or failure to obtain a drivers license. Ultimately, it was necessary to omit the 42 students without license numbers from the analysis.

Exposure information for the evaluation was obtained from three informational postcards sent to each student. Generally, there was not strong response from the students. As might be expected, the first postcard elicited the best response. This was due in part to the fact that in some cases, the teachers distributed the first postcard to the students at the conclusion of the course and then returned them to HSRC. The second and third postcards were mailed to each student directly and did not elicit the same level of response as the first card. For the first two years, with 786 cards mailed each time, 176 students responded to the first card, 157 to the second, and 104 to the third.

In addition to crash and exposure data problems, a final problem occurred because all the participants did not have an opportunity to take the written tests: two sites started teaching before the decision to give a written test was made, two sites did not administer the pre-test because they were lost in the mail, and for unknown reasons, one other site did not give either test. Sixty-six percent of the students in the experimental groups that received both the pre-test and post-test actually took both tests. Many (175) of the control students took the pre-test, but only 120 took the post test. While each teacher was instructed to administer the post test to the control students, many were unsuccessful in contacting all of the control students at the later date.

In summary, the main problem which affected the evaluation was the small sample size ultimately used. As noted earlier, this problem made the desired analysis of motorcycle crash rates impossible. Other related problems were low motorcycle ridership, failure to match all participants with their driver history, exposure information problems, and problems with the number of students taking the written tests.

ANALYSIS AND RESULTS

In the preceding sections of the paper, the pilot program implementation process and problems encountered have been discussed. In addition, some discussion has been presented concerning problems encountered in the planned evaluation process. As was noted there, because of the small sample sizes involved in the project, no analysis of motorcycle crashes was possible. In addition, as mentioned before, other problems such as poor response rates with exposure data, and logistical difficulties with questionnaire collection and pre- and post-test administration have resulted in further erosion of the by no means large sample size used in this study.

However, even with these problems, some interesting conclusions may be drawn from the data. As discussed in the following sections, the analyses of the available data was divided into three parts. First, to compare prior riding experience of the control and experimental groups, the questionnaire responses for the two groups were examined. Second, both pre- and post-test results were studied to see if differences could be attributed to the motorcycle course or to other factors. Finally, an analysis of the violation and accident experience of the experimental and control subjects was conducted to determine whether or not the motorcycle education program had in any way affected subsequent driver records in any type of vehicle.

Analysis of Student Questionnaire Data

As discussed earlier, an attempt was made to have all experimental and control students fill out a questionnaire before the motorcycle course was taught. The questionnaire (Figure 3, shown on the next page) contained 12 questions, all of which related to prior riding experience or ownership of motorcycles, minibikes or mopeds, and to plan for future motorcycle acquisition.

Figure 3. Riding experience questionnaire.

NAME ______________________________

ADDRESS ______________________________

N.C. DRIVER'S LICENSE NUMBER ______________________________

SCHOOL ______________________________

(Circle the correct answer)

1. DO YOU OWN A MINIBIKE (50 CC - 75 CC)?

   a. Yes b. No

2. HAVE YOU EVER RIDDEN A MINIBIKE?

   a. Never b. Once or twice c. Several times

   d. Once a week e. Daily

3. IF YOU HAVE RIDDEN A MINIBIKE, WHERE HAVE YOU RIDDEN?

   a. Off the road b. In traffic c. On side streets

4. DO YOU OWN A MO-PED?

   a. Yes b. No

5. HAVE YOU EVER RIDDEN A MO-PED?

   a. Never b. Once or twice c. Several times

   d. Once a week e. Daily

6. HAVE YOU EVER BEEN A PASSENGER ON A MOTORCYCLE?

   a. Never b. Once or twice c. Several times

   d. Once a week e. Daily

7. HAVE YOU EVER DRIVEN A MOTORCYCLE?

   a. Never b. Once or twice c. Several times

   d. Once a week e. Daily

8. IF YOU HAVE DRIVEN A MOTORCYCLE, WHERE DID YOU RIDE?

   a. Off the road b. In traffic c. On side streets

9. HAVE YOU EVER HAD ANY MOTORCYCLE INSTRUCTION?

   a. Yes b. No

   IF YES, FROM WHOM DID YOU RECEIVE INSTRUCTION?

   a. Motorcycle course b. Motorcycle dealer c. Friend or relative

10. DO YOU OWN A MOTORCYCLE?

   a. Yes b. No

11. DOES ANYONE IN YOUR FAMILY OWN A MOTORCYCLE?

   a. Yes b. No

12. IF YOU DO NOT OWN A MOTORCYCLE, ARE YOU PLANNING TO BUY ONE IN THE NEAR FUTURE?

   a. Yes b. No

Again, it must be noted the questionnaire was not completed by every subject in either Year 1 (39 percent completed) or Year 2 (64 percent completed). Hence, the basic assumption under which the following conclusions are drawn is that the sample of students that did complete the questionnaire are representative of the groups they fall in.

Responses to questions 1-11 were independent of group (i.e., control or experimental). This finding provides a quasi validation of the randomness of the assignment of students to the two groups. Thus, at least on the basis of the questionnaire, there appear to be no differences between the control and the experimental groups in terms of past riding experience. The only difference which was evident was in question 12, where 71.3 percent of the experimental students noted they plan to buy a motorcycle in the near future; while only 56.2 percent of the control group gave this response. The higher percentage in the experimental group suggests that students in this group could have been motivated by their inclusion in the motorcycle course, since at the time the questionnaires were filled out, unfortunately, most students knew which group they had been assigned to.

The questionnaire data were further studied to examine the relationship of the responses to other variables such as sex, age, race and school region. Here, because of the small sample size, age and school were categorized into two groups. Age was partitioned as 14-17 and 18-20 years and schools were assigned to a group representing either the eastern or the western part of the state. The results of these analyses (significance of chi-square) are shown in Table 5.

As the table indicates, many of the results were non-significant, that is, no differences existed in responses to questions on the basis of sex, age, race,

Table 5. Analysis of motorcycle questionnaire by sex, age, race and school region.

Questions	Sex	Age	Race	School Region
1	Males show higher ownership.	No difference	Whites show higher ownership.	Western schools, higher ownership.
2	Males have ridden more.	No difference	Whites have ridden more.	Western schools, ridden more.
3	No difference	No difference	No difference	No difference
4	*	*	*	*
5	No difference	No difference	Whites have ridden more.	Western schools, ridden more.
6	No difference	No difference	Whites more frequently	Western schools, more frequent.
7	Males more frequently	No difference	Whites more frequently	No difference
8	No difference	No difference	No difference	No difference
9	No difference	No difference	Whites, more often.	No difference
9B	No difference	No difference	No difference	No difference
10	Males more often	No difference	Whites more often	No difference
11	No difference	No difference	Whites more often	No difference
12	Males more often	No difference	Non-whites more often	No difference

(Significance level = 0.05)

or school region. In the cases where significant results did exist, there were fairly consistent patterns through all questions. The data appears to indicate that males, whites, and students from the western schools have had more prior experience and have owned more bikes. The only exception to this pattern is in response to question 12 where males more often planned to buy a bike than did females, and, non-whites indicated plans to buy a bike more often than did whites.

Analysis of Test Scores

As indicated earlier, a pre-test and post-test was supposed to be given to each control and experimental student. However, a total of only 307 students, 175 in the control group and 132 in the experimental group, took the pre-test. As shown in Appendix B, the test asked information concerning parts of the motorcycle and safe motorcycling (and general driving) practices. These test scores were analyzed to determine whether or not differences existed and if these differences could be explained by group (experimental or control) or by any of the other major variables such as age, sex, race or school region. Again, it must be noted that the conclusions drawn from the analyses are compromised to some degree by the differential test administration procedures. That is, as noted in an earlier section, a lower percentage of control group members subsequently were given a post-test because of difficulties in getting these students back into the classroom in an adequate post-test situation. The conclusions drawn are based on the assumption that the control students and experimental students who took the test are representative of the groups of which they are members.

Pre-test scores.

In the initial analyses, the relationship of pre-test scores to the various demographic and group variables was examined to see whether or not the students started from the same knowledge threshold in both groups. In addition, the relationships between pre-test scores and the questionnaire were examined to determine whether or not response from the questionnaire had any relationship to pre-test scores. The results of these analyses indicated that pre-test scores were independent of age and group (i.e., control, experimental). This finding is important since it indicates that the students from the two groups started from the same level in terms of knowledge concerning motorcycle riding and motorcycle safety. When the relationships between pre-test scores and the questionnaire items were examined, it was noted that the pre-test scores were related to responses in questions 1, 2, 6, 7, 10 and 11. As can be seen in Figure 3, all of these questions deal with ownership and riding experience with motorcycles and mini-bikes. Hence a higher score on the pre-test was related to a greater amount of previous riding experience and/or ownership. This, of course would be expected.

Post-test scores.

A more important analyses of test score data would be an analysis of the post-test score to determine whether or not knowledge gained from the course was significantly different for the experimental and control groups and to determine whether or not those test scores were related to other factors such as age, race, sex, or school. Two analyses were run in an attempt to answer these questions. First, a simple analysis of variance was carried out. The results are shown in Table 6. Here, the analysis showed that group, race, and school were significant main effects. The data indicate that experimental students had higher scores than did control students on the post-test. Similarly, white students scored slightly higher than non-white students, students from the eastern part of the state had higher scores than students

Table 6. Analysis of post-test scores (scaled to 100 points).

Variable	Mean	Std. Error	Sample Size
Experimental	82.0	0.81	107
Control	68.9	1.24	121
Males	76.5	1.00	171
Females	74.7	1.44	89
Whites	77.2	1.13	153
Non-whites	74.1	1.16	107
Eastern Schools	77.1	1.06	127
Western Schools	74.8	1.25	133
Experimental - Males	80.9	1.03	98
Control - Males	70.7	1.68	73
Experimental - Females	84.6	1.11	41
Control - Females	66.3	1.75	48

Analysis of Variance

Source of Variation								
Main Effects			10947.180	4	2736.795	21.494	0.000
Class			7995.488	1	7995.488	62.794	0.000
Race			1860.071	1	1860.071	14.608	0.000
Sex			269.760	1	269.760	2.119	0.147
Registered School			1089.253	1	1089.253	8.555	0.004
2-Way Interactions			1664.441	6	277.407	2.179	0.046
Class	Race		72.621	1	72.621	0.570	0.451
Class	Sex		948.797	1	948.797	7.452	0.007
Class	Reg school		70.402	1	70.402	0.553	0.458
Race	Sex		352.561	1	352.561	2.769	0.097
Race	Reg school		337.299	1	337.299	2.649	0.105
Sex	Reg school		351.235	1	351.235	2.758	0.098
3-Way Interactions			60.430	4	15.108	0.119	0.976
Class	Race	Sex	5.923	1	5.923	0.047	0.829
Class	Race	Reg school	9.849	1	9.849	0.077	0.781
Class	Sex	Reg school	6.311	1	6.311	0.050	0.824
Race	Sex	Reg school	28.584	1	28.584	0.224	0.636
Explained			14492.301	14	1035.164	8.130	0.000
Residual			31195.563	245	127.329		
Total			45687.863	259	176.401		

from the western schools. (This last finding is somewhat of interest since the original questionnaire data had indicated that the western schools had more students with prior experience on the bike.)

The only significant two-way interaction was between class and sex. Here the difference in post-test scores between the experimental and control groups were greater for the female students than for the male students. There were no significant three-way interactions.

The second analysis carried out (and perhaps the most appropriate one) was an analysis of co-variance. Here, it is noted that an important consideration in the analysis of this type of data is to measure performance in the post-test while controlling for the pre-test score. Analysis in which metric independent variables (such as the pre-test scores) are used in conjunction with non-metric factors (e.g., group, sex, race, and school) are known as analysis of co-variance designs.

The metric co-variant, pre-test score in this case, is used to remove extraneous variations from the dependent variable (post-test scores) to improve the measurement precision. This is necessary since the primary concern is with the non-metric factors such as group, sex, race, and school. The pre-test scores are serving as a control. Table 7 indicates the results of this three-way analysis of co-variance.

After removing the effects of the pre-test scores, significant main effects included group and school and unlike the original analysis of variance, race had no significant effect. As in the first analysis of variance model, the experimental students improved their test scores more than did the control students, and students from the eastern schools performed better than did their counterparts from the western schools. As before, the

Table 7. Analysis of covariance for post-test scores.

Source of Variation					
Covariates	7364.613	1	7364.613	76.597	0.000
Npretest	7364.613	1	7364.613	76.597	0.000
Main Effects	5435.879	4	1358.970	14.134	0.000
Class	2390.050	1	2390.050	24.858	0.000
Race	25.696	1	25.696	0.267	0.606
Sex	10.527	1	10.527	0.109	0.741
Reg school	862.263	1	862.263	8.968	0.003
2-Way Interactions	1265.501	6	210.917	2.194	0.045
Class Race	1.908	1	1.908	0.020	0.888
Class Sex	460.996	1	460.996	4.795	0.030
Class Reg school	1.741	1	1.741	0.018	0.893
Race Sex	487.160	1	487.160	5.067	0.026
Race Reg school	66.181	1	66.181	0.688	0.408
Sex Reg school	198.626	1	198.626	2.066	0.152
3-Way Interactions	196.700	4	49.175	0.511	0.727
Class Race Sex	6.246	1	6.246	0.065	0.799
Class Race Reg school	12.721	1	12.721	0.132	0.716
Class Sex Reg school	57.587	1	57.587	0.599	0.440
Race Sex Reg school	131.393	1	131.393	1.367	0.244
Explained	19945.535	15	1329.702	13.830	0.000
Residual	17691.164	184	96.148		
Total	37636.699	199	189.129		

only significant two-way interaction was between group and sex. The difference in post-test scores between control and experimental groups for the female students was higher than the difference for male students.

In summary, the analyses of questionnaire data and test score data indicate that when students for whom data existed were examined, no difference was found prior to the teaching of the program in either previous ridership or ownership. Thus, at least as indicated by the questionnaire results, the random assignment process was satisfactory. Analysis of the pre-test scores indicated that there were some basic differences between pre-test scores by sex, race, and school region. However, there were no differences in pre-test scores for the control or experimental groups, another indication that the randomization process was adequate. The analysis of variance and analysis of co-variance indicated that the experimental group did acquire significantly more knowledge concerning safe motorcycle operation in the course than did the control group which was not given the training. In addition, it appears that the students in the eastern schools showed knowledge gains which were greater than those for the students in the western schools. Based on the two-way interactions present it also appears that the female students who were involved in the teaching program increased their knowledge more than did their companion male students, as compared to their respective control groups. The teaching program does seem to have had a significant effect on knowledge gained concerning safe motorcycle operation.

Analysis of Violation Information

As indicated earlier, the final analysis involved the driver histories of the program subjects -- their violation histories and accident records. To examine the effects of the motorcycle course on traffic violations, a complete driver history record was extracted for each student in the study from the N.C.

driver history file. To take into account the different motorcycle course completion dates for the various schools, the driver history record for each student was partitioned into six-month intervals before and after completion. The variables listed in Appendix C were stored for each interval. While intervals of any length could have been used, the selection of exposure intervals had to be based on (1) the need to study the potential effects of the course as soon after the course completion date as possible (the assumption being that the training effect would be most pronounced immediately upon course completion), and (2) the need to have a large enough exposure interval in order to allow for the accumulation of adequate numbers of violations and accidents. The six-month interval was arbitrarily chosen in an attempt to meet both these needs. By combining successive six-month intervals, longer periods may be analyzed.

The "base date" or starting point for the first after period interval for treatment subjects was either the course completion date or the date of licensure, whichever was later. In order to use a similar algorithm for the control students, an "artificial" course completion date was assigned to each student. For a given control student, this date was the course completion date of the treatment students at the same high school.

Violation and accident counts were then accumulated in six-month intervals both backward and forward in time from this baseline date. To insure equal exposure periods, only <u>complete</u> six-month intervals were used for each student. Obviously, if licensure followed the course complete date for a given student, no before intervals existed. Similarly, under the above algorithms, if licensure preceded course completion by ten months, only one before interval would be recorded -- the six-months immediately preceding the course completion. To allow time for analysis, the cut-off date for the after periods was May 9,

1978. Since very few students had any exposure prior to the second before exposure period and after the second after exposure period, the final analysis restricted itself to two before periods and two after periods. The usable samples of student records for each of these periods is shown in Table 8.

Table 8. Sample sizes for six-month analysis periods.

	Experimental	Control	Total
Before Period 2 (earliest)	100	250	350
Before Period 1	160	353	513
After Period 1	243	494	737
After Period 2	156	306	462

For these data, tables were generated to study the relationship between the various violations listed in Appendix C and both the variables such as group (experimental, control), sex, race, school-region, and some measure of prior motorcycle experience from the questionnaire (Questions 7, 9, 10, 11). While analyses were run for all four time periods, because of the larger sample size and closeness to the course completion, the most detailed analyses concerned the first before and first after periods. Table 9 summarizes the results of the different crosstabulations. For each comparison indicated as significant at the p = .20 level, and entry denoting p level and direction is presented. Where differences were significant at the .05 level, the cell also contains an asterisk.

Most of the analyses showed no significant relationship between the various violation types and the different variables such as sex, group, etc. This is due to both a lack of real differences in the tables and to the small sample sizes in this study. Total violations in the final column of Table 9 does indicate some significant relationships. However, even here there is no significant relationship between total violation and group (control or

Table 9. Summary of crosstabulation analyses between violation indicated during first six months and group, sex, race, school region, and questions 7, 9, 10, 11.

Variable	Period	Speeding	Stop	Moving	Reckless	Alcohol	Administrative	Total Violations
Group (Control/ Experimental)	Before	--	--	--	--	--	--	--
	After	--	--	--	--	--	--	--
Sex	Before	M > F* p = .01	--	F > M p = .06	--	--	--	M > F p = .11
	After	M > F p = .07	--	--	--	--	--	M > F* p = .01
Race (W/NW)	Before	N > NW p = .17	--	W > NW* p = .05	--	--	--	W > NW p = .10
	After	W > NW* p = .03	--	--	--	--	--	W > NW p = .06
School (E/W)	Before		--	--	--	--	--	--
	After	W > E p = .20	--	--	--	--	--	W > E p = .18
Question 7 (Have you ever driven a motorcycle?)	Before	Yes > No* p = .05	--	--	--	--	--	Yes > No p = .12
	After	Yes > No p = .13	--	--	--	--	--	Yes > No p = .13
Question 9 (Have you ever had motorcycle instruction?)	Before	Yes > No* p = .01	--	--	--	--	--	Yes > No p = .11
	After	--	Yes > No p = .14	--	Yes > No* p = .00	--	--	Yes > No* p = .01
Question 10 (Do you own a motorcycle?)	Before	--	--	--	--	--	--	--
	After	Yes > No* p = .01	--	--	--	--	--	Yes > No* p = .05
Question 11 (Does anyone in family own motorcycle?)	Before	--	--	--	--	--	--	--
	After	Yes > No p = .13	--	--	Yes > No* p = .05	--	--	Yes > No* p = .05

-- Not significant at p = .20 level

* Significant at p = .05 level

experimental). Most of the significant results appear to be a measure of higher exposure. Thus, males have more total violations than females, whites more than non-whites and people with previous experience (Questions 7, 9, 10, 11) have more violations than people with no experience.

To further examine these data, the mean number of total violations per student within the different subcategories (group, sex) were calculated and analyzed for all four time intervals separately, after which the two before and after periods were combined to provide a one-year before and one-year after period. Table 10 presents the results. While there appear to be fairly consistent patterns in the after periods, with the experimental subjects having a lower mean number of violations in general, none of the individual comparisons within categories is significant. Because these patterns appeared somewhat consistent, the total violations data were further examined by calculating the proportion of drivers who had accumulated one or more violations in the experimental and control groups controlled by sex, race, and school-region (Table 11). While, as would be expected, no signficant differences were found in either the first six-month before period or the first twelve-month before period, use of the Mantel-Haenszel statistical test also indicated no significant difference in either of the two corresponding after periods. Thus, when the factors of sex, race, and region are controlled for simultaneously, the trends indicated by Table 10 disappear.

In summary, there is no evidence to support the hypothesis that the training has affected the violation experience of the students.

Table 10. Mean number of violations [standard deviation] and (sample size) per person for different exposure periods by sex, race and school region.

	SEX				RACE				SCHOOL			
	MALES		FEMALES		WHITE		NON-WHITE		EASTERN		WESTERN	
	Control	Exptl.	Control	Exptl.	Control	Exptl.	Control	Exptl.	Control	Exptl.	Control	Exptl.
Before Period 2	.10 [0.31] (163)	.13 [0.37] (72)	.07 [0.30] (87)	.04 [0.19] (28)	.13 [0.35] (135)	.11 [0.32] (35)	.05 [0.22] (115)	.09 [0.34] (65)	.12 [0.35] (129)	.08 [0.27] (64)	.06 [0.23] (121)	.14 [0.42] (36)
Before Period 1	.12 [0.43] (236)	.12 [0.33] (113)	.06 [0.24] (117)	.02 [0.15] (47)	.13 [0.46] (193)	.12 [0.33] (67)	.06 [0.23] (160)	.08 [0.27] (93)	.07 [0.30] (171)	.09 [0.29] (88)	.13 [0.43] (182)	.10 [0.30] (72)
After Period 1	.19 [0.45] (321)	.17 [0.43] (171)	.09 [0.32] (173)	.07 [0.26] (72)	.19 [0.46] (298)	.17 [0.44] (126)	.10 [0.32] (196)	.10 [0.33] (117)	.14 [0.41] (224)	.13 [0.43] (112)	.16 [0.41] (270)	.15 [0.35] (131)
After Period 2	.16 [0.46] (201)	.11 [0.32] (114)	.01 [0.10] (105)	.02 [0.15] (42)	.12 [0.41] (201)	.11 [0.32] (90)	.09 [0.34] (105)	.06 [0.24] (66)	.05 [0.21] (84)	.07 [0.25] (45)	.13 [0.43] (222)	.10 [0.30] (111)
12 Month Before Period	.21 [0.52] (163)	.28 [0.56] (72)	.11 [0.36] (87)	.07 [0.26] (28)	.24 [0.57] (135)	.31 [0.58] (35)	.10 [0.31] (115)	.17 [0.45] (65)	.18 [0.44] (129)	.19 [0.43] (64)	.18 [0.50] (121)	.28 [0.61] (36)
12 Month After Period	.36 [0.63] (201)	.25 [0.49] (114)	.07 [0.29] (105)	.02 [0.15] (42)	.29 [0.58] (201)	.24 [0.50] (90)	.19 [0.48] (105)	.12 [0.33] (66)	.12 [0.33] (84)	.16 [0.37] (45)	.31 [0.61] (222)	.21 [0.47] (111)

Table 11. Proportion of experimental and control students accumulating one or more violations controlled by sex, race, and school region. (sample size).

	MALE								FEMALE							
	WHITE				NON-WHITE				WHITE				NON-WHITE			
	Eastern		Western		Eastern		Western		Eastern		Western		Eastern		Western	
	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C
6-Month Before Interval (B1)	.11 (9)	.11 (36)	.17 (35)	.12 (95)	.12 (51)	.04 (69)	.06 (18)	.11 (36)	.13 (8)	.08 (25)	0 (15)	.08 (37)	0 (20)	.02 (41)	0 (4)	.07 (14)
6-Month After Interval (A1)	.14 (22)	.23 (53)	.20 (61)	.19 (138)	.17 (53)	.08 (83)	.06 (35)	.19 (47)	0 (14)	.15 (41)	.17 (29)	.06 (66)	0 (23)	.04 (47)	0 (6)	.05 (19)
12-Month Before Interval	.40 (5)	.37 (27)	.29 (21)	.21 (63)	.18 (38)	.08 (48)	.13 (8)	.12 (25)	.20 (5)	.14 (21)	0 (4)	.04 (24)	.06 (16)	.09 (33)	0 (3)	.22 (9)
12-Month After Interval	.13 (8)	.30 (20)	.31 (55)	.32 (117)	.24 (21)	.14 (28)	.10 (30)	.31 (36)	.17 (6)	0 (10)	0 (20)	.07 (54)	0 (10)	0 (26)	0 (5)	.14 (15)

Analyses of Accident Rates

As the reader will recall, the original evaluation plan was to analyze the motorcycle-related accidents of the trained and untrained groups, since this would be the criterion most logically affected by the training. However, as discussed earlier, because of sample size problems and subsequent motorcycle exposure problems, there were two few accidents involving students on motorcycles for analysis. As a proxy measure (and one that can certainly be questioned) it was decided to analyze total accidents involving the students. This was done under the hypothesis that the increased hours of training on the motorcycle and in the classroom might affect the students' ability to safely drive any vehicle.

In this analysis (as in the section on violations), the accidents were studied in six-month intervals before and after the course completion date. Again, only those accidents involving students with complete exposure periods were included to help insure equal exposure intervals.

In the first part of the analysis, the total number of accidents per student was analyzed. As in the section on violations, the accidents were first controlled by sex, race, and school region, and then the mean number of accidents per student for each experimental group was compared to the figure for the corresponding control group (Table 12). Under the assumption of an underlying Poisson distribution for the occurrence of accidents, the test used indicated that no significant differences existed in either the before or after six-month intervals closest to the base date or the one-year before or after exposure periods.

Because of the small sample sizes in many of the cells in Table 12, the data were then grouped into categories defined by sex, race, or school region (Table 13) and the mean number of accidents per student was calculated for

Table 12. Mean number of accidents (and sample size) per person controlled by sex, race, and school region.

	MALE								FEMALE							
	WHITE				NON-WHITE				WHITE				NON-WHITE			
	Eastern		Western		Eastern		Western		Eastern		Western		Eastern		Western	
	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C
6-Month Before Interval (B1)	.222 (9)	.028 (36)	.086 (35)	.158 (95)	.059 (51)	.029 (69)	.000 (18)	.083 (36)	.125 (8)	.040 (25)	.000 (15)	.135 (37)	.050 (20)	.049 (41)	.000 (4)	.000 (14)
6-Month After Interval (A1)	.136 (22)	.057 (53)	.049 (61)	.145 (138)	.038 (53)	.012 (83)	.171 (35)	.170 (47)	.000 (14)	.073 (41)	.138 (29)	.106 (66)	.043 (23)	.064 (47)	.000 (6)	.053 (19)
12-Month Before Interval	.200 (5)	.148 (27)	.239 (21)	.286 (63)	.079 (38)	.093 (48)	.250 (8)	.120 (25)	.200 (5)	.048 (21)	.000 (4)	.204 (24)	.125 (16)	.122 (33)	.000 (3)	.000 (9)
12-Month After Interval	.111 (18)	.200 (20)	.109 (55)	.256 (117)	.096 (21)	.179 (28)	.367 (30)	.167 (36)	.333 (6)	.200 (10)	.048 (21)	.148 (54)	.000 (10)	.115 (26)	.000 (5)	.133 (15)

Table 13. Mean number of accidents (and sample size) within age, race and school region categories.

	SEX				RACE				SCHOOL			
	MALES		FEMALES		WHITE		NON-WHITE		EASTERN		WESTERN	
	Exptl.	Control	Exptl.	Control	Exptl.	Control	Exptl.	Control	Exptl.	Control	Exptl.	Control
6-Month Before Interval (B1)	.071 (113)	.102 (236)	.043 (47)	.077 (117)	.164 (67)	.135 (193)	.043 (93)	.044 (160)	.080 (88)	.035 (171)	.042 (72)	.126 (182)
6-Month After Interval (A1)	.082 (171)	.106 (321)	.083 (72)	.081 (173)	.071 (126)	.117 (298)	.077 (117)	.066 (196)	.054 (112)	.045 (224)	.099 (131)	.133 (270)
12-Month Before Interval	.153 (72)	.196 (163)	.107 (28)	.115 (87)	.200 (35)	.230 (135)	.108 (65)	.096 (115)	.109 (64)	.101 (129)	.194 (36)	.215 (121)
12-Month After Interval	.176 (114)	.224 (201)	.071 (42)	.143 (105)	.122 (90)	.219 (201)	.197 (66)	.152 (105)	.133 (45)	.167 (84)	.162 (111)	.207 (222)

each cell. As in the earlier data categories, the testing indicated no significant differences between the experimental and control rates in either the before or after periods for the six-month or twelve-month exposure data. While the bottom row of the table shows that the twelve-month after data means for the experimental groups are lowest in all but one case (the non-white category), examination of the third row, the companion before period, indicates a very similar pattern. Thus, no shifts are indicated between before and after periods. The six-month means appear to be even more random, again indicating a lack of effect.

In the second part of the analysis, the total number of accidents were further categorized into "at-fault" and "not at-fault" crashes. The accidents were analyzed according to these categories to examine the hypothesis that, while total accidents might not be affected because the experimental students might be involved more often as "innocent participants," the increased training might affect the frequency of at-fault crashes.

Fault was determined by reading the investigating officer's accident report for each accident analyzed, and in every two-vehicle accident a decision was made concerning which one of the vehicles was more at-fault than the other vehicles. These judgements were made independently by two of the authors, and any differences in opinion were resolved by mutual agreement. The judgements were made "blind" in that at the time of decision making, the reviewer did not know the identity of the driver of either vehicle. This identity was attached only after judgement was made for all vehicles, whether driven by the control or experimental students or by the non-study drivers who were involved in these crashes.

In this series of analyses, the at-fault accident rates per students were first calculated while controlled by sex, race, and school region (Table 14),

Table 14. Mean number of at-fault accidents (and sample size) per person controlled by sex, race, and school region.

	MALE								FEMALE							
	WHITE				NON-WHITE				WHITE				NON-WHITE			
	Eastern		Western		Eastern		Western		Eastern		Western		Eastern		Western	
	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C
6-Month Before Interval (B1)	-- (9)	-- (36)	.057 (35)	.095 (95)	.039 (51)	.014 (69)	-- (18)	.083 (36)	.125 (8)	.040 (25)	-- (15)	.108 (37)	.050 (20)	.049 (41)	-- (4)	-- (14)
6-Month After Interval (A1)	-- (22)	.057 (53)	.049 (61)	.094 (138)	.038 (53)	.012 (83)	.114 (35)	.043 (47)	.143 (14)	.073 (41)	.103 (29)	.061 (66)	.043 (23)	.021 (47)	-- (6)	.053 (19)
12-Month Before Interval	.200 (5)	.111 (27)	.190 (21)	.190 (63)	.026 (38)	.042 (48)	.125 (8)	.120 (25)	.200 (5)	.048 (21)	-- (4)	.167 (24)	.063 (16)	.091 (33)	-- (3)	-- (9)
12-Month After Interval	-- (8)	.150 (20)	.055 (55)	.162 (117)	.048 (21)	.143 (28)	.267 (30)	.056 (36)	.333 (6)	.200 (10)	-- (21)	.093 (54)	-- (10)	.000 (26)	-- (5)	.133 (15)

and then were grouped into the larger categories of sex, race, or school (Table 15). In each case, control and experimental data in the six and twelve-month intervals before and after the baseline date were compared. The test indicated no significant differences in any of the cells at the $p < .10$ level.

While it is noted that the frequencies of at-fault crashes are smaller than total accidents or violations, and the small sample sizes would reduce the changes of a given difference being significant, the conclusion still remains that no differences exist.

Thus, as noted earlier, the analysis of total accident rates and at-fault accident rates failed to indicate any significant difference between the trained and untrained students when compared on a per student basis. The data appear to indicate that the motorcycle training did not have a significant effect on the students' accidents while driving another vehicle. Again, the use of total accidents and at-fault accidents is, at best, probably a poor substitute for the desired dependent criterion variable--motorcycle crashes. The results of these analyses should not be interpreted as indicative of a lack of training effect on motorcycle crashes. Unfortunately, such an analysis could not be conducted. The results can only be interpreted to mean that the increase in driver education training hours <u>on a different vehicle</u> did not signficantly affect total accident rates or at-fault accident rates.

Description of Motorcycle Crashes

As the final part of the accident analysis process, case numbers for all experimental and control group accidents involving motorcycles were extracted from the computerized file. A copy of the accident report completed by the investigating officer was then obtained and reviewed in detail. These cases

Table 15. Mean number of at-fault accidents (and sample size) within age, race and school region.

	SEX				RACE				SCHOOL			
	MALES		FEMALES		WHITE		NON-WHITE		EASTERN		WESTERN	
	Exptl.	Control	Exptl.	Control	Exptl.	Control	Exptl.	Control	Exptl.	Control	Exptl.	Control
6-Month Before Interval (B1)	.035 (113)	.059 (236)	.043 (47)	.068 (117)	.045 (67)	.083 (193)	.032 (93)	.038 (160)	.045 (88)	.023 (171)	.028 (72)	.088 (182)
6-Month After Interval (A1)	.053 (171)	.065 (321)	.056 (72)	.052 (173)	.048 (126)	.084 (298)	.060 (117)	.026 (196)	.027 (112)	.036 (224)	.076 (131)	.074 (270)
12-Month Before Interval	.097 (72)	.135 (163)	.071 (28)	.092 (87)	.171 (35)	.163 (135)	.046 (65)	.070 (115)	.063 (64)	.070 (129)	.139 (36)	.157 (121)
12-Month After Interval	.105 (114)	.139 (201)	.048 (42)	.086 (105)	.056 (90)	.144 (201)	.136 (66)	.076 (105)	.067 (45)	.107 (84)	.099 (111)	.126 (222)

included all crashes in which a subject (either experimental or control) was either the operator of the motorcycle or the operator of another vehicle which struck or was struck by a motorcycle. As noted in the earlier section, the initial analysis plan called for detailed analysis of these crashes to determine (1) whether the training affected the motorcycle riders' crashes and (2) whether the training affected the manner in which the students perceived and interacted with motorcycles while operating another vehicle. Unfortunately, as noted earlier, neither of these two questions could be examined. Over the total study period, only three motorcycle-related crashes involved an experimental student and only six involved controlled students. Brief summaries of the accidents are presented in Table 16.

While such small samples of crashes completely eliminate the possibility of drawing influences, these are some points of interest. For the experimental group, the single motorcycle accident occurring after the course involved a skill not taught in the on-range training--judgement of curved sharpness at high speeds. Both the other motorcycle crash and the car-motorcycle crash occurred before the course, and both involved skills that would hopefully be affected by the training. In the motorcycle-related accidents involving the control group students, the most consistent problems appeared to be the failure to adequately monitor surrounding traffic and the failure of the motorcycle rider to take evasive action when in an emergency situation. Oddly enough, the most striking thing noted is that there was a crash in which two control students collided while both were riding motorcycles. Given the low motorcycle usage among the subject groups, the probability of these occurring should have almost too low to calculate. Both riders appeared to make errors which might have been at least covered in the training course. Again, although these points are of interest, the sample sizes are far too small to allow any inferences to be drawn.

Table 16. Summary of motorcycle-involved crashes for experimental and control students.

Experimental Group

A. Motorcycle Operator Crashes (student was motorcycle rider)

No. 1

Type:	Single Vehicle
Maneuver:	Entering divided highway to turn left, misjudged position of center median, at edge of median opening, struck with front tire and overturned
Estimated Speed:	20 mph
Possible Cause:	Poor coordination of traffic monitoring/vehicle handling task
Fault:	Student at fault
Time:	Before course began

No. 2

Type:	Single Vehicle
Maneuver:	Driver lost control of vehicle when entering exit ramp at interchange
Estimated Speed:	50 mph
Possible Cause:	Excessive speed--poor judgment of sharpness of curve
Fault:	Student at fault
Time:	After course completion

B. Other Vehicle Operator Crashes (student was driver of other vehicle)

No. 3

Type:	Two Vehicle (passenger car - motorcycle)
Maneuver:	Passenger car making left turn, no signal, swerved right, then turned left in front of motorcycle who was following
Estimated Speed:	Passenger car - 10 mph; motorcycle - 20 mph
Possible Cause:	Lack of signal, poor turning pattern, poor monitoring of following traffic
Fault:	Student at fault
Time:	Before course began

Table 16 (Continued)

Control Group

A. Motorcycle Operator Crashes (student was motorcycle rider)

No. 1

Type:	Two Vehicle (motorcycle - passenger car)
Maneuver:	Passenger car, following truck, turned left in front of oncoming motorcycle. Motorcycle skidded into car
Estimated Speed:	Passenger car - 30 mph; motorcycle - 15 mph
Possible Cause:	Poor traffic monitoring before turn, no evasive action by motorcycle (skidded 41' prior to impact)
Fault:	Student not at-fault
Time:	Before course began

No. 2

Type:	Two Vehicle (motorcycle - passenger car)
Maneuver:	Passenger car stopped in left lane to make left turn, motorcycle struck passenger car in right rear
Estimated Speed:	Passenger car - 0 mph; motorcycle - 25 mph
Possible Cause:	Lack of traffic monitoring, poor evasive action
Fault:	Student at fault
Time:	After date of course completion

No. 3

Type:	Two Vehicle (motorcycle - motorcycle) (both operators were in control group)
Maneuver:	Lead motorcycle (#1) suddenly turned right, was struck in right side by overtaking motorcycle (#2)
Estimated Speed:	Motorcycle #1 - 20 mph; motorcycle #2 - 20 mph
Possible Cause:	Improper gap, improper lane position, failure to signal turn
Fault:	Motorcycle #2 student operator at fault
Time:	After date of course completion

Table 16 (Continued)

B. Other Vehicle Operator Crashes (student was driver of other vehicle)

No. 4

Type:	Two Vehicle (car - motorcycle)
Maneuver:	Passenger car stopped for turning vehicle in lane, trailing motorcycle struck passenger car in rear
Estimated Speed:	Passenger car - 0 mph; motorcycle - 35 mph
Possible Cause:	Improper gap, poor traffic monitoring, poor evasive action
Fault:	Student not at-fault
Time:	Before course completion date

No. 5

Type:	Two Vehicle (passenger car - motorcycle)
Maneuver:	Passenger car stopped suddenly to avoid oncoming bicycles, trailing motorcycle struck passenger car in right rear
Estimated Speed:	Passenger car - 10 mph; motorcycle - 35 mph
Possible Cause:	Improper gap, poor traffic monitoring, poor evasive action
Fault:	Student not at fault
Time:	After date of course completion

No. 6

Type:	Two Vehicle (passenger car - motorcycle)
Maneuver:	Passenger car turned left in front of oncoming motorcycle, motorcycle struck car in right front
Estimated Speed:	Passenger car - 0 mph; motorcycle - 25 mph
Possible Cause:	Passenger car failure to yield, poor traffic monitoring, poor evasive action
Fault:	Student not at fault
Time:	After date of course completion

Mileage Data Analyses

As noted in the implementation and evaluation methodology sections, an attempt was made at collecting motorcycle exposure data--the number of miles ridden each week for school, work, and pleasure. These data were collected to allow for the computation of mileage based motorcycle crash rates. While the crashes analyzed were non-motorcycle crashes, and thus calculation of rates would be enormous, the mileage data are presented for informational reasons.

As noted earlier only a subsample of students returned any of the three postcards--106 (42%) of the experimental students and 116 (22%) of the control students. Whereas student questionnaire information collected prior to the training indicated that 67 experimental and 57 control students owned or had access to a motorcycle, and the postcard surveys indicated that 39 experimental and 38 control students owned or had access to a motorcycle after the course was completed, only 20 of the experimental groups and 20 of the control groups returned postcards with weekly mileages greater than zero, indicating low usage among the students returning the cards. It was of interest to note that two of the six students involved in motorcycle crashes as riders returned cards indicating usage. Two-thirds of those known to be riders did not return the cards. Obviously, the discrepancies in these figures make it most difficult to estimate the true proportion of students in each group who have subseqently obtained motorcycles. This question is of interest since some professionals in the safety field have hypothesized that offering motorcycle education to young riders may seriously increase the overall young driver group's risk of serious injury or death by inducing a higher proportion of these young riders to obtain motorcycles than would normally be the case. Using the pre-course questionnaire data as a basis of estimation, and assuming that the subsample who completed the questionnaire are a representation sample of their respective groups, the proportion of experimental students who either own a motorcycle or have access to one is 21.9%, while the corresponding proportional of control group students is 16.1%. If it is assumed that those students who returned exposure cards are a representative sample of their respection groups, then a count of affirmative awareness to either the personal or the family ownership question on the card indicates that 36.8% of the experimental and 32.8% of the control group are riders. However, using the above stated numbers of students indicating positive mileages on the returned cards, the proportions drop to 18.9% and 17.2% respectively. When these proportions are compared, the initial figures from the pre-course questionnaire indicates a significant difference ($p = .03$) while neither of the post-training differences are significant at the $p = .20$ level. Thus, on the available data from up to two years of exposure for students, it woiuld be difficult to say the hypothesis of a real difference in the usage rates is supported. While the experimental proportions are consistently slightly higher, the only significant difference indicated is based on a pre-training measure. While the problems inherent in these data make it difficult to draw hard conclusions and therefore continue to leave the hypothesis an open one, there don't appear to be any large differences in the subsequent rates of the two groups in the North Carolina program.

Weekly mean mileage controlling for each of the factors of sex, race, and school separately are presented in Table 17; the means calculated when these factors controlled for simultaneously are present in Table 18. Because these data only represent a subsample of the students, it is implicitly assumed that these estimates are valid for all students in the control and the experimental groups. Of interest in the tables is the wide range of weekly mileages between cells and the large standard deviations within the cells. Obviously, the estimates of mileage obtained had many zero estimates and varied greatly from

Table 17. Weekly mean mileage, standard deviation, and sample size for experimental and control students within sex, race, and school region categories.

		EXPERIMENTAL			CONTROL		
Variable	Level	Mean	Standard Deviation	Sample Size	Mean	Standard Deviation	Sample Size
Sex	Males	22.7	64.3	69	18.7	46.1	74
	Females	9.0	28.5	37	1.5	9.6	42
Race	Whites	25.6	68.3	58	14.6	45.0	63
	Non-whites	8.7	29.4	48	10.0	28.0	53
School	Eastern	17.7	62.4	59	12.1	40.9	75
	Western	18.2	43.9	47	13.2	32.9	41
Total		17.9	54.8	106	12.5	38.1	116

Table 18. Weekly mean mileages for experimental and control students controlled by sex, race, and school region. (sample size)

	Experimental	Control
Male		
White		
Eastern	54.0 (12)	27.9 (17)
Western	31.9 (20)	19.3 (20)
Non-White		
Eastern	7.4 (28)	13.9 (31)
Western	8.2 (9)	16.0 (6)
Female		
White		
Eastern	6.1 (9)	--
Western	8.5 (17)	5.2 (12)
Non-White		
Eastern	13.5 (10)	--
Western	--	--

-- No estimate possible because of sample size.

student to student. Analysis of the mileages within the cells of Tables 17 and 18 indicated that even though some of the means appear to differ from experimental to control, none of the differences are significant.

Analysis of Program Costs

As was mentioned earlier, each site submitted a proposed budget for the first year, which included such costs as insurance, gas, maintenance, as well as necessary range modifications. Taking these requests into account, DPI and HSRC drew up a budget to be used as a guideline for spending for each site. The first year's budget and actual spending was used as a basis for the suggested budget for the next two years. DPI and HSRC monitored spending. At the conclusion of the teaching, each site submitted a detailed list of expenditues and a copy of all bills to HSRC for reimbursement.

Table 19 shows the costs for the motorcycle driver education pilot program for each site and year of participation. The following conclusions can be drawn from the table.

1. The average cost per student for classroom-related teacher pay is $22. Classroom-related teacher pay remained constant no matter what the class size because the teacher was paid for 15 hours of classroom instruction whether he taught four students or 20. Pay for the range segment of the instruction was based on the number of students taught. The cost per student for teacher pay was much higher than the overall average at Wake, Cleveland, and Kinston. Wake County's high teacher pay can be attribtued to small class size. Cleveland County included a trail riding segment in their course and were thus paid for extra hours. Kinston City taught two small classes, which caused high teacher pay per student at that location.

2. The cost per student for insurance, maintenance, helmets, and other costs vary from site to site. The overall average cost per student ws $33.14. There are several reasons for the range of costs. In obtaining insurance, some sites were able to add a rider to their regular driver education insurance, while others found it necessary to take out a separate policy. Some sites purchased new helmets, while others were able to borrow helmets or buy used ones. Some sites were able to pay for gas through other funds, thereby reducing their costs. Again, the smaller

Table19 . Motorcycle driver education costs by site by year.

Site	Teacher Pay	Insurance, Maintenance, Helmets, and Other Costs	Total Cost	#Students Taught	Cost Per Student for Teacher Pay	Cost Per Student for Insurance, Maintenance, Helmets and Other Costs	Total Cost Per Student
Cabarrus (1)	--	$813.86	$813.86	17	--	$47.87	$47.87
Charlotte/ (1)	$512.00	$777.39	$1,289.39	32	$16.00	$24.29	$40.29
Mecklenburg (2)	190.00	499.27	689.27	7	$27.14	$71.32	$98.46
Total	$702.00	$1,276.66	$1,978.66	39	$18.00	$32.73	$50.73
Gaston (1)	$735.81	$427.66	$1,163.47	35	$21.02	$12.22	$33.24
(2)	735.81	511.88	1,247.69	32	$22.99	$16.00	$38.99
(3)	786.21	250.50	1,036.71	36	$21.84	$ 6.96	$28.80
Total	$2,257.83	$1,190.04	$3,447.87	103	$21.92	$11.55	$33.47
Halifax (1)	$643.83	$927.67	$1,571.50	32	$20.12	$28.99	$49.11
Wake (1)	$320.00	$366.28	$686.28	11	$29.09	$33.30	$62.39
(3)	170.00	384.06	554.06	4	$42.50	$96.02	$138.52
Total	$490.00	$750.34	$1,240.34	15	$32.67	$50.02	$82.69
Bertie (2)	$320.00	$976.70	$1,296.70	20	$16.00	$48.84	$64.84
Cleveland (2)	$560.00	$856.14	$1,416.14	16	$35.00	$53.51	$88.51
(3)	301.33	657.48	958.81	10	$30.13	$65.75	$95.88
Total	$861.33	$1,513.62	$2,374.95	26	$33.13	$58.22	$91.35
Edenton-Chowan (2)	$310.42	$675.40	$985.82	14	$22.17	$48.24	$70.41
(3)	256.98	502.29	759.27	9	$28.55	$55.81	$84.36
Total	$567.40	$1,177.69	$1,745.09	23	$24.67	$51.20	$75.87
Edgecombe (2)	$367.90	$985.81	$1,353.71	19	$19.36	$51.88	$71.24
Kinston (2)	$586.34	$626.56	$1,212.90	15	$39.09	$41.77	$80.86
Total	$6,796.63	$10,238.95	$17,035.58	309	$22.00	$33.14	$55.14

the class, the higher the costs. Most expenses were not accumulated on a per student basis. Each site accquired approximately ten motorcycles and obtained insurance for each of them, even if all the motorcycles were not needed to teach the class. The purchase of other items, such as cones, helmets, etc., was necessary for each class, regardless of how many students were enrolled. Consequently, the per student cost for these items was high for small classes.

3. It was anticipated that costs might decrease for sites that participated in the program for more than one year due to "carryover" materials and improved efficiency. Generally this was not the case. Most items, such as insurance, helmets, etc. had to be purchased new each year.

Thus, on the average the motorcycle education program cost approximately $55 per student trained. The basic conclusion drawn from the more detailed analysis of these cost data is that full classes are necesssary to best utilize the money available.

Calculation of Break-even Benefit Level

Because of the previously discsused low number of motorcycle riders and related lack of knowledge concerning motorcycle crash reductions, no actual cost-benefits calculations could be carried out. However, because the above discussed cost figures are considered accurate, and because other data exist related to motorcycle crash rates and severities, it is possible to calculate a hypothetical "break-even" level of benefit--that is, the crash reduction level which must be realized in order for accident savings to equal program costs. It must be noted that such a calculation is, to some extent, tenuous because of the number and the nature of the assumptions which have to be made. These assumptions and the procedure used are outlined below.

First, because there is no way to anticipate the demand for such a motorcycle eduation course on a statewide basis, the calculations will be based on the arbitrary figure of 10,000 students. (Actually, the final results will hold for any number of students.) The use of 10,000 students simply results in a sufficient number of crashes to allow for meaningful discussion.

In order to carry out this break-even calculation process, it is necessary to calculate both the student costs involved and the accident costs which could be considered potential benefits. Student cost calculations are relatively straightforward. Using the above average figure of $55.14 per student in program costs, the cost for training 10,000 students would be $551,400.

Calculation of accident costs is not nearly as simple. First, estimates have to be made of how many of these 10,000 students can be expected to buy motorcycles and how many accidents can be expected to occur. Second, in order to calculate the economic costs of these accidents, some assumptions about both the average severity of the crash and the cost per severity level must be made.

The first step, calculating the number of expected crashes for the 10,000 students, used the following assumptions. From N.C. data concerning the population of licensed drivers and the number of regsitered motorcycles in January 1978, it can be calculated that the ownership rate is .0251 motorcycles per licensed driver. As discussed earlier, the percentage of program students who reported that they had access to a motorcycle was much higher. Estimates ranged from 16 to 37 percent depending on the measure used (i.e., the questionnaire or the mileage inventory cards). Using a combination of N.C. data concerning the number of crashes per motorcycle per year and the crash rate experienced in the project sample, it appears that a fairly accurate assumption might be that 20 percent of the students might have access to a motorcycle. It was also assumed that the crash rate for these motorcycles is .0318 crashes per motorcycle, based directly on the experience of the control and experimental students in this study. Thus, for the 10,000 students, 2000 could be expected to have access to motorcycles. With a crash rate of .0318 crashes per motorcycle, we could expect approximately 64 crashes per year to occur. It was also assumed that the experience and knowledge gained in the course are such that the duration of effectiveness or service life of the motorcycle education course would be approximately one year. That is, knowledge gained during a year of riding would be assumed to be equal to the knowledge gained in the course itself.

Based on other N.C. data for the 15-19 year olds in motorcycle crashes, it appears that the crash severity distribution is as follows: 2.5 percent of all motorcyle crashes are fatal crashes, 86.0 percent are injury crashes, and 11.5 percent are PDO crahes. It should be noted that this is quite different from the pattern for the automobile crash population, for which the majority of crashes are PDO crashes. Based on information taken from a North Carolina study of severity within the injury crashes (i.e., the percentage of serious injuries, moderate injuries, and minor injuries) and on some companion data from a California study, it appears that approximately 84 percent of motorcycle injuries would be minor and moderate injuries, and 16 percent would be serious injuries. Using injury cost figures from a 1976 NHTSA publication (Faigin, 1976), and information concerning the cost of fatalities obtained from an April 1978 report by McFarland, et al., the 1978 dollar values for fatal, injury, and PDO motorcycle crashes are as follows: fatal motorcycle crash--$330,700; injury motorcycle crash--$8000 (various estimates of cost of injury accidents range from $4408 to $9288); and PDO motorcycle crash--$300. Based on the above distribution of motorcycle crash severity, it can be calculated that the average cost of a motorcycle crash in 1978 dollars is $14,432. Thus, using the 64 crashes calculated earlier, the accident benefits which could potentially result from the program amount to $917,875, if <u>ALL</u> the accidents are eliminated.

With a total cost of $551,400, it becomes apparent that for the program to break even economically, it must eliminate 60 percent of the motorcycle crashes involving the course's students. It could also be argued that motorcycle education might provide benefits by making the crashes less severe rather than totally eliminating 60 percent of them. However, this argument is weak because (1) the education program would have to affect the severity of essentially 100 percent of the crashes in order to equal the benefits gained from eliminating 60 percent of them, and (2) affecting the severity of a motorcycle crash, once the crash sequence has begun, is extemely difficult. Other than through increasing helmet usage, there is little that an education program can do to reduce a crash's severity per se.

Because of all these difficulties, a second estimate was made. If it is assumed that twice as many of the course's students will have access to motorcycles (i.e., that 40 percent of the students subsequently have access to a motorcycle, rather than the 20 percent assumed above), then the calculations indicate that to break even, the program must eliminate only 24 percent of the motorcycle accidents involving the course's students.

Obviously when compared to the effects of existing driver-related countermeasures, the elimination of 60 percent of the accidents is very high. While it might be possible to reach such a goal, because motorcycle riding is a very hazardous endeavor, the chances would appear rather slim. However, the 24 percent figure is a much more realistic expectation of a well-designed, well-implemented motorcycle education program. Because there is no way of determining whether or not the N.C. program resulted in such a reduction (see the Recommendations section), it becomes very important for driver education administrators to closely monitor the results of other research that is measuring the true effectiveness of motorcycle education. If analyses begin to demonstrate that such programs can eliminate 20-25 percent of their students' crashes, then serious consideration should be given to implementing such programs.

Thus, in summary, the analysis of the cost data indicate that: the more cost effective situations are those in which full classes of 20 students are taught; the average cost per student in North Carolina is $55.14; and, in order for the program to break even economically under the set of assumptions given above, the motorcycle education program would have to eliminate, in the subsequent one-year period, between 24 and 60 percent of the course's students' motorcycle crashes.

Teacher Evaluation Questionnaire

As a final measure of the program benefits and problems, each teacher and driver education coordinator involved in the three-year program was sent a detailed questionnaire requesting his comments, criticisms, and suggestions on every phase of the pilot program. The teachers were asked questions on volunteers, equipment and facilities, administration, teaching, and evaluation. Each teacher was also invited to add any additional comments or questions. A copy of the questionnaire can be found in Appendix A. The questionnaire was mailed to 21 teachers. Ten persons returned the completed questionnaire.

Nine of the ten teachers responding indicated that they had problems getting student volunteers for the motorcycle course (a fact borne out by the previously cited data). According to the teachers, the main reasons for the lack of volunteers were other extracurricular activities and after school jobs. Other reasons mentioned were general lack of interest, lack of interest among licensed drivers, parental disapproval, transportation problems, fear of injury, the possibility of not being selected for the course, and previous motorcycle experience. The most common methods used by the teachers to obtain volunteers were announcements at the schools and personal contact with possible students (including visiting classrooms). Other methods mentioned were posters and newspaper announcements. Other groups mentioned by the teachers as being more appropriate for motorcycle training were students who had completed driver education but had not received a license, driver education students, ninth graders, adults, and finally, any person interested in the training.

All respondents indicated that they had no problems obtaining motorcycles, helmets, or other equipment. Three of the nine answering the question stated that they had a problem obtaining motorcycle insurance and medical payment insurance. Four teachers said the insurance was added to their county fleet policy and two said a rider was attached to the student insurance policy.

Five teachers taught on the parking lot, four on a driving range, and one used both. Those who taught on a parking lot had no problems arranging for its use. Three people indicated that they used both a parking lot and a range and preferred the range because there was no traffic, less interference from bystanders, and less set-up and preparation required. The range users found no range modifications were necessary.

Generally, the teachers had few mechanical problems with the motorcycles. The problems mentioned were dead batteries and transmission failure. The motorcycle dealer was always cooperative in handling mechanical problems.

All respondents found the administrative memos and letters prepared by DPI/HSRC to be clear and helpful and felt that these items covered all necessary information. All respondents felt the money provided for the program was adequate. The only item mentioned which was not included in the budget was money to cover accidents affected by a $100 deductible policy. Eight persons indicated that they had no other administrative problem. Two persons mentioned that the only administrative problem they faced was motorcycle storage.

All teachers who responded felt that the training they had received at the university level and at the workshop level was adequate. They all found the Motorcycle Safety Foundation's curriculum to be adequate and had no problems with it. Eight teachers stated that not being able to teach on-road riding caused no problems. One teacher felt that the absence of on-road riding reduced interest and made it difficult to teach traffic strategies. Given the choice, four teachers said they would add a street riding segment to the course, four said they would not, one was undecidecd, and one did not respond. Spring and early fall were mentioned as the best times of the year to offer a motorcycle course. Seven of the nine teachers responding to the question said that they had problems with students dropping out of the course after teaching had begun. The most prevalent reason for the few dropouts which did occur was a work conflict. Other reasons cited were transportation problems, other activities, lack of interest, parents, and a motorcycle accident in the community. The teachers felt the problem of dropouts could be partially solved by teaching during school hours, allowing the teachers to choose the participants, teaching anyone interested, or teaching younger students.

All respondents felt that the students enjoyed the course and benefited from it. Some of the complaints which students had expressed about the course to the teachers were that it was too short, that it did not involve enough riding or include street riding, and that it was held after school. When asked why so few students have purchased motorcycles, four teachers cited money and four cited parental disapproval and apathy. Fear of danger, lack of comfort and passenger capabilities, and peer pressure were also listed as possible reasons.

The teachers were asked what priority they would give motorcycle driver education as compared to other driver education courses (e.g., emergency maneuvers, regular driver education). Two ranked motorcycle driver education second behind regular driver education, four ranked it third, and two ranked it equal with the other two courses. Two teachers felt that the classroom instruction for motorcycles should be included in regular driver education. If it meant taking funds from other programs, three felt motorcycle training should have equal priority, three felt it should be third, and four were undecided.

Finally, in response to a question concerning a possible future implementation scheme in which the teachers would be under somewhat more control because of a required subcontractual relationship (rather than strictly voluntary compliance with requirements), six teachers indicated that they would still participate in the program. Four said they would participate, depending on the specifications. All respondents felt that motorcycle driver education should be a standard program in North Carolina.

FINDINGS AND RECOMMENDATIONS

Principal Findings

The preceding sections of this report have detailed the implementation and evaluation of a pilot motorcycle rider education program conducted by North Carolina driver education teachers. As was noted early in the paper and reemphasized a number of times, the basic problem encountered in this project involved the small number of students who were trained and the even smaller number who subsequently obtained motorcycles. Initial problems were encountered because of necessary funding constraints which did not provide for as many students as were initially desired. As will be noted in the following summary of findings, however, even for those students who were trained, the level of motorcycle acquisition was lower than had been anticipated, and thus, motorcycle exposure and motorcycle crashes were at a very low level. Even with these small samples of riders, however, the project efforts have indicated several findings which could be important to the future implementation of such programs. These findings can be summarized as follows:

1. A very small sample of students ultimately acquired or had access to motorcycles. In the experimental group, between 19 and 37 percent of the students were principal or part-time riders of bikes, (depending on the estimates used). Only 16 to 33 percent of the control group students had access to bikes. It is of interest to note that the percentages of the two groups were quite similar. Thus, at least in North Carolina, it does not appear that offering motorcycle education courses in the high schools significantly influences whether young drivers obtain bikes within the first two years. The hypothesis has been put forward by a number of persons in the safety field that motorcycle education should be questioned since it will increase the overall risk to the teen-age population by "enticing" students who would not normally ride motorcycles to buy them. However, based on the results of this program, while this hypothesis is still open, there is little indication of large differences between the rates of the two groups.

2. Quasi-experimental designs can be designed and implemented in the real world with proper planning. As has been noted because of the knowledge of budget constraints and the ability to work with the program implementors and plan the program ahead of time, it was possible to set up randomly assigned experimental and control groups in the project. Given that motorcycle accidents had occurred and, thus, that a good criterion measure could have been examined, the use of the design would have made possible the drawing of sound conclusions concerning the program.

   However, this is not to say that the design did not cause some problems. First, one objection, although not a very vocal one, expressed by the teachers was having to work within the experimental design context. As would be expected, the teachers wanted to handpick their "best" students for the motorcycle classes, and thereby give themselves the best chance for success with the training. Such an approach would would be very defensible in a normal driver education program, given that the training is known to be beneficial. However, such an approach would make it impossible to determine whether or not the training really had any effect. Again, the teachers did understand the need for the evaluation and this objection was not a very strong one.

   Perhaps more important to the success of the experimental design in future efforts is the need to find methods of increasing the number of students who ultimately buy or ride motorcycles. As noted above, very low numbers of students subsequently acquired motorcycles in our study. In future pilot programs, it might be possible to work with motorcycle dealers or to work with other potential groups of students (e.g., adult students) to increase the number of subsequent motorcycle acquisitions for study purposes.

3. The Motorcycle Safety Foundation curriculums used (BRC and MRC) were acceptable to the teachers and students. The teachers indicated that the curriculums were easily implemented and that the workshop conducted by MSF personnel was most helpful as a review of the important tenets of motorcycle education. No problems were experienced in use of these materials. The only departure from the curriculum was that no on-street training could be conducted. At one school, additional off-road/off-range training was provided.

4. The major implementation problems experienced throughout the project involved obtaining adequate numbers of volunteers and obtaining motorcycle insurance. By far the most important problem was the volunteer problem. The problems seemed to vary in degree from site to site, and thus, from teacher to teacher. However, the continued existence of this problem, which was not anticipated by any of the teachers before the project efforts were begun, does indeed point out the need to anticipate that such problems may exist in future classes--the demand may not be as high as is expected and additional work on the part of the teachers to insure student participation may well be acquired.

5. The use of post card survey method to obtain subsequent mileage exposure was not very successful. Only 28 percent of the students subsequently returned any of the cards, and thus, the mileage rates used in calculation of accident and violation rates can certainly be challenged.

6. In terms of project results, the analysis of the data indicates that the training did result in an increase in knowledge of safe motorcycle operation on the part of the trained students. The control group showed no such gain. It is also of interest to note that the students in the eastern schools and the female students appeared to gain more knowledge than did their western school or male counterparts.

With respect to the accident analyses conducted, it is again noted that the crashes used were a proxy measure of what should have been used--the motorcycle crashes--because motorcycle crashes were virtually non-existent. Because the proxy measure was used, sound conclusions concerning the success of the program in reducing motorcycle crashes cannot be drawn. In terms of total violations and accidents, the analysis did not indicate any differences in violation rates, or in total or at-fault accident rates. Based on the analyses which were possible, all that can be said is that the increased training on a motorcycle did not appear to affect driving records of students while they operated other types of vehicles.

When the project costs are analyzed, the data indicate that the motorcycle driver education in North Carolina costs $55.14 per student to implement. As might be expected, the situations which were most cost-effective were those in which full classes (20 students) were taught. When the cost data were combined with assumed level of motorcycle crash frequency, severity, and dollar cost/crash, it appears that the program would need to reduce 24 to 60 percent of the expected crashes to break even economically.

Recommendations

Based on the above principal findings, the following recommendations are made:

1. Implementation of well designed pilot evaluation efforts should continue to be conducted in North Carolina and in other states. Without such evaluation, our knowledge concerning whether or not a given program is of benefit to driver education students and thus where to best spend our limited driver education dollars will continue to be severely limited. As noted above, evaluations, including random assignment of subjects, are possible with proper planning period. Thus, it is recommended that such planning should always take place.

2. Project implementors/evaluators must carefully plan how to best choose subject groups to maximize the probability of a successful evaluation. As indicated above, the use of young high school students has not led to a usable number of motorcycle acquisitions or crashes for study. Thus, it is recommended that in future projects involving such pilot programs, additional care must be taken in choosing both the size and type of subject groups for the training. Groups such as adults, who might more often acquire bikes, or potential customers, drawn from visitors to motorcycle dealerships, might be examined. If students are used, much larger (and thus more expensive) sample sizes will be necessary.

3. When implementing such pilot program/evaluation process, cooperation of local school units must be insured. A series of recommendations concerning implementation of the program was presented in both the first and second annual progress reports (Project Progress Report: Driver Education for Motorcycle Operation, Desper and Council, July 1976, September 1977). With the final year's experience now in hand, the recommendations made earlier still stand. These include the following:
    1. Provide each candidate school with a detailed time schedule to be followed in implementing the course.
    2. Assure the cooperation of school administrators as well as teachers in obtaining volunteers.
    3. Anticipate problems in medical insurance acquisition, motorcycle equipment acquisition, and especially student volunteer acquisition in order to provide sufficient lead time to overcome these problems.
    4. The evaluation team must educate the teachers concerning the requirements for sound evaluation and convince the teachers of this need.
    5. The evaluation team should communicate directly with the participating teachers to keep them abreast of the need to stay within the evaluation framework and also to obtain feedback from the teachers concerning necessary changes in the program format.

4. DPI should consider tighter administrative or contractual control in future trial program efforts. As has been indicated in the Year 1 and Year 2 progress reports and particularly in this final year of the implementation phase of the project, the major problems that resulted in the limited number of trained students (not subsequent riders) involved (1) certain sites which failed to complete preliminary work in time to teach students and (2) other sites where adequate numbers of volunteers were not found. Based on a review of the individual situations that occurred, it appears that it might be possible to overcome some of these problems by working only with sites that agree beforehand to follow certain administrative guidelines and meet certain contractual obligations. It is of interest to note that in response to a related question in the teacher survey, the majority of the small sample responding indicated they would continue to work in such a program even if a subcontractual agreement was required. While it may well be that the teachers responding were the successful teachers and that those not responding were those who had problems, in reality, in any trial program in which money is being spent in hopes of obtaining a benefit, it is the "successful" teachers who are most desirable as participants.

5. Finally, based on an economic "break-even" analysis utilizing the developed N.C. program costs and what appear to be valid assumptions concerning hypothesized motorcycle crash rates, severity, and injury cost levels, it appears that in order to break even, the rider education program would have to reduce the total projected first year's crashes for the trained group by 24 to 60 percent. Because this lower level may well be obtainable, it is recommended that N.C. driver education administrators carefully monitor the results of ongoing and future evaluations aimed at defining such levels of effectiveness. If the evaluations indicate a 20 to 30 percent reduction, then serious consideration should be given to a larger scale program. If such a program is implemented, it will be very important that it be carefully planned to assure that the students trained are those subjects most likely to subsequently acquire motorcycles since the overall benefits gained from such a program are directly related to the proportion of the trained group who become riders.

Thus, in summary, because of problems including disappointingly small samples of riders and the resulting low number of accidents involving the trained and untrained students participating in the program, no firm conclusions can be drawn concerning the effects of the motorcycle training program on motorcycle crashes. Such crashes did not exist in large enough numbers to be studied. The program does appear to be a success in the eyes of the teachers and the students who participated. The Motorcycle Rider Course produced by the Motorcycle Safety Foundation appears to be a well-designed and easily implemented text. Finally, while the task efforts did increase the students' knowledge of safely operating motorcycles, nothing can be said about their effects on motorcycle crashes. No effect was found on the crashes involving other vehicles. In future pilot efforts, careful planning to overcome some of the problems of this project must be carried out.

REFERENCES

Council, F.M., Roper, R.B. & Sadof, M.G. An evaluation of North Carolina's multi-vehicle range program in driver education: A comparison of driving histories of range and non-range students. Chapel Hill: University of North Carolina Highway Safety Research Center, 1975.

Council, F.M. & Desper, L.P. Project progress report: Driver education for motorcycle operation. Chapel Hill: University of North Carolina Highway Safety Research Center, 1976.

Desper, L.P. & Council, F.M. Second annual progress report: Driver education for motorcycle operation. Chapel Hill: University of North Carolina Highway Safety Research Center, 1977.

Faigin, B.M. 1975 societal costs of motor vehicle accidents. Washington, D.C.: National Highway Traffic Safety Administration, December 1976.

McFarland, W.F., Griffin, L.I., Rollins, J.B., Stockton, W.R., Phillips, D.T., & Dudek, C.L. Assessment of techniques for cost-effectiveness of highway accident countermeasures. College Station: Texas Transportation Institute, April 1978.

Motorcycle Safety Foundation. Motorcycle Rider Course. Linthicum, Maryland: Author, 1976.

Motorcycle Safety Foundation. The Beginning Rider Course. Washington, D.C.: Author, 1973.

Appendix A

Motorcycle Driver Education Teacher Questionnaire

Motorcycle Driver Education Teacher Questionnaire

(Use back of sheet if additional space is needed.)

Volunteers

1. Did you have problems getting volunteers for the motorcycle course? If so, what problems did you have?

2. What method did you use to get volunteers?

3. What reasons did you find for students not wanting to volunteer?

4. Would other groups be more appropriate for motorcycle training?

Equipment and Facilities

1. Did you have any problems obtaining motorcycles, helmets, and other equipment? If so, how did you overcome these problems?

Equipment and Facilities (Continued)

2. Did you have any problems obtaining motorcycle insurance and medical payment insurance? If so, what problems did you have?

3. What did you discover to be the best way to get the insurance?

4. Did you teach the course on a driving range or a parking lot?

5. If you used a parking lot, did you encounter any problem in arranging for its use?

6. If you have taught the motorcycle training on both a range and a parking lot, which did you find more satisfactory and why?

7. After having taught the course, did you find that the range needed to be modified in any way?

Equipment and Facilities (Continued)

8. Did you have any mechanical problems with the motorcycles? If so what problems did you have?

9. Was your motorcycle dealer cooperative in handling mechanical problems?

Administration

1. Did you find the administrative memos and letters to be clear and helpful?

2. Were there any subjects not included in the memos and letters that you feel should have been included?

3. Was the money allotted to you for the program adequate for all expenses?

Administration (Continued)

4. Were there any expenses not included in the budget that should have been included?

5. Did you have any other administrative problems?

Teaching

1. Was your training adequate both at the university level and at the workshop presented for this program? If not, how would you change it?

2. Was the Motorcycle Safety Foundation's curriculum adequate for teaching the program?

3. Did you have any problems with the curriculum? If so, what problems did you have?

Teaching (Continued)

4. Did you find that not being able to teach on-road riding caused any problems? If so, what problems?

5. Given the choice, would you add a street riding segment to the course?

6. What is the best time of year to offer a motorcycle course?

7. Did you have any problems with students dropping out of the course after teaching had begun?

8. What were the reasons for the drop-outs?

9. How do you think the problem of drop-outs could be improved?

Evaluation

1. Did the students seem to enjoy the course and benefit from it?

2. What complaints did the students have about the course?

3. Why do you think so few students have purchased motorcycles?

4. What priority would you give motorcycle driver education as compared to other driver education courses, i.e., emergency maneuvers, regular driver education?

5. What priority would you give the motorcycle course if it meant taking funds from other programs?

Evaluation (Continued)

6. If you had to sign a subcontract specifying certain tasks for which you would be responsible, would you still participate in this program?

7. Do you think motorcycle driver education should be a standard program in North Carolina?

PLEASE WRITE BELOW ANY ADDITIONAL COMMENTS OR QUESTIONS YOU HAVE ABOUT ANY PHASE OF THE PROJECT.

THANK YOU FOR YOUR COOPERATION!

Appendix B

Knowledge Test Presented to Trained and Untrained Subjects

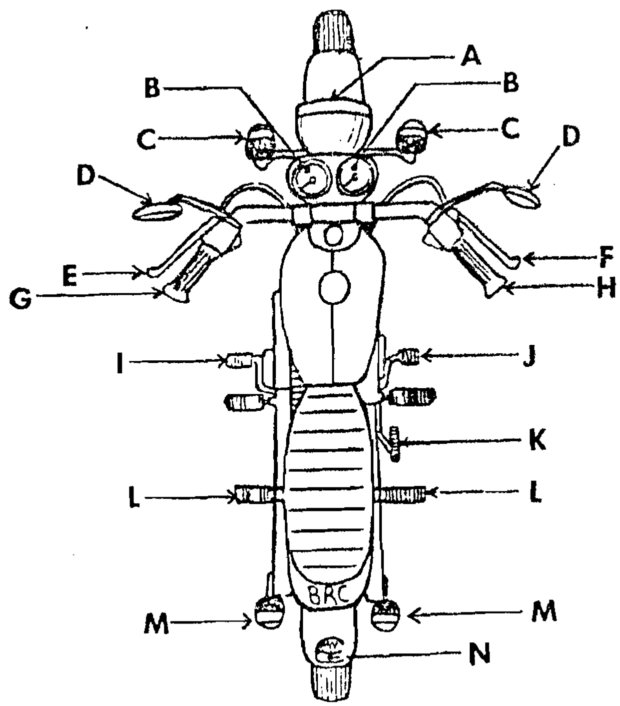
Full name________________________________

N.C. driver's license number________________________

Name of school________________________

Place the proper letter (s) in the blank to the left of each number:

______ 1. Clutch Lever
______ 2. Headlight
______ 3. Taillight
______ 4. Turn Signal Light
______ 5. Brake Lights
______ 6. Gear Change Lever
______ 7. Front Brake Lever
______ 8. Rear Brake Pedal
______ 9. Throttle
______ 10. Mirrors



Please circle the best answer.

11. Before mounting your motorcycle:

    a. Adjust the mirror
    b. Set gearshift lever
    c. Return kickstart lever to storage position
    d. Visually check the tires

12. Before riding a motorcycle, the rider should

    a. Make sure the lights are working
    b. Replace the spark plug
    c. Tighten the kick stand

13. Before attempting to start a motorcycle engine, it is an important safety factor that the operator:

    a. Prime the engine
    b. Turn ignition switch to on position
    c. Build compression in the engine
    d. Place gear selector in neutral

14. You should check the fuel and oil level of your motorcycle:

    a. Once a week
    b. Every time you prepare to ride
    c. Twice a week

15. Most drivers have difficulty seeing motorcycles. Which of the following techniques can make you and your motorcycle more visible to other drivers?

    a. Use headlights
    b. Wear highly visible clothing
    c. Mark helmet and motorcycle with reflectorized tape
    d. Have and use electric turn signals
    e. All of these

16. It is unsafe to ride:

    a. Two abreast
    b. Without a windshield
    c. Barefoot
    d. As fast as other vehicles

17. It is a safer practice to keep your ___________ rather than look at your motorcycle controls.

    a. Eyes on the road ahead
    b. Eyes on the handlebars
    c. Eyes on the instruments

18. If you see an object in the middle of your lane, it is best to:

    a. Move into the lane used by oncoming traffic
    b. Drive onto the shoulder
    c. Slow down and avoid running over it
    d. Stop and remove it from the road

19. When riding your motorcycle, you should not:

    a. Watch traffic from the side
    b. Note vehicles moving the same direction as you
    c. Keep an eye on other drivers for a clue to how they react
    d. Assume that the other drivers see you

20. The most powerful drive for stopping a motorcycle is:

    a. The front wheel brake
    b. The rear wheel brake
    c. Cleats on the rider's shoes
    d. The engine's compression

21. If it is very windy, you should:

    a. Lean toward the wind
    b. Not worry about oversteering
    c. Avoid using your front brake
    d. Driver faster than normal

22. When signaling, a motorcycle rider must use the same signals as an auto driver.

    a. True
    b. False

23. You are most likely to skid when going:

    a. Up a hill on a sand or gravel road
    b. On a gravel road with a passenger
    c. Around curves and turns
    d. Down a hill if you downshift

24. When driving on a wet or slippery road, it is best to:

    a. Put more weight on the front wheel
    b. Reduce your tire pressure
    c. Avoid the center of your lane
    d. Lean motorcycle more than usual when turning

25. You may carry a passenger on your motorcycle only if:

    a. The passenger has a motorcycle license
    b. You have been driving a motorcycle for one year or more
    c. You have collision insurance
    d. Your motorcycle is equipped for carrying a passenger

26. When you are carrying a passenger:

    a. You will need more distance to slow down and stop
    b. The motorcycle will speed up faster
    c. The motorcycle will be more stable at slow speeds

27. The North Carolina law prescribes that when riding a motorcycle you must have:

    a. A leather jacket
    b. A face shield
    c. A helmet
    d. Shoes

28. A motorcyclist must wear a helmet:

    a. Only when riding on a freeway
    b. When carrying a passenger
    c. Whenever he rides a cycle
    d. Only when riding in traffic

29. The North Carolina law states that a motorcyclist must:

    a. Use the headlight during the dark hours
    b. Use the headlight whenever the motorcycle is in operation
    c. Use hand signals instead of signal lights
    d. Not wear sunglasses

30. Required equipment on a motorcycle includes:

    a. At least one stop lamp
    b. Not more than three headlamps
    c. Not less than two taillights
    d. Parking lights

31. The system that carries harmful fumes from the engine to the rear of the car and releases them is called the:

    a. Ignition system
    b. Fuel system
    c. Suspension system
    d. Exhaust system

32. When driving in a heavy snowstorm during the day, you should use:

    a. Parking lights
    b. Low-beam headlights
    c. Four-way flashers
    d. High-beam headlights

33. Conviction for which of the following carries the highest number of points?

    a. Reckless driving
    b. Hit-and-run with property damage
    c. Driving without a license
    d. Passing a stopped school bus unloading children

34. When rounding a curve, a car tends to:

a. Speed up
b. Move to the inside of the curve
c. Stay in the center of the lane
d. Move to the outside of the curve

35. The percentage of highway deaths caused by drunken drivers is about:

a. 10%
b. 25%
c. 50%
d. 67%

36. Studies have shown that under normal conditions the chance of a car being involved in an accident on an interstate highway is greater if the driver:

a. Maintains a steady speed
b. Travels considerably below the posted speed limit
c. Travels at the posted speed limit
d. Maintains his position relative to cars in front and behind him in his lane

37. Overloading a car may result in which of the following?

I. Shorter stopping distance.
II. Damage to the car's transmission and tires.

a. I only
b. II only
c. Both I and II
d. Neither I nor II

38. If your car breaks down on a highway at night, you should do which of the following?

I. Raise the hood and tie a white cloth to the left door handle.
II. Switch on the parking lights.

a. I only
b. II only
c. Both I and II
d. Neither I nor II

39. If you miss your exit on an interstate highway, you may do which of the following?

I. Make a U-turn.
II. Stop and back up.

a. I only
b. II only
c. Either I or II
d. Neither I nor II

40. If your car starts to skid, you should do which of the following?

I. Apply the brake.
II. Turn the steering wheel in the direction in which the rear end of the car is skidding.

a. I only
b. II only
c. Both I and II
d. Neither I nor II

41. When you are driving through a curve, you should:

   a. Continue to slow down until you come out of the curve and begin going straight.
   b. lean your body with the motorcycle and turn the handlebar as needed
   c. Sit far back in the seat
   d. Steer toward the outside of the lane

42. If your front wheel begins to skid, you should:

   a. Release the rear brake
   b. Release the front brake
   c. Shift to a lower gear
   d. Press the clutch lever

43. To prepare your motorcycle for carrying a passenger, you <u>may</u> have to:

   a. Adjust the rear shocks
   b. Decrease air pressure in the rear tire
   c. Decrease air pressure in the front tire
   d. Install a larger drive chain

44. To help avoid skids, you should:

   a. Not drive in high gear
   b. Enter turns at slow speeds
   c. Ride near the center of the lane
   d. Put oversized tires on a motorcycle

45. Before making a turn, it is most important to:

   a. Look ahead to see if the turn can be made safely
   b. Downshift as you start to turn
   c. Use the front brakes
   d. Put your foot down on the inside of the turn

Appendix C

Driving Record Format for Each Participating Subject

Record Format for Each Student

Violation Data

I. Total Speeding

II. Total Stop

III. Total Moving

IV. Total Reckless

V. Total Alcohol

VI. Total Administrative

VII. Total Accidents at Fault

VIII. Total Suspension and Revocation

IX. Total Equipment

X. Total Violations

XI. Total Accident Violations

XII. Total Accidents

XIII. Total 4-Point Letters

XIV. Total 7-Point Letters

XV. Total Suspension

XVI. Total Revocations

XVII. Total Conference

XVIII. Total Hearing

XIX. Total Preliminary Hearing

XX. Total Accidents Not at Fault

XXI. Total Days Under Suspension or Revocation

(Cont'd)

Accident Data

- Year Digit
- Accident Case Number
- Driver License Number
- Accident Reporting Type
- Vehicle Position Number
- Month
- Day of Month
- Day of Week
- Time of Day
- Investigated By
- Highway Class
- Locality
- Speed Limit
- Road Features
- Road Surface
- Road Defect
- Road Conditions
- Light Condition
- Weather
- Object Struck
- Pedestrian Action
- Accident Severity
- Vehicle Type
- Accident Type
- Initial Point of Contact
- Rollover
- Vehicle Maneuver
- Miscellaneous Action
- Vehicle Defect
- Estimated Speed Prior to Impact
- Tire Impressions
- TAD Rating #1
- Damage Severity Rating
- Vehicle Model Year
- HSR Vehicle Size
- Body Style
- Model Year
- Total Number of Occupants
- Learners, Out-of-State or Pedestrian
- Physical Condition
- Sobriety
- Chemical Test Given
- Driver Charged with Violation
- Violation #1
- Vehicle Severity
- Injury Class of Driver
- Restraint of Driver
- Race of Driver
- Sex of Driver
- Age of Driver

(Cont'd)

MRSI

M - Means of Involvement

Single Vehicle Accident

Multi-Vehicle Accident

R - Region of Impact

# of Study Drivers Involved in Accident

Fault

Motorcycles in Accident

Last Name

First Initial

Birthdate

Sex

Race

License Issue Date

Course Completion Date

Initial Classification

Final Classification

Course Enrolled

Year

School Code